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AN ANNOTATED BIBLIOGRAPHY ON DURUM WHEAT 1972-1984

International Center for Agricultural Research in the Dry Areas
ICARDA

ICARDA and CGIAR

The overall objective of the International Center for Agricultural Research in the Dry Areas (ICARDA) is to increase agricultural productivity and food availability in both rural and urban areas, thus improving the economic and social well-being of people in developing countries, particularly in North Africa and West Asia. The center focuses mainly on winter rainfall areas with 200-600 mm annual precipitation. When appropriate, research also covers environments with monsoon rainfall or irrigation.

ICARDA is a world center for the improvement of barley, lentil and faba bean, and a regional center for improving wheat, chickpea, farming systems, livestock, and pasture and forage crops. The training of agricultural researchers from developing countries and the communication of research results are an important part of ICARDA's activities.

ICARDA is a non-profit research center established in 1977 by the Consultative Group on International Agricultural Research (CGIAR). The CGIAR, an informal association of donors including governments, organizations, and private foundations, supports agricultural research worldwide to improve food production in developing countries, through a network of 13 international research institutions, including ICARDA. The network covers crop and livestock systems that provide three-fourths of the food supply of the developing world.

An Annotated Bibliography on Durum Wheat 1972 - 1984

J.P. Srivastava, G. Kashour, S. Dutta
ICARDA, Aleppo, Syria

International Center for Agricultural Research in the Dry Areas
ICARDA, Box 5466, Aleppo, Syria

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FOREWORD

Generation of new knowledge is important for development, but equally important is the communication of that knowledge to those who need it and will use it. Because the knowledge is spread through a multitude of documents, any researcher today is faced with the challenge to reach those documents to pick up the information most relevant to his work and also to save duplication of efforts. One of the answers to this challenge is specialized bibliographies. Bearing this in mind, the Cereal Improvement Program, in collaboration with the Scientific and Technical Information Program and Computer Services of ICARDA, decided to produce this annotated Durum Wheat Bibliography. And, evidently, I endorsed this decision.

ICARDA is designated by the Consultative Group on International Agricultural Research (CGIAR) as a regional center for durum wheat improvement in West Asia and North Africa where 80% of world's durum wheat is grown. In this region, durum wheat occupies a very important place in the diets of the people. ICARDA, in collaboration with national program scientists, has made considerable progress in durum wheat improvement. The past experience, however, has shown that national program scientists often find it difficult to reach the world literature, for various reasons, and this affects their work seriously. A knowledge of the work done in the past and being done currently is essential to put any research program on a sound footing.

I sincerely hope that this bibliography will be useful to all those involved in durum wheat improvement in identifying the sources that would help them in their work.

Mohamed A. Nour
Director General

INTRODUCTION

Durum wheat is one of the major crops in many countries, particularly those in the arid and semi arid environments. In the past, however, this crop has received less attention than bread wheat, but in view of its importance in the diets of the masses, researchers are now increasingly turning their attention to the improvement, production, and utilization of this crop. An urgent need is therefore being felt for information about the researches conducted on this crop.

This is the first annotated bibliography on durum wheat. The earlier publication, Bibliography on Wheat (Scarecrow Press 1971), which covered the period 1959-1968) had only about 250 entries on durum wheat. Since 1984, the Commonwealth Agricultural Bureau has been publishing Wheat, Barley, and Triticale Abstracts, which is serving as a useful service to researchers. The present bibliography complements these publications by covering much of the intervening period (1972-1984, including many 1985 citations) and by providing a coverage of many reports not formally published.

This bibliography covers all aspects of durum wheat, including durum wheat food products and their utilization. The references were collected through contacts with a number of researchers and research institutions, from secondary sources, and through our own search of literature. Annotations have been adopted, and often shortened from the authors' original abstracts, when available. For some of the more general articles (those not reporting on specific research findings) and for some of the articles on food technology, abstracts were judged as not necessary and only the citations are included. Also, a number of original reports or their abstracts were not available to us at the time of publication. All citations and annotations are given in English, with the original language of publication noted next to the title.

While every effort was made to include as many citations as were accessible to us, we are aware that this bibliography is by no means a complete record of work on durum wheat. The bibliography will be updated periodically and readers are requested to help us with information about the missing entries as well as new reports. If it is not possible to send a copy of the entire publication, a complete citation (title, author, journal, etc.) and an abstract should be sufficient. Suggestions to improve the future editions of this bibliography will be most welcome.

Acknowledgements

Grateful thanks are due to Dr Mohamed A. Nour, Director General of ICARDA, for the encouragement and facilities to produce this bibliography; to a large number of scientists from national programs and ICARDA for providing copies of their articles, bulletins, and reports on durum wheat research; to Tom Rauch from USA for reviewing the manuscript; to Mr Khaled S. El-Bizri, Director, Computer Services, and Mr Bashir Bshara for developing the program to produce this bibliography and to make computerized retrieval of specific group of references possible for users; to the staff of the Scientific and Technical Information Program for their assistance on editing and production; and to many other colleagues within and outside ICARDA for their help and cooperation.

HOW TO USE THIS BIBLIOGRAPHY

This bibliography contains 1590 entries on durum wheat improvement. The entries are first grouped under some 25 subject categories (see Contents). Within the subject categories, the entries are arranged alphabetically by the first author's surname. In case of more than one contribution by the same author, the entries are arranged chronologically.

An individual entry may even contain information about more than one of the subject categories, but it has been placed under the subject category to which it is considered most related, and no cross-reference is provided. However, the subject index will help locate entries pertaining to more than one subject categories. Descriptors in the subject index are mostly selected from AGROVOC thesaurus prepared by the FAO and CEC (APIMONDIA, 1982).

Each entry provides the following information: author/s, year, title of the paper, locus (in case of a journal article, name of the journal, year, and volume number; in case of a conference paper or chapter from a book, sufficient data to identify the document), and number of pages. Bibliographical citations are followed by an abstract in most entries.

Titles in foreign languages have been translated into English. However, the language of the original document has been indicated, in parentheses at the end of the title according to the language code. Code in lower case indicates the language of the abstract in the original.

There are two indexes - author and subject. The subject index is based on the descriptors listed (which include relevant country names also). A number of descriptors have been assigned to each entry. All information for this publication is computed in ICARDA's VAX 11/780 computer. The program allows location of information on any topic, or combination of topics (by descriptors).

Language Codes

AR	Arabic	It	Italian
Bg	Bulgarian	Ja	Japanese
Ch	Chinese	Ko	Korean
Cs	Czechoslovakian	Pl	Polish
Da	Danish	Pt	Portuguese
En	English	Ro	Roumanian
Fr	French	Ru	Russian
De	German	Es	Spanish
Gr	Greek	Sv	Swedish
Hu	Hungarian	Tr	Turkish

LIST OF ABBREVIATIONS

A.B.Pf.(Austria)	Austria,Bundesanstal fuer Pflanzenbau
Ar.J.N.G.Bs.As.(Argentina)	Argentina,Junta Natcional De Granos Buenos Aires
AU.Inst.Agric.Sci.(Australia)	Australian Institute of Agricultural Sciences
Abstr.Paper,American Chem.Soc.(USA)	Abstracts of Papers,American Chemical Society
Acta Bot.Sinica.(China)	Acta Botanica Sinica
Agric.Pakistan. (Pakistan)	Agriculture Pakistan
Agric Res.Rev.(Egypt)	Agricultural Research Review
Agric.Biol.Chem.(Japan)	Agricultural and Biological Chemistry
Agric.Gaz.N.S.Wales.(Australia)	Agricultural Gazette New South Wales
Agric.Italiana (Italy)	Agricoltura Italiana
Agric.Pathol.Veg.(France)	Agricole et de Pathologie Vegetale
Agric.Res.(USA)	Agricultural Research
Agric.Res.Rev.(Egypt)	Agricultural Research Review
Agric.Ric.(Italy)	Agricultura Ricerca
Agric.Sci.Moshtobor.(Egypt)	Agricultural Science, Moshtobor
Agric.Tecnica.(Chile)	Agricultura Tecnica
Agric.Dell Venezie.(Italy)	Agricultura Dell Venezie
Agron.Annu.Conf.(Canada)	Agronomists Annual Conference
Agron.J.(USA)	Agronomy Journal
Agron.Prog.Rep.(USA)	Agronomy Progress Report
Andhra Agric.J.(India)	Andhra Agricultural Journal
Ann.Amelior.Plantes (France)	Annales Amelior Plantes
Ann.Appl.Biol.(Australia)	Annals of Applied Biology
Ann.Est.Exp.Aula Dei.(Spain)	Annales de la Estacion Experimental Aula Dei
Ann.Fac.Agr.Univ.Bari.(Italy)	Annali Della Facolta di Agraria Universita Bari
Ann.Fac.Agr.Univ.Perugia.(Italy)	Annali Della Facolta di Agraria, Universita Degli Studi Perugia
Ann.Fac.Agr.Studi Sassaresi.(Italy)	Annali Della Facolta di Agraria, Studi Sassaresi
Ann.Fac.Agr.Univ.Cathol.Sacro Cuore (Italy)	Annali Della Facolta di Agraria Universita Catholica del Sacro Cuore, Milano

Ann.Fac.Sci.Agr.Univ.Napoli.(Italy)	Annali Della Facolta di Scienze Agraria Della Universita Degli Studi Napoli
Ann.Inst.C.P.C.Plante Tehn.Fund. (Romania)	Analele Institutului de Cercetari Pentru Cereale si Plante Tehnice, Fundulea
Ann.Inst.Na.Invest.Agr.Univ. Cordoba (Spain)	Annlos del Instituto Nacional de Investigaciones Agrarias Universidad de Cordoba
Ann.Inst.Nat.Agron.(France)	Annales de L'Institue National Agronomique
Ann.Ist.Sper.Agron.Bari (Italy)	Annali Dell'Istituto Sperimentale Agronomico
Ann.Ist.Sper.Cereal.Rome (Italy)	Annali Delli'Istituto Sperimentale per la Cerealicoltura Rome, Italy
Ann.Ist.Sper.Patol.Veg.Rome (Italy)	Annali Dell'Istituto Sperimentale per la Patologia Vegetale Rome
Ann.Ist.Sper.Studio e la Difesta del Suolo, Firenze (Italy)	Annali Dell'Istituto Sperimentale Per lo Studio e la Difesa del Suolo,Firenze
Ann.Nutr.Food.(FAO)	Annals of Nutrition and Food
Ann.Technol.Agric.(France)	Annales de Technologie Agricole
Ann.Zootec.(France)	Annales de Zootechnique
Annu.Res.Rep.(Thailand)	Annual Research Report
Appl.Envir.Microbiol.(USA)	Applied and Environmental Microbiology
Arch.Zuechtungschung.(F.R.G)	Archiv fuer Zuechtungforschung
Assoc.Operative millers Bull.	Assiciation of Operative Millers Bulletin
Australian J.Agric.Res.(Australia)	Australian Journal of Agricultural Research
Australian J.Exp.Agric.Animal Husb.(Australia)	Australian Journal of Experimental Agricultural and Animal Husbandry
Beit.Trop.Landw.Veter.(F.R.G)	Beitrage Zur Tropischen Landwirtschaft und Veterinarmedizin
Biochem.Biophys.Acta.(USA)	Biochemica Biophysica Acta
Bioche.Physiol.Pflanz.(F.R.G)	Biochemie und Physiologie der Pflanzen
Bol.Off. Republica (Argentina)	Boletin Official de la Republica Argentina
Bulgarian Acad.Sci.(Bulgaria)	Bulgarian Academyc of Science
Bull.Acad.Sci.Agr.Forestieres (France)	Bulletin de L'Academie des Sciences Agricoles et Forestieres
Bull.Acad.Sci.Georgian.(USSR)	Bulletin of the Academy of Science of the Georgian
Bull.Akad.S.RSSmold.Ser.Biol.I. Khim. (USSR)	Bulletin Akademie S.RSS Moldavian Serie Biologie I.Khimie
Bull.An.E.L'Ecole Meun.ENSMIC. (France)	Bulletin des Anciens Eleves de L'Ecole de Meunerie (ENSMIC)
Bull.Assoc.Operative Millers.(USA)	Bulletin Association of Operative Millers

Bull.Chugoku Nat.Agric.Exp.Sta. (Japan)	Bulletin of the Chugoku National Agricultural Experiment Station
Bull.Inform.Liasion Synp.(France)	Bulletin D'Information et de Liasion Synprodur
Bull.Inform.Ministere Agr.(France)	Bulletin D'Information du Ministere de L'Agriculture
Bull.Inform.Univ.Agric. (France)	Bulletin D'Information du Universite de L'Agriculture
Bull.New Mexico Agric.Exp.Sta.(USA)	Bulletin New Mexico Agricultural Experiment Station
Bull.Polonian Acad.Sci.Ser.Biol. Sci.(Poland)	Bulletin of the Polonian Academy of Science series of Biological Science
Bull.Techn.Rec.Zootechn.Veter. (France)	Bulletin Technique Centre de Recherches Zootechniques et Veterinares de Theix
Bull.Tohoku Nat.Agric.Exp.Sta. (Japan)	Bulletin of the Tohoku National Agricultural Experiment Station
Bundesv.Alpen.Landw.(Austria)	Bundesversuchsanstall fuer Alpenlandische Landwirschaft
Byull.Vses.L.Inst.Rast.N.I.Vavilova (USSR)	Byulleten Vsesoyunogo Ordens i Lenina Druzhbey Narodov Instituta Rastenievodstva Imeni N.I.Vavilova
C.E.C.(Luxembourg)	Commission of the European Communities
C.R.Acad.Bulgare Sci.(Bulgaria)	Comptes Rendus des L'Academie des Science
C.R.Acad.Sci.Paris.(France)	Comptes Rendus des L'Academie des Science Paris
C.R.Hebd.Acad.Sci.(France)	Comptes Rendus Hebdomadaires des L'Academie des Sciences Paris
C.R.Seanc.Acad.Agric.(France)	Comptes Rendus des Seances des L'Academie D'Agriculture de France
C.R.Symp.Int.Matiere...Premieres (France)	Comptes Rendus du Symposium International Sur: Matieres Premieres et Pates Alimentaires
CA.Agric.(USA)	California Agriculture
CA.Agric.Exp.Sta.(USA)	California Agricultural Experiment Station
CA.Farmer.(USA)	California Farmer
CGSB. (Canada)	Canadian Government Specifications Board Standard
CIIA, Paris (France)	Commission International des Industries Agricoles et Alimentaires
Can.Grain Com.(canada)	Canadian Grain Commission
Can.Inst.Food Sci.Technol.J. (Canada)	Canadian Institute of Food Science and Technology Journal
Can.J.Bot.(Canada)	Canadian Journal of Botany

Can.J.Genet.Cytol.(Canada)	Canadian Journal of Genetics and Cytology
Can.J.Plant Sci.(Canada)	Canadian Journal of Plant Science
Cereal Chem.(USA)	Cereal Chemistry
Cereal Res.Commu.(AUB)	Cereal Research Communications
Cereals Ind.(France)	Cereals Industry
Cienc.Invest.Agr.(Chile)	Ciencia e Investigatcion Agraria
Coll.Agric.Nagpur Magazine (India)	College of Agriculture Nagpur Magazine
Coll.Agric.Pune,Biovigyanam.(India)	College of Agriculture,Pune,India,Boivgyanam
Coltiv.Erb.Univ.Bologna.(Italy)	Coltivazioni Erbacee,Universita di Bologna
Comu.INIA.Serie Prod.Veget.(Spain)	Comunicaciones INIA. Serie Production Vegetal
Commu.62th Cong.Annu.AACC-San Francisco.(USA)	Communication Presented on 62th Annual Congress of AACC-San Francisco
Con.Int.trav.Entomol,Prod.Stocks (France)	Conference International Travail Entomol, Produitis Stocks
Consorzio Agr.Provinciale-Parma. (Italy)	Consorzio Agrario Provinciale-Parma
Cooperazione Agric.(Italy)	Cooperazione in Agricoltura
Crop Qual.C(USA)	Crop Quality Council
Crop Sci.(USA)	Crop Science
Cult.Techn.,Symp.Prenatal Dev.5th (France)	Cultivation Techniques, Symposium sur Prenatal Developement 5th,1981
Cytol.Genet.(USA)	Cytology and Genetics
Dep.Agric.Bangkok.(Thailand)	Department of Agriculture, Bangkok
Dep.Bot.Plant Sci.Univ.CA,Riverside. (USA)	Department of Botany and Plant Science, University of California,Riverside,CA.
Diss.Abst.Int.(USA)	Dissertation Abstracts International
Doklady Tskha (USSR)	Doklady Tskha
Doklady O.L.Akad.Sel'sk.Nauk. V.I.(USSR)	Doklady Ordena Lenina Akademii Sel'skokhozyaistvennykh Nauk Imeni V.I. Lenina
Doklady Vses.Akad.Sel'skokhoz. Nauka.(USSR)	Doklady Vsesoyuznoj Akademii Sel'skpkhozyajstvennykh Nauka
EPPO Bull. (France)	European and Medeterranean Plant Protection Organization Bulletin,Paris
Economic Bot.(USA)	Economic Botany
Ege Univ.Ziraat,Fak.Dergisi.(Turkey)	Ege Universitesi Ziraat Fakultesi Dergisi
Egyptian Acd.Sci.Res.Technol. (Egypt)	Egyptian Academy of Scientific Research and Technology Cairo.

Egyptian J.Bot.(Egypt)	Egyptian Journal of Botany
Egyptian J.Soil Sci.(Egypt)	Egyptian Journal of Soil Science
Egyptian J.Microb.(Egypt)	Egyptian Journal of Microbiology
Eng.Res.Serv.Rep.(Canada)	Engeneering Research Service Report
Euc./FAO-IAEA Conf.Mut.Polypl. (Italy)	Eucarpia/FAO-IAEA Conference on Mutation and Polyploidy Bari
Eur.FAO Rys.D. W. Qual. (France)	European FAO Rysum on Durum Wheat Quality, Montepellier
Eur.FAO Network Durum Wheat. (Italy)	European FAO Network on Durum Wheat, Viterbo
Eur.Infor.(Belgium)	Euro-Information,Bruxelles
F.Rep.R.CUBADDA,Etude.(France)	Final Report by R.CUBADDA,Etude
Fac.Land Bouwettens Chappen, Gent (F.R.G)	Faculteit Landbouwettenschappen, Gent
FAO,Publ.Rome (Italy)	FAO,Publication, Italy
Fargo U.S Dep.Agric.(USA)	Fargo U.S Department of Agriculture
Field Crop Res. (Netherlands)	Field Crop Research
Fiziol.Biokhim.Kul't.Rast.(USSR)	Fiziologiya i Biokhimiya Kul'turnykh Rastenii.
Fiziol.Rast.(USSR)	Fiziologiya Rastenii
Food Chem.(U.K)	Food Chemistry
Food Eng.Int.(USA)	Food Engineering International
Food Prod.Dev.(USA)	Food Product Development
Food Sci.Technol.(Poland)	Food Science and Tehnology
Food Sci.Technol.Abstr.(U.K)	Food Science and Technology Abstracts
Foreign Agric.(USA)	Foreign Agriculture
Foreign Agric.Serv.(USA)	Foreign Agricultural Service
Fr.Pat.(France)	French Patent
G.Agric. (Italy)	Giornale di Agricoltura
G.Bot.Italiane (Italy)	Giornale Botanico Italiane
Gazz.Uffic.Republlica Italiana. (Italy)	Gazzeta Ufficiate Della Republlica Italiana
Genet.Plant Breed.(Bulgaria)	Genetics and Plant Breeding
Genet.Selekt.(Bulgaria)	Genetica i Selektsiya
Ger.Pat.	German Patent
Germ.Inst.CNR.Bari (Italy)	Germplasm Institute,CNR. Bari

God.Z.Zemjod.Fac.Univ.Skopje (Poland)	Godison Zbornik na Zemjodelskiot Fakultet na Univerzitetot Vo Skopje
Haryana Agric.J.Res.(India)	Haryana Agricultural Journal of Research
Hu.Agric.Rev.(Hungary)	Hungarian Agricultural Review
IAEA,Vienna.(Austria)	International Atomic Energy Agency
ICARDA,Aleppo.(Syria)	International Center for Agricultural Research in the Dry Areas,Aleppo
IDAE. (India)	Indian Department of Atomic Energy
IJAR. (India)	Indian Journal of Agricultural Research
I.N.A. Paris (France)	Memoire de Fin d'etudes I.N.A.Grignon
INRA,Montepellier.(France)	Institute National de la Kesearche Agronomique, Montepellier
I.T.C.F.,O.N.I.C.Ministre Agric. (France)	I.T.C.F., O.N.I.C. Ministre de Agricole
I.W.C. (U.K)	International Wheat Council
Ind.Alimenc.Agr.(France)	Industries Alimentaires et Agricoles
Indian Frm.(India)	Indian Farming
Indian J.Agric.Sci.(India)	Indian Journal of Agricultural Scinence
Indian J.Agron.(India)	Indian Journal of Agronomy
Indian J.Genet.Plant Breed.(India)	Indian Journal of Genetics and Plant Breeding
Indian Soc.Plant Breed.Genet.(India)	Indian Society of Plant Breeding and Genetics
Infor.Agr.(Italy)	Informatore Agrario
Infor.Bull.CIMMYT (Mexico)	Information Bulletin CIMMYT, Mexico
Infor.Fitopatl.(Italy)	Informatore Fitopatologico
Inst.Agron.Veg.Hassan 2 (Morocco)	Institute Agronomique et Vegetal Hassan 2
Inst.Nat.Nutr.Rome (Italy)	Institute National de la Nutrition,Rome
Inst.Sper.Agron.(Italy)	Instituto Sperimentale Agronomico
Int.Colloquium.(France)	International Colloquium
Int.Symp.Durum Wheat."Ind.Sci.Res". (Italy)	International Symposium on Durum Wheat "Industry and Scientific Research"
Int.Wheat Genet.Symp.Madrid (Spain)	International Wheat Genetic Symposium,Madrid
Irrg.Sci.(F.R.G)	Irrigation Science
Ist.Agron.Gen.Coltiv.Erbacee.(Italy)	Istituto di Agronomia Generale e Coltivazioni Erbacee
Ist.Nematol.Agr.Bari.(Italy)	Istituto di Nematologia Agraria,Bari

Izv.Timiryazev.Sel'sk-khoz.Akad. (USSR)	Izvestiya Timmiryazevskoi Sel'skokhozyaistvenno: Akademi
Izv.Vyssh.Uchebn.Zaved,Pishch-Technol.(USSR)	Izevestia Vysshikh Uchebnykh Zavedenii Technologiya Teskstil'nori Promyshlennosti
J.Agric.Food Chem.(USA)	Journal of Agricultural and Food Chemistry
J.Agric.Res.(Pakistan)	Journal of Agricultural Research
J.Agric.Res.(China)	Journal of Agricultural Research
J.Agric.Sci.(U.K)	Journal of Agricultural Science
J.Am.Oil Chem.Soc.(USA)	Journal of the American Oil Chemists Society
J.Assoc.Official Anal.Chem.(USA)	Journal of the Association Official of Analytical Chemist
J.Austr.Inst.Agric.Sci. (Australia)	Journal of the Australian Institute of Agricultural Science
J.Econ.Ento.(USA)	Journal of Economic Entomology
J.Exp.Botany. (Italy)	Journal of Experimental Botany
J.Fac.Appl.Biol.Sci.Hiroshima Univ.(Japan)	Journal of the Faculty of Applied Biological Science,Hiroshima University
J.Food Protec.(Canada)	Journal of Food Protection
J.Food Sci.(USA)	Journal of Food Science
J.Food Sci Technol.(Indaia)	Journal of Food Science and Technology
J.Food Technol.(USA)	Journal of Food Technology
J.Hered.(USA)	Journal of Heredity
J.Indian Bot.Soc.(India)	Journal of Indian Botany Society
J.Inst.Can.Sci.Technol.Aliment. (Canada)	Journal de L'Institute Canadien de Science et Technologie Alimentaire
J.Korean Agric.Chem.Soc.(Korea)	Journal of the Korean Agricultural Chemical Society
J.Maharashtra Agric.Univ.(India)	Journal of Maharashtra Agricultural University
J.Nutr.(USA)	Journal of Nutrition
J.Plant Foods (Guildford)	Journal of Plant Foods
J.Plant Nutr.(USA)	Journal of Plant Nutrition
J.Res.Punjab Agric.Univ.(India)	Journal of Research,Punjab Agricultural University
J.Singapore Nat.Acad.Sci. (Singapore)	Journal of Singapore National Academy of Science
J.Soil Sci.Soc.Am.(USA)	Journal of the Soil Science Society of America
J.South African Bot.	Journal of South African Botany

J.Stored Prod.Res.(U.K)	Journal of Stored Products Research
JNKVV.Res.J.(India)	Jawaharlal Nehru Krishi Vishwa Vidyalaya Research Journal
Japanese J.Genet.(Japan)	Japanese Journal of Genetics
Kuibysh.Kniz.Izadet'stvo (USSR)	Kuibyshevksoe Knizhnoe Izadet'stvo
La Depeche Commer.Agr.(France)	La Depeche Commerciale et Agricole
Landessatz.Univ.Hohen.Stuttgart. (F.R.G)	Landessatzuchtanstall, Universitat Hohenhein, Stuttgart-Hohenhein
Lebensm.Wissen.Technol.(F.R.G)	Lebensmittel-Wissenschaft Technologie
Lebensmittel Ind.(F.R.G)	Lebensmittel Industry
Lucr.Ceretare,Inst.C.Pentru Ind. (Romania)	Lucari de Ceretare,Institutul de Cercetari Pentru Industrie Si Chemie Alimentra
Lucr.Stunt.Inst.Agron.Timis.S.A. (Romania)	Lucari Stuntifice,Institutal Agronomic Timisoara,Seria Agronomie
Macaroni J.(USA)	Macaroni Journal
Mitt.Gebiete Leb.Unfer.Hygiene. (F.R.G)	Mitteilungen a us dem Gebiete der Lebensmittel-untersuchung und Hygiene
Monographie Genet.Agr.(Italy)	Monographie di Genetica Agraria
Motor.Techn.Agr.(France)	Motorisation et Technique Agricole
Mut.Breed.Newsl.(Austria)	Mutation Breeding Newsletters
Mut.Res.(Italy)	Mutation Research
Mysore.J.Agric.Sci.(India)	Mysore Journal of Agricultural Science
N.S.W.D.Agric.Div.Marketing Econ.(Australia)	New South Wales Department of Agriculture Division of Marketing and Economics
N.Z.W.Pest Cont.Soc.(New Zealand)	New Zealand Weed and Pest Control Society
Nat.Breed.Sta.(Kenya)	National Breeding Station
Nauch-Tekhn.Byul.Vses.Se.Genet. Inst.(USSR)	Nauchno-Tekhnicheskij Byulleten Vsesoyuznogo Selektsionno Geneticheskoga Instituta
NIAB, Cambridge (U.K)	National Institute of Agricultural Botany,Cambridge
North Dakota Farm Res.(USA)	North Dakota Farm Research
O.N.I.C. (France)	Office National Interprofessionnel des Cereals
Official J.Eur.Commu.(Luxembourg)	Official Journal of the European Communities
Pak.Assoc.Adv.Sci.(Pakistan)	Pakistan Assocciation for Advancement of Science
Pak.J.Sci.Res.(Pakistan)	Pakistan Journal of Scientific Research
Physiol.Plant.(Denmark)	Physiologia Plantarum
Physiol.Veg.(France)	Physiologie Vegetale

Phytop.Mediterranea (Italy)	Phytopathologia Mediterranea
Plant Breed.Inst.Univ.Bari (Italy)	Plant Breeding Institute University, Bari
Plant Genet.Resour.Newsl.(IBPGR)	Plant Genetic Resources Newsletter (IBPGR) FAO
Plant Physiol.(USA)	Plant Physiology
Plant Protc.Bull.(India)	Plant Protection Bulletin
Plant Sci.(Bulgaria)	Plant Science
Plant Sci.Letters.(Netherlands)	Plant Science Letters
Plant.Cell.Physiol.(Japan)	Plant and Cell Physiology
Prob.Gen.Amelior.Confr.Pleniaire (Belgium)	Problemes Generaix d'Amelioration Conference Pleniaire. Gembloux
Prob.Genet.Teor.Aplic.(Romania)	Problem de Genetica Teoretica Si Aplicata
Prob.Povysh.Kach.Zerna.(USSR)	Problemy Povysheriya Kachetva Zerna
Prob.Prot.Plantelor (Romania)	Probleme de Protectica Plantelor
Proc.1st Greek Agr.Res.Symp. (Greece)	Proceeding of the 1st Greek Agriculture Researcl Symposium
Proc.3rd Reg.Wheat Woekshop (Tunisia)	Proceeding of the 3rd Wheat Workshop, Tunis,Tunisia
Proc.4th FAO/Rockefeller Found. W.S.(Teheran)	Proceeding of the 4th FAO/Rockefeller Foundation Wheat Seminar,Teheran.
Proc.4th Int.Wheat Genet.Symp.	Proceedings of the 4th International Wheat Genetics Symposium
Proc.5th Int.Wheat Genet.Symp. New Delhi.(India)	Proceedings of the 5th International Wheat Genetics Symposium,New Delhi
Proc.6th Australian Weeds Confer. (Australia)	Proceedings of the 6th Australian Weeds Conference
Proc.6th Int.Wheat Genet.Symp. Kyoto (Japan)	Proceedings of the 6th International Wheat Genetics Symposium,Kyoto
Proc.8th Durum-Teigwaren (F.R.G)	Proceedings 8th Durum und Teigwaren Tagung-Detmold
Proc.9th Nat.Conf.Wheat Utiliz. Res.(USA)	Proceedings of the 9th Conference on Wheat Utilization Research
Proc.Indian Nat.Sci.Acad. (India)	Proceedings of the Indian National Science Academy
Proc.Symp.Genet.Breed.D.W. (Italy)	Proceedings of the Symposium on Genetics and Breeding of Durum Wheat
Proc.Int.Symp.IAEA, Vienna (Austria)	Proceedings of International Symposium IAEA, Vienna
Prod.Agr.Francais (France)	Prodecteur Agricole Francais

Prod.Veg.Cereale Plante Tehnice (Romania)	Productica Vegetata-Cereale Si Plante Tehnice
Prog.Farmer West.(USA)	Progressive Farmer for the West
Pub.L'Expose Presente au "Beri" Teig.T.(F.R.G)	Publication de L'Expose au "bericht-ueber-die 9. Durum und Teigwaren Tagung-Detmold
Pub.O.N.I.C.Monthly Docum.(France)	Publication O.N.I.C.Monthly Documentation
Quaderni Ris.Sci.(Italy)	Quaderni de la Ricerca Scientifica
Quick Frozen Foods Int.(USA)	Quick Frozen Foods International,New York.
Rap.Stage IUT,Marseille (France)	Raport de Stage IUT,Marseille.
Rasteniev'd Nauki (Bulgaria)	Rasteniev dni Nauki.
Rech.Agron.(Belgium)	Recherches Agronomiques
Red.Propag.Techn.Agr.(Romania)	Redacta de Propaganda Technica Agricola
Referat.Zh.(USSR)	Referativnyi Zhurnal
Rep.Agric.Exper.Station ,Oregon Univ.(USA)	Report of the Agricultural Experiment Station Oregon, University
Res.Network Durum Wheat.(Italy)	Research Network on Durum Wheat,Bari
Res.Thesis.Food Fac.Ege Univ. Izmir (Turkey)	Resume of Thesis, Food Faculty Ege University.Izmir
Rev.Fac.Agron.Univ.Nac.Plata (Argentina)	Revista de la Facultad de Agronomia. Universitad Nacional de la Plata
Rev.G.Bot.(France)	Revue General de Botanique
Rev.Invest.Agropec.(Argentina)	Revista de Investigaciones Agropecuarias
Ric.Sci.C.N.R.(Italy)	Ricerca Scientifica Consiglio Nazionali dell Richerche
Rijksuiv.Gent Fac.Landbouw.(Belgium)	Rijksuniversitiet Gent Faculteit Landbouwetenschappen
Riv.Agric.Subtrop.Tropic.(Italy)	Rivista di Agronomica Subtropicale e Tropicale
Riv.Agron.(Italy)	Rivista di Agronomia
Riv.Politica Agraria (Italy)	Rivista di Politica Agraria
Riv.Sci.Technol.Alim.Nutr.(Italy)	Rivista di Scienza e Technologia Degli. Alimenti e di Nutrizione Umana
Riv.Soc.Italiana Sci.Alimentaz. (Italy)	Rivista Della Societa Italiana di Scienza Dell'Alimentazione
Rocz.Akad.Roln.Poznaniu.(Poland)	Roczniki Akademii Rolniczej W Poznaniu
Rocz.Pantw.Zak.Higieny (Poland)	Roczniki Pantwoeego Zaklandu Higieny
S.C.E.E.S.(France)	Service Central des Enquietres et Etude Statestiques

S.O.I.C.Q.(France)	Stage Organise par l'Institut de Chimie Analytique et du Controle de la Qualite
Sci.Rep.Fac.Agric,Kobe Univ. (Japan)	Science Reports of Faculty of Agriculture Kobe University
Sel'sk-Khoz.Biol.(USSR)	Sel'skokhozyajtvennaya Biologiya
Selekts.Genet.Inst.(USSR)	Selekstsionno Geneticheskogo Instituta
Selkts.Semenov.(USSR)	Seleksiya i Semenovodstvo
Sibr.Vest.Sel'sk-Khoz.Nauki. (USSR)	Sibriskii Vestnik Sel'skokhozaistvennoi Nauki
S.O.Inst.Chim.Anal.Control Qual.(France)	S.O.Innstitute Chimie Analytic et Control Qualite
Soc.Italian Studi.Lotta.Malerbe. (Italy)	Societa Italian per lo Studi Della Lota Alle Malerbe
Soviet Plant Physiol.(USA	Soviet Plant Physiology
Soviet Genet.(USA)	Soviet Genetics
Special Rep.Agric.Exp.Sta. Oregon State Univ.(USA)	Special Report,Agricultural Experiment Station, Oregon State University
Studi.Infor.Zak.Vedy.Zem. (Czechoslovakia)	Studijni Informance,Zakladni Vedy V Zemedelstvi
Symp.Bioch.Technol.Qual.B.D. (France)	Symposium sur les bases Biochemiques et Technologiques de l'amelioration de la Qualite des Varietes des bles durs
Symp.Int.Chem.Cerealier.(Italy)	Symposium International,Chemie Cerealier, Rome
Tech.Bull.Agric.Res.Inst. (Cyprus)	Technical Bulletin of Agricultural Research Institute,Nicosia
Tech.Bull.(France)	Technical Bulletin
Tech.Bull.Ministry Agric. Natural Resources.(Cyprus)	Technical Bulletin,Ministry of Agriculture and Natural Resources,Nicosia
Tech.Ind.Cerealieres.(France)	Techniques des Industries Cerealieres
Technol.Alimentari (Italy)	Technologie Alimentari
Technol.New York.(USA)	Technology, New York
Tezisy docl.Simpoz,Po S-kh. Radiobiol.SSR.	Tezisy doklady Simpozium Po s-kh. Radiobiologie
Theor.Appl.Genet.(F.R.G)	Theoretical and Applied Genetics
These de Doctorat de 3ieme Cycle. Univ.Sci.Tech.Lang.(France)	These de Doctorat de 3ieme Cycle,Universite des Sciences et Techniques du Languedoc,Montepellier.
Tohoku J.Agric.Res.(Japan)	Tohoku Journal of Agricultural Research
Tr.Kishinev.Sel'sk-Khoz.Inst. (USSR)	Trudy Kishinevskogo Sel'skokhozyaistvennogo Instituta Imeni M.V.Frunze

Tr.Prikl.Bot.Genet.Selek.(USSR)	Trudy Po Prikladnoi Botanike,Genetike Seleksii
Tr.VNLL Zern.Kh-Va (USSR)	Trudy VNLL Zern.Kh.Vavilova
Tsitol.Genet.(USSR)	Tsitologiya i Genetika
U.K Pat.(U.K)	U.K Patent
U.S Pat.(USA)	U.S Patent
Univ.Sci.Techn.Lang.Montepellier (France)	These de Doctorat de 3ieme Cycle. Universite des Sciences et Techniques du Languedoc, Montepellier
Vestn.Sel'sk-khoz.Nauki (USSR)	Vestnik Sel'skokhozaistvennoi Nauki
Voor Anal.Agrochemie (Belgium)	Voor Analitische en Agrochemie
Weed Sci.(USA)	Weed Science
Wheat.Infor.Serv.(Japan)	Wheat Information Service
Z.Acker.Pflanz.(F.R.G)	Zeitshrift fuer Aker-Und Pflanzenbau
Z.Lebens.Unter.Forsch.(F.R.G)	Zeitschrift fuer Lebensmittel-Unterschung Und Forschung
Z.Pflanzenzuchtung (F.R.G)	Zeitschrift fuer Pflanzenzuchtung
Z.Pflanz.Physiol.(F.R.G)	Zeitschrift fuer Pflanzen Physiolgie
Zootec.Nutriz.Annimale (Italy)	Zootecnica e Nutrizione Animale

Descriptor Codes

1 Adaptation
2 Agronomic characters
3 Agronomic practices
4 Amino acids
5 Aneuploidy

6 Animal feeding
7 Animal nutrition
8 Biological yield
9 Breeding
10 Breeding methods

11 Bulks
12 Carbon dioxide
13 Chemical composition
14 Chromosomes
15 Climate

16 Cold resistance
17 Colour
18 Combining ability
19 Competition
20 Cooking quality

21 Cropping system
22 Cutltivation
23 Cytogenetics
24 Cytology
25 Cytoplasm

26 Disease resistance
27 Diseases
28 Bacterial diseases
29 Fungal diseases
30 Erysiphe graminis

31 Helminthosporium
32 Root rots
33 Rusts
34 Puccinia graminis
35 Puccinia recondita
36 Puccinia striiformis
37 Septoria tritici
38 Tilletia caries
39 Tilletia foetida
40 Tilletia indica

41 Ustillago nuda
42 Dormancy
43 Drought resistance
44 Dwarf
45 Electrophoresis

46 Endosperm
47 Environment
48 Enzymes
49 Experimental Design
50 Fertilizers and nutrients

51 Calcium
52 Magnesium
53 Micronutrients
54 Nitrogen
55 Phosphorus

56 Potassium
57 Food composition
58 Food products
59 Food quality
60 Gene effects

61 Genetic diversity and resources
62 Genetic variance
63 Genetic variation
64 Genetics
65 Genotype environment interaction

66 Germination
67 Gibberillic acid
68 Gluten
69 Glutenin - gliadin
70 Grain quality

71 Growth development stages
72 Haploids
73 Harvest index
74 Heat resistance,tolerance
75 Hectolitre weight

76 Height
77 Herbicides
78 Heritability
79 Heterosis
80 Hormones

81 Hybridization
82 Hybrids
83 Infection
84 Inheritance
85 Inhibitors

86 Insect control
87 Insect resistance
88 Insecticides
89 Insects
90 Interspecific/Intergeneric hybridization

91 In vitro culture
92 Irrigation
93 Land races
94 Leaves
95 Light

96 Linkage
97 Lodging
98 Macaroni
99 Male fertility restorer
100 Male sterility

101 Markets, trade
102 Milling
103 Milling quality
104 Molecular genetics
105 Mutation

106 Nematode resistance
107 Nitrate reductase
108 Nucleic acids
109 Nutritive value
110 Pasta

111 Pesticides
112 Pests
113 Photoperiodicity
114 Photosynthesis
115 Physiology

116 Pigments
117 Plant growth regulators
118 Plant water relations
119 Polyploidy
120 Production

121 Proteins
122 Protein fractions
123 Resistance, Tolerance
124 Roots
125 Salinity, salt

126 Seed production
127 Seed technology
128 Seed weight
129 Seedlings
130 Seeds

131 Selection
132 Semidwarfs
133 Semolina
134 Soil moisture
135 Sowing date

136 Sowing rate
137 Starch
138 Spaghetti
139 Spikes
140 Spikelets

141 Stability
142 Straw
143 Sugar
144 Taxonomy
145 Tillering

146 Tissue culture
147 Triticum
148 Triticum aestivum
149 Varieties, cultivars
150 Vitreousness

151 Weed control
152 Weeds
153 Winter habit
154 Yellowberry
155 Yield components

156 Yields
157 World
158 Africa
159 America
160 Asia

161 Europe
162 Middel East and North Africa
163 Afganistan
164 Algeria
165 Argentina

166 Australia
167 Austria
168 Bangladesh
169 Britain
170 Bulgaria

171 Canada
172 Chile
173 China
174 Cyprus
175 Czechoslovakia

176 Ecuador
177 Egypt
178 Ethiopia
179 France
180 Germany

181 Greece
182 Guatemala
183 Hungary
184 India
185 Iran

186 Iraq
187 Italy
188 Japan
189 Jordan
190 Kenya

191 Korea
192 Lebanon
193 Libya
194 Mexico
195 Morocco

196 Nepal
197 New Zealand
198 Nigeria
199 Oman
200 Pakistan

201 Peru
202 Poland
203 Portugal
204 Qatar
205 Romania

206 Saudi Arabia
207 Somalia
208 Spain
209 Srilanka
210 Sudan

211 Sweden
212 Switzerland
213 Syria
214 Tanzania
215 Thailand

216 Turkey
217 Tunisia
218 U.S.A.
219 U.S.S.R.
220 People's Dem. Rep. of Yemen

221 Yemen Arab Republic
222 Yugoslavia
223 Zambia

Durum wheat - General

1. ANON. 1979
Durum wheat: increasing the production in France. (Fr)
Semence et Progres (France), 20:31-32.

The current situation (1979) and anticipated needs for durum wheat production, quality and prices in France are reviewed.

2. ANON. 1980
Subsidies to Italian durum wheat (in the EEC) (It)
AIMA Notizie (Italy), 4-6.

3. ANON. 1981
Production and utilization of Durum Wheat in the Mediterranean Region as well as in Europe. (Fr)
International Colloquium.(France), 18.

The results are given from a questionnaire on durum wheat which was distributed to several Mediterranean countries. Included is information on production, marketing, varieties, grain quality, and food products.

4. BEBEYEHOU,G. 1975
Durum wheat production and research in Ethiopia.
Proc.3rd Reg.Wheat Workshop,Tunisia, 341-344.

The production conditions (climate and soils), diseases and breeding efforts for durum wheat in Ethiopia are described.

5. BOY,E. and MARTY,F. 1983
Durum wheat: a crop for the south of France. (Fr)
Prod. Agr.Francais (France).

Durum wheat production in Southern France is under evaluation. Production is not always regular due to climatic reason and for many farmers it's only an occasional crop. The biggest problem is marketing.

6. BURCKHARDT,O.A. 1977
Durum wheat-does its cultivation pay in Germany. (De)
DLG-Mittelungen (F.R.G), 92:1113-1114.

7. C.E.C. 1984
Council Regulation (EEC) no.1028/84 of 31 March 1984 amending Regulation (EEC)no.2731/75 fixing standard qualities for common wheat, rye, barley, maize and durum wheat.
Official J.Eur.Commu(Luxembourg), 27:17-18.

8. C.N.R.BARI 1976
Documentation on durum wheat accessions of Mediterranean origin. (It)
Ric.Sci.C.N.R (Italy), 45:56.

9. FAO, ROME 1980
Report of the 1980 consultation on the European network on durum wheat, Ankara, Turkey, 14-17 October. (Italy)
FAO, Rome (Italy), 82.

10. GHOSHEH,J. 1975
Durum wheat in Jordan.
Proc.3rd Reg.Wheat Workshop,Tunisia, 345-349.

Durum wheat production, uses, breeding, and agronomic practices in Jordan are described.

11. GOODFELLOW,V.V. 1976
Current trends in hard red spring wheats and durum.
Cereal Foods World (USA), 21:445-446.

Several significant hard spring wheat varietal changes have occurred in recent years. Conventional height wheats have been challenged by semi-dwarf types changing production patterns somewhat. Producer experience with both types of wheat is beginning to establish preferences and indicate shifts in acreage. With this background information, better seeding decisions can be made. However, consideration of disease resistance, yield, protein level, milling and baking qualities, must be assessed by growers in selection of wheat varieties to be grown, and by millers in meeting flour specifications.

12. HACHEMI,L. 1975
A brief review of Durum wheat in Algeria.(Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 68-74.

13. IANNELLI,P. 1976
Durum wheat: You have worked hard, but you have to insist in this way to be self-sufficient. (It)
Infor.Agr.(Italy), 32:21575-21584.

14. ICARDA. 1979
Regional wheat and barley nurseries, 1978-79 preliminary report.
ICARDA,Aleppo,Syria.82pp.

15. IRVINE,G.N. 1976
Canadian Grain Commission Research Laboratory Report on 1975 Amber Durum wheat.
Macaroni J.(USA), 58:14.

16. IRVINE,G.N. 1979
Durum wheat quality: Comments on the international collaborative study.
Inst.Nat.Nutr.Rome.(Italy)30 May 1979, 182.

17. LULLI,L., GREGORI,E. and MICLAUS,M. 1980
Basic cartography for the interventions on marginal lands with Upper Era Valley as representative area-Botro dell'Alpino and Renaglio [Italy] 2: Soil map, illustrative note. Durum wheat suitability map. Forest trees suitability map. (It)
Ann.Ist.Sper.Studio.Difesa.S.Fir.(Italy) 11:33-96.

18. MINCK,J. 1975
Hard wheat and its industrial utilization. Present situation and future prospects. (Fr)
Tech.Ind.Cerealieres. (France), 149:9-12.

19. PORCEDDU,E. 1979
Report on activities in the period 1976-78 and future programmes [on durum wheat].
FAO, Rome (Italy)1979:5p.

20. SAVITSKAYA,V.A., SINITSYN,S.S. and SHIROKOV,A.I. 1979
Durum wheat in Siberia. (Ru)
Selekts.Semenov.(USSR), 40.

In this book, the biology, breeding, cv. and economic effectiveness of the cultivation of durum wheat are described. Greater attention is given to the seed production of durum wheat on an industrial basis.

21. SCARASCIA,M.G.T. 1975
Durum wheat importance in world's nutrition.
Proc.3rd Reg.Wheat Workshop,Tunisia, 4-28.

Data are presented in the tables and figures. Information is divided in three categories: 1) Durum wheat- acreage, production, and yield all over the world. 2) Durum wheat- trade, prices, consumption and utilization, including comparison with all other kinds of wheat. 3) Comparison of the quality characteristics and the chemical composition of durum wheat, bread wheat and pastry wheat. The objectives of the pasta breeding programs for durum wheat as well as the ones projected for the future are presented.

22. SCARASCIA,M.G.T. 1976
Report on the establishment of a network for durum wheat improvement among European scientific and technical institutes and universities.
FAO, Rome (Italy), 6.

23. SCARASCIA,M.G.T. 1979
Report on the activities of the European cooperative network on durum wheat.
FAO, Rome (Italy), 8.

24. SCARASCIA,M.G.T. 1980
Report to the "1980 consultation on the FAO European cooperative network on durum wheat". Ankara (Turkey)
FAO, Rome (Italy): 10pp.

This report for the Third Consultation of the Network is divided into two main parts. The first part gives a general outline of the inception, consolidation and development of the network during its first four years of activity. The second part discusses the problems and future avenues of the network, based on the work performed and on the experience gained.

25. SCARASCIA,M.G.T. 1981
Report on the European cooperative network on durum wheat.
FAO, Rome (Italy): 8pp.

26. SCARASCIA,M.G.T. 1981
Report on the FAO Cooperative Research Network on durum wheat.
FAO, Rome (Italy): 8pp.

27. SCARASCIA,M.G.T. 1982
1982 Consultation on the European cooperative network on durum wheat.
FAO, Rome (Italy): 8pp.Appendix 3.

28. SCOTTI,G. 1982
Symposium papers on durum wheat: Varieties [Triticum] Mediterranean

Countries. (Fr)
Perspectives Agricoles (France), 26-28.

An international symposium on durum wheat production and utilization in the mediterranean basin and European countries was held in Paris on November 18-19, 1981. The three major subjects discussed were: 1) Production, marketing and regulations of durum wheat in the different countries; 2) Processing products of durum wheat; 3) Varieties and registration protocol.

29. SEDDON,Q. and TROW-SMITH,R. 1980
Arable.
Farmers Weekly (U.K), 93:28.

The possible use of durum wheat and triticale in the UK is discused,among other topics.

30. SEIBEL,W. 1978
International situation with durum wheat in the cereal years 1976/77 and 1977/78. (De)
Getreide, Mehl Und Brot (F.R.G), 32:141-145.

Due to the low yield & reduced growing areas of durum wheat in Argentina, Canada, USA and the European community, the world durum wheat production has declined substantially. Climatic influences affected the quality of the 1977 harvest, particularly with regard to color and cooking characters. The market supply is still higher than the demand.

31. SOLEN,P., FIRAT,A.E., DUTLU,C. and ALKUS,E. 1975
Durum wheat situation in Turkey.
Proc.3rd Reg.Wheat Workshop,Tunisia, 88-93.

This article describes the production, uses, and varietal improvement efforts for durum wheat in Turkey.

32. SRIVASTAVA,J.P. 1984
Durum wheat-its world status and potential in the Middle East and North Africa.
RACHIS (ICARDA,Aleppo,Syria), 3:1-8.

A review of durum wheat origin, characteristics, area and production, grain yield, consumption, and research efforts.

33. TAHIR,M. 1982
Area, population, wheat and barley varieties in the high elevation of the ICARDA region.
RACHIS (ICARDA,Aleppo,Syria), 19-20.

The possibilities for increasing durum wheat, bread wheat and barley production in the high elevation areas of the ICARDA region (including Afganistan, Iran, Pakistan, Iraq, Turkey, Algeria, Morocco and Tunisia) are discussed.

34. UPADHYAYA,Y.M. 1978
Durum wheat.
Indian Fmg. (India), 27:28-31.

Brief information is presented on the characteristics of Indian durum wheats and their improvement, resistance to Puccinia and Alternaria, and quality for semolina, macaroni and chapati production.

35. VARUGHESE,G. 1975
Needs of durum wheat in the North African and Near and Middle East Regions.
Proc.3rd Reg.Wheat Workshop,Tunisia, 53-65.

36. WALSH,D.E. 1974
Durum wheat research and pasta processing at the North Dakota State University. (De)
Getreide,Mehl Und Brot. (F.R.G), 28:193-197.

North Dakota State University has a particular role in production of durum wheat with high quality. North Dakota state produces 87% of durum wheat production in U.S.A, this represents 1.2 million tonnes. North Dakota has a cool and dry climate, the days during summer are long, and the soil is very fertile. Thus, this region has several natural advantages for the durum wheat production. North Dakota has continuous research activities on durum wheat through North Dakota State University. High yielding and durum wheat varieties with high quality were bred specially for this region. The research work carried out in 1973 resulted in the release of several varieties for commercial production. e.g. Crosby, Btno and Rugby. The major emphasis of the research is on 1) durum wheat breeding. 2) development of methods for quality

screening. 3) basic research on biochemistry for applied breeding. 4) harvest research.

37. ZITELLI,G. and VALLEGA,V. 1981
Durum wheat: past, present and future. (It)
Infor.Agr. (Italy), 37:17421-17422.

Durum wheat is grown on 3% of the agricultural land in Italy. In 1980 mean grain yield of durum wheat was 2.18 t/ha compared with 3.28 t in wheat. Grain yields have risen from 1.2 t in the late 1950s to 2.18 t due to the introduction of medium-tall, early, high yielding, disease resistant cv. and the extension of the crop into the fertile areas of central Italy.

38. ZITELLI,G. and VALLEGA,V. 1983
Production and varietal evolution in 1982-83. (of Triticum durum in Italy) (It)
Infor.Agr. (Italy), 39:27609-27610.

In 1983 Italy produced about 2,850,000 t. of durum wheat. Grain yields have risen from 1.2 t/ha in the late 1950's to 2.18 t/ha due to the introduction of medium-tall, early, high yielding, disease resistant varieties, and the extension of the crop into the more fertile areas of central Italy.

Economics: Development, Marketing, Trade

39. AGPB CONGRESS. 1982
Durum Wheat .(Fr)
Prod.Agr.Francais.(France), 312:25.

40. ANDRAWULT,J.P. 1981
The First International Colloquium on Durum Wheat:a most active market but difficult to control .(Fr)
Prod.Agr.Francais (France), 301:15.

41. ANDRAWULT,J.P. and SCOTTI,G. 1982
Durum wheat symposium: production, commercialization and reglementation. (Fr)
Perspectives Agricoles (France), 56:12-21.

42. ANON. 1974
Characteristics and statistical data of soft and durum wheat varieties in Italy. (It)
Tecnica Molitoria (Italy), 25:181-194.

43. ANON. 1974
Congress on durum and macaroni in Detmold . (It)
Tecnica Molitoria (Italy), 26:75-82.

44. ANON. 1978
Market situation. Balances and perspectives, durum wheat .(Fr)
O.N.I.C.(France).

45. ANON. 1978
Novelties concerning seeds: Durum wheat stability-more important changes. (Fr)
Semences et Progres,(France), 24-25.

46. ANON. 1979
Durum wheat: decreased production, difficult marketing .(Fr)
Le Petit Meunier,(France), 3.

47. ANON. 1982
Cereals and the P.A.C. reform .(Fr)
Bull.Infor.Ministere Agric. (France).

Even though the community has been short in durum wheat crops, some problems can be foreseen in the future mainly through an increased production in Greece.

48. ANTONIANI,C. 1975
Durum wheat: here is the way to become selfsufficient. (It)
Informatore Agrario (Italy), 31:21201-21202.

49. Ar.Jo.Na.G.Bs.As. 1979
Reference price for durum and bread wheat. Resolution no.20489.(Argentina) (Es)
Bol.Off.Republica (Argentina), 87:6.

50. Ar.Jo.Na.G.Bs.As. 1979
Reference price of durum and bread wheat. Resolution no.20416. (Argentina) (Es)
Bol.Off.Republica (Argentina), 87:2.

51. Ar.Jo.Na.G.Bs.As. 1979
Reference price of durum and bread wheat. Resolution no.2362. (Argentina) (Es)
Bol.Off.Republica (Argentina), 87:3.

52. Ar.Jo.Na.G.Bs.As. 1979
Reference price of durum and bread wheat. Resolution no.20438. (Argentina) (Es)
Bol.Off.Republica (Argentina), 87:7.

53. Ar.Jo.Na.G.Bs.As. 1979
Reference price of durum and bread

wheat. Resolution no.20550.(Argentina) (Es)
Bol.Off.Republica (Argentina), 87:2.

54. BUNNIES,H. 1980
Substitution of durum wheat for aestivum: consequences for raw material prices of pasta.(De)
Getreide, Mehl Und Brot (F.R.G), 34:262-265.

55. BUNNIES,H. and EINHOFF,K. 1981
Can a "purity-demand" solve the economic problems of German durum-mills. (De)
Getreide, Mehl Und Brot (F.R.G), 35:52-54.

56. BUNNIES,H. and EINHOFF,K. 1982
The fabrication of pasta at rises of raw material prices.(De)
Gordian (F.R.G), 82:102-104.

57. EICHIN,E. 1980
Nitrogen economy in T . durum Desf.(Es)
Balcarce,Bs.As.(Argentina), 44.

58. FAO, ROME 1975
Durum wheat situation 1972/73 to 1975/76.
FAO-ESC-CCP-GR.FAO ACCESS.No.30055.

59. GERSON,D. 1978
Durum wheat. Only a real strategy for producing high quality can save this production. (Fr)
Le Petit Meunier (France), 1.

60. KOETTER,U. and KIRSCHKE,D. 1977
Agricultural commodities market problems of the EC only in markets with structural surplus: e.g.durum wheat market.(De)
Goettingen Univ.(F.R.G), 87.

61. LAGRONE,W.F. and KRENZ,R.D. 1980
Hard red spring wheat and durum wheat production practices in selected states 1978. Report, Nebraska University, Dept.of Agriculture.
Economics (USA), 34.

62. LAIGNELET,B. 1979
Study of a problem of durum wheat technology as an example of utilization of multidimensional statistical method.
Ind.Aliment.Agr.(France), 96:1243-1254.

63. M.A.F. ITALY 1982
Decree of 20 November 1982. Provision for concession of (economic) help provided from (EEC) norms for durum wheat [T . durum] produced in 1983. (It)
Gazz.Uffic.Republica Italiana (Italy), 123:8752-8756.

64. M.A.F. ITALY 1983
Decree 7 June 1983. Determination of the amount of community help for T . durum of 1983 production. (It)
Gazz.Uffic.Republica Italiana (Italy), 124:4787.

65. M.A.N. KENYA. 1980
Durum wheat develoment (in Kenya)
Nat.Breed.Sta.(Kenya), 11.

66. O.N.I.C. FRANCE 1977
Evolution of harvesting. Market situation. Durum wheat.(Fr)
Press Commu.Permanent Comm.O.N.I.C.28SEP.

67. O.N.I.C. FRANCE 1977
Evolution of yield. Market situation. Durum wheat. (Fr)
Press Commu.Permanent Comm.O.N.I.C.26Oct.

68. O.N.I.C. FRANCE 1980
Situation of durum wheat market. Balance and perspectives.(Fr)
Bull.Meet.Permanent Comm.O.N.I.C.27 Aug.

69. O.N.I.C. FRANCE 1981
Marketing Cereals. Documentation. Durum wheat. (Fr)
Publ.O.N.I.C.Monthly Docu.No.6 June 1981 83-88.

70. O.N.I.C. FRANCE 1981
Marketing Cereals. Documentation. Durum wheat. (Fr)
Publ.O.N.I.C.Monthly Docu.No.8 Sept 1981 82-88.

71. O.N.I.C. FRANCE 1981
Marketing Cereals. Documentation. Durum wheat. (Fr)
Publ.O.N.I.C.France.January 1981, 83-88.

72. O.N.I.C. FRANCE 1983
Marketing Cereals. Documentation. Durum wheat.(Fr)
Publ.O.N.I.C.Monthly.Oct.1983, 82-88.

73. PATUELLI,V. 1976
Economic problems of hard wheat in central Italy. (It)
Riv.Politica Agraria. (Italy), 23:57-65.

74. PECCHI,L. 1980
Durum no longer ahead (Triticum ,its investments in Italy) (It)
G. Agric.(Italy), 90:12-13.

75. PERCIVAL,R.H. 1978
Durum wheat industry to expand [production, economics, trade, Australia]
N.S.W.D.Agric.Div.Market.Econ.Australia, 7:1-5.

76. SARNO,R. 1974
Hard wheat: An appreciable source of income.(It)
Info .Agr.(Italy), 30:17044-17058.

77. SEIBEL,W. 1976
Durum wheat production in the cereal year 1975/76 (De)
Getreide, Mehl Und Brot (F.R.G), 30:233-236.

The production of durum wheat has in the cereal economic year of 1975/76 very significantly increased. In some countries record harvests were achieved because of the acreage yield and area extention. Because of the higher price levels of earlier years of pasta industry and the processing of bread wheat (semolina, coarse flour) in different percentage with durum wheat semolina, this will saturate the market on semolina products. The available reports indicate that the durum wheat acreage will increase in the next year (1976) and this will increase further the durum wheat over production (saturation).

78. TASSOT,J. 1975
The hard wheat and the slump. (Fr)
Agri Sept (France) 6 Nov.1975.No.556.

79. TASSOT,J. 1979
Hard wheat: French production goes for quality. (Fr)
Agri Sept (France) 1979, 28-29.

80. TASSOT,J. 1980
Hard wheat, the choice of quality varieties is a necessity. (Fr)
Agri Sept (France) 1980, 27.

81. TIPPLES,K.H. 1981
Exportations of Canadian durum wheat. (Fr)
Canadian Grain Commission
No.200,1980/81.

82. TROW-SMITH,R. 1984
Arable.
Farmers Weekly.(U.K), 101:1-30.

Reports the results of the attempt to identify alternative sources of semi-dwarfing genes in wheat. 6000 lines of wheat from Ethiopia were screened for response to gibberellic acid at seedling stage. In addition F2's and parental lines from a diallel cross among one sensitive and three insensitive lines were tested for Ga3 response. Only three Ethiopian lines showed clear insensitivity to Ga3. The analysis of F2 families showed that insensitive lines carry the semidwarfism gene Rht.

Agronomy

83. ACHIETINGER,R. 1980
Plant protection trials with durum wheat (Triticum durum) (De)
Gesunde Pflanzen. (F.R.G), 32:107-112.

In field trials in 1977-79 the responses of durum wheat cv. Agathe, Lakota, Lambro, Rio and 2 breeding lines to various fungicide and herbicide treatments were compared with those of the soft wheat cv. Kormoran in autumn sowings and Kolibri in spring sowings. Yield increases resulting from disease control were greatest in the autumn crop in 1978 and ranged from 6% in Lambro to 34% in Lakota. Herbicide treatments did not generally reduce yield, but in 1979 Arelon (isoproturon) + Aretit (dinoseb acetate) reduced yield of Kolibri by 5% and those of durum cv. by 6-15%. In the untreated controls, Lakota and Agathe sown in spring yielded 75-80% as much as Kolibri, but when sown in autumn they yielded only 47-67% as much as Kormoran. The relative profitability of durum and soft wheat is discussed.

84. ALESSANDRONI,A., D'EGIDIO,M.G., STEFANIS,E.De., GALTERIO,G. and NARDI,S. 1982
Grain and grain protein yield as function of seeding arrangements in durum wheat . (It)
Genetica Agraria (Italy), 36:155-156.

Two durum wheat varieties, Trinakria and Valgerardo, differing in yielding ability and morphological characteristics, were grown in 1980 in

Rome, at four seeding rates (200,300,400,500 seeds/m2) in two row spacings (17&25 cm rows). The response of individual plants to seeding arrangements was measured at anthesis, 22 days after anthesis and maturity. At maturity, grain and grain protein yield of plots were determined. There was significant variation in the yield components attributable to different seeding rates. The significant effects of row spacing indicated that narrower rows tend to increase yield, by affecting number of ears per plant (tillering) and per unit area. Well defined varietal differences in all responses are found. The nitrogen concentration in the leaves, stems and ears of three plant samples at different stages was affected by the planting arrangement. Using correlation analyses, the significant close association between stem nitrogen concentration and both grain nitrogen concentration and grain protein yield was found.

85. ALESSANDRONI,A. and SCALFATI,M.C. 1974
Effect of various stages of seed on viability and on Agronomic characters of progenies in T. durum. (It)
Ann.Ist.Sperim.Cerealicoltora(Italy), 4:97-111.

86. ANIKOVICH,V.F. 1982
Durum wheat yield as affected by different sowing dates .(Ru)
Zernovoe Khozyajstvo(USSR), 2:35.

87. ANON. 1974
Soft and hard wheat: Result of wide range experiments.(It)
Informatore Agrario.(Italy), 30:17179-17181.

88. ANON. 1975
Wheat production in the Kingdom of Saudi Arabia.
Proc.3rd Reg.Wheat Workshop,Tunisia, 355-357.

This report, on wheat and barley trials in 1973/1974 in Saudi Arabia, is in two parts. Part 1 deals with "Evalution and Development of Varieties/Lines". Part 2 includes "Agronomic Trials".

89. ANON. 1975
Harvest of wheat 1975: quality of soft wheat and hard wheat.(Fr)
Prod.Agr.Francaise (France), 178:13-15.

90. ANON. 1975
Soft wheat and hard wheat. Sowing for 1975.
Bull.Inform.Univ.Agric.(France), 69:25-30.

91. ANON. 1977
Comparison tests between varieties of durum wheat and common wheat.(It)
Evoluzione Agricola (Italy), 22:43-45.

92. ANON. 1979
"Whiteness" of durum wheat and climatic factors. (It)
Consorzio Agr.Provinciale-Parma. (Italy) 87:101.

93. BAGHOTT,K.G. and PURI,Y.P. 1979
Response of durum and bread wheats to nitrogen fertilizer.
CA.Agric (USA), 33:21-22.

The effect of 0, 80, 160 or 240 lb N/ac as ammonium sulphate on yield and milling quality of durum wheat cv. Modoc and Leeds was studied. Grain yields of cv. Modoc and Leeds were in ranges 4020-6450 and 4260-4830 lb/ac. with highest yields with 240 and 160 lb/ac, resp. Grain CP content always increased with increasing N rate. Test wt. generally decreased with increasing N rate, except that with durum wheat it was highest with 80 lb N/ac.

94. BAKDASH,M.N. 1983
Agronomic investigations in durum wheat in Aleppo. North Syria.
FAO, Rome (Italy), 718-724.

Durum wheat cv.(a) Jori C69, (b) Giorgio 331, (c) Senator Capelli, and (d) Humari a local cv.were grown at Aleppo in 1975-8 with 50 or 100 kg N + 0 or 60 kg P205/ha and at 3 sowing rates. Av. grain yields were (a) 3.62 (b) 2.91. (c) 2,67 and (d) 2.11 t/ha. Grain yield was not significantly affected by fertilizer level except in 1977-8. Grain yields increased with increasing sowing rate in 1976-7 and 1977-8 but decreased with increasing sowing rate in 1975-6.

95. BALDNI,G. 1979
Durum wheat, sugar beet, maize, horticultural and seed crop yield. (It)
Infor.Agr (Italy), 35:5155-5166.

96. BALLATORE,G.P., PRIMA,G.Di. and SARNO,R. 1975
Influence of sowing density on the

biological performance and yield of some durum wheat varieties. (It)
Riv.Agron.(Italy), 9:159-169.

For the mean across 5 sowing densities cv.13F had the most plants/m2 and culms per plant, had the least grain shrivelling, had the highest 1000 grain weight and had the highest hectolitre weight. Capeiti 8 had the most ears per m2 and per plant, was the shortest and, with Trinakria, had the highest grain yield per ha. Trinakria and Capeiti 8 were the earliest to head and mature. Variety X density interactions were sigrificant in 1970 for culms per plant, days to maturity and grain yield, in 1971 only for 1000 -grain weight and in both years for percentage grain shrivelling, ears per plant and plants per m2.

97. BARI,V. and RIZZO,V. 1979
Sowing rate and nitrogen application rates on durum wheat in the Apulian "Tavoliere"region. (It)
Ann.Ist.Sper.Agron.(Italy), 10:87-117.

Nitrogen was applied at the rate of 0, 100 or 200 kg N/ha to 5 durum wheat cv. sown at 100, 150 or 200 kg seed/ha. In 1976-7, N and sowing rates had no effect on grain yields, but in 1977-8, grain yields ranged from 2.32 t/ha with no N at 150 kg seed to 3.68 t with 100 kg N at 200 kg seed and in 1978-9 from 2.95 t with no N at 200 kg seed to 4.23 t with 100 kg N at 150 kg seed. Straw yields were unaffected by N and sowing rates in 1976-7 and 1978-9, but in 1977-8 ranged from 6.86 t/ha with 100 kg N at 100 kg seed to 12.04 t with 200 kg N at 200 kg seed.

98. BASSO,F. 1977
Influence of some chemical weed killers on productivity and technical qualities of durum wheat grown in the hills of Basilicata. (It)
Soc.Italian Studi.Lotta.Malerbe.(Italy). 73-79.

Chlortoluron at 2.5 kg prouduct/ha post-em. gave the best weed control but the highest grain yield was obtained with trifluralin + linuron at 3 litres product/ha pre-em. Total nitrogen content of the harvested grain was highest with 2,4-D at 1 litre/ha, while MCPA at 3.5 kg/ha produced the highest wt/1000 grains and the highest gluten content. All the herbicide treatments affected the percentages of milling products.

99. BENVENUTI,A., BONARI,E. and MIELE,S. 1982
Analysis of yield variability in T. aestivum and durum in the coastal area of Tuscany. (Fr)
Coltivazioni Erbacee,Univ Bologna(Italy) 81-97.

The effects of cv. , previous crop, N, sowing methods and soil tillage methods on grain yields are discussed.

100. BERENGIER,J., GOYENVALLE,C. and LACONDE,J.P. 1981
Efficacy of etephon for lodging control in winter. (Fr)
COLUMA,Paris (France)1981, 877-883.

101. BISHNOI,K.C. and SHARMA,H.C. 1978
Relative performance of dwarf durum and aestivum varieties of wheat under varying dates of sowing.
Indian J.Agron (India), 23:271-272.

Six Triticum aestivum and T. durum wheat cv. sown on 1 or 11 Nov. , 6 or 16 Dec. gave av. grain yields of 2.1, 1.92, 1.82 and 1.68 t/ha, resp. cv. HD-2009 gave the highest yield of 2.04 t/ha, followed by cv. Kalyansona with 1.94 t/ha.

102. BOGGINI,G. and DALLI,A. 1980
Decrease in durum wheat (T.durum) cultivation in Italy.(It)
Ann.Ist.Sper.Cerealicoltura, (Italy), 11:153.

103. BOZZINI,A. 1975
Criesus: a durum wheat having a high production and large adaptability. (It)
Infor.Agr. (Italy), 31:20347-20354.

An attempt is made to give some information on the history and development of durum wheat research in Italy, with particular emphasis on breeding and physiological studies and agronomical aspects of its cultivation. Concerning the main problems related to morphological and physiological ideo-type of durum wheat, different attempts for finding the correct germplasm to be used for fulfilling the goal are illustrated by a description of the subsequent varieties released in the last 30 years. Quality problems are afterwards taken into consideration,

some of which are still to be resolved, particularly if breeding techniques are taken into consideration. Finally, nitrogen uptake, metabolism, and protein accumulation research is dealt with, particularly in relation to the response to nitrogen fertilization of some key enzymes, like nitrate reductase and proteases.

104. BOZZINI,A. 1975
Recent developments in Durum wheat research in Italy.
Proc.3rd Reg.Wheat Workshop,Tunisia, 39-52.

105. BRANDENBURGER,H. 1976
Development of durum wheat production in the northern part of Federal Republic of Germany.(De)
Getreide, Mehl Und Brot (F.R.G), 30:194-196.

The north German area has surplus of bread wheat. The farmers in this area are looking forward to growing durum wheat. The conditions for production, area, techniques, and marketing organization are available. New varieties have been released. However, the durum wheat breeding is still under-developed. Research on durum wheat is expected to increase in near future.

106. BRUNETTI,N., D'EGIDIO,M.G., FERRANDI,L., GALTERIO,G. and NARDI,S. 1981
Behaviour of two varieties of T. durum after N and S distribution. (It)
Genetica Agraria (Italy), 35:47-48.

Grain yield and protein percentage increased with application of up to 200 kg N/ha. Beyond this dose of N fertilizer, only protein content increased, while the grain yield remained constant. Nitrate reductase activity (NRA) did not level off even at high doses of N fertilizer, at any date of sampling and for the different organs examined. High correlation values were found between NRA at "heading stage" and grain and total yield, percent and total grain protein. This confirms that "a single assay date" can be used for predicting grain and grain protein yields in screening and selection for breeding purposes as in agricultural management. In vivo assay of NRA was always highly correlated to total reduced N present in leaves, indicating that this method of assay can be considered a real index for estimating the amount of N available for protein synthesis. As for grain protein composition, increasing N doses mainly affected glutenin and gliadin fractions.

107. CAMPBELL,C.A. 1979
Effect of temperature, nitrogen fertilization and moisture stress on yield, yield components, protein content and moisture use efficiency of Manito spring wheat.
Can.J.Plant Sci (Canada)., 59:963-974.

108. CASCIO,B. and LETO,C. 1982
Effects of different methods of soil preparation on growth conditions of durum wheat in two soil types. (It)
Riv.Agron. (Italy), 16:181-186.

A brown clay soil and a vertisol were (a) untreated, (b) Ploughed to a depth of 35 cm following harrowing, (c) disc harrowed to a depth of 15 cm or (d) rotavated to a depth of 5 cm before sowing durum wheat cv.Trinakria. Herbicides were applied post-em. Root densities down to 55 cm depth were similar in (a) and (b). Grain yields were similar in both soils.

109. CHATHA,M.Q. and QUICK,J.S. 1976
Effect of nitrogen and plant population on some agronomic characters of durum wheats in north Dakota, USA.
Agric.Pakistan, 27:227-239.

The effect of (a) 0, (b) 45 or (c) 90 kg N/ha on 8 durum wheat cv. grown at densities of 230, 330 or 430 plants/m2 were assessed. N delayed heading in 5 trials. The number of ears/plant increased by 25% in response to N at Carrington. Grain wt. decreased in 2 trials; (c) decreased grain yield in 1971 at Langdon and Carrington. cv. D6647 gave a progressive increase in grain yield from (a) to (c) at Carrington in 1971. Days to heading decreased with increase in plant population. Grain yield and ear number/ha increased with increase in plant density but number of grains/ha decreased.

110. CHOUDHURY,P.N. and KUMAR,V. 1980
The sensitivity of growth and yield of dwarf wheat (Triticum) to water stress at three growth stages.
Irrg.Sci.(F.R.G), 1:223-231.

111. CORINO,L., BOGGINI,G., CORBELLINI,M., MANMANA,P.N. and BORGHI,B. 1976
Comparative trial on durum wheats (1974-75) agronomic data. (It)
Ann.Ist.Sper.Cerealicoltura (Italy), 32:23151-23160.

112. CORTAZAR,S.R. 1984
Factors affecting yield and other wheat characteristics at the La Plantina Experimental Station during the years 1971-1981. 1. Effect on the differences between bread and durum wheat.(Es)
Agricultura Tecnia (Chile), 44:149-153.

Irrigated yield trials between 1971 and 1981 of several hundred bread and durum wheat lines are reported and data are tabulated. The average yields for the 11 years were 53.54 q/ha for bread wheat and 53.29 q/ha for durum wheat. The former yielded more than the latter after early sowing, in warm years and in dry years, while the latter yielded more in cool years, in rainy years and after late sowing.

113. CROS,D.L.du., WRIGLEY,C.W. and HARE,R.A. 1982
Prediction of durum wheat quality from gliadin-protein composition.
Australian J.Agric.Res (Australia), 33:429-442.

114. DESAI,R.M. and BHATIA,C.R. 1978
Nitrogen uptake and harvest index in durum wheat varying in their grain protein concentration.
Euphytica (Netherland), 27:561-566.

In 1974-75 there was significant variation in grain yield, biological yield, plant nitrogen and nitrogen in the straw amongst 15 varieties grown in the field and harvested without roots. Plant nitrogen was positively correlated with biological yield, grain yield and grain protein yield. Nitrogen harvest index, a measure of the efficiency of the partitioning of nitrogen between grain and straw varied from 57 to 86 per cent and was positively correlated with harvest index which varied from 19 to 40 per cent. Grain yield was positively correlated with plant nitrogen and harvest index.

115. DI BARI,V. and RIZZO,V. 1979
Sowing density and nitrogen application rates on durum wheat in the Apulian "Tavoliere" region (Italy) (IT)
Ann.Ist.Sper.Agron. (Italy), 1:87-117.

A three-year experiment was carried out to evaluate the effects of increasing seed densities (100- 150- 200 kg/ha of seeds) and nitrogen application rates (0- 100- 200 kg/ha of N) on quanti-qualitative yield of 5 durum wheat cultivar (Isa, Ader, Sansone, Capeiti 8 and B 52), characterized by different plant height and growth cycles. The effect of increasing seed densities showed high variability between the years. On the whole it seems that the sowing density of 150 kg of seed per hectare is best. With regard to the nitrogen fertilization, good yields were also found in "0" N plots in the first year, perhaps due to the residual fertility stored in the soil by foregoing fertilizations. In the following two years the yields increased, changing from 0 to 100 kg/ha of N, whereas they decreased or gave the same results with "200 kg/ha" plots. The interactions between these 2 factors also confirmed the best results with the combination of middle doses (N = 100 + seed = 150 kg/ha). From the point of view of yields the tall type varieties (Isa, Capeiti 8 and B 52) gave better results than those of short type (Ader and Sansone).

116. DIAZ,M.S., PARODI,P.C. and NEBREDA,I.M. 1977
Coleoptile length, percent emergence and emergence index in wheat (Triticum aestivum L. and T. durum Desf.) and triticale (X Triticosicale W.) under varying levels of depth of planting and temperature. (Es)
Cienc. Invest. Agr. (Chile), 4:15-20.

The wheat genotypes UC-2 and UC-1 (Triticum aestivum and T. durum, respectively), and three triticale genotypes were subjected to two levels of temperature, 10 and 20 centigrade and three depths of planting, 5.0, 7.5, and 10.0 cm, to determine the effect of these environmental components on coleoptile elongation, percent emergence

and emergence rate index. Differences among genotypes, in their response to the imposed variables, could not be attributed to genera or species. In every case, increased planting depth, was associated with longer coleoptiles, but deteriorated percent emergence and emergence index. Coleoptiles developed under 20 centigrade were shorter than those developed under 10 centigrade percent emergence and emergence rate index, however, increased at 20 centigrade.

117. DONNELLY,B.J. and GILLES,K.A. 1976
Changes in production and utilization of durum wheat and durum products.
Proc. 9th Nat. Confer. Wheat Utiliz. Res 76-85.

118. DUWAYRI,M. 1981
Effect of seeding date and rate on yield and yield components of 'Stork' wheat grown under rainfed conditions in Jordan.
Univ.Jordan Amman., 407-413.

A study was conducted during two growing seasons to determine the effect of dates and rate of seeding on the yield and yield components of 'Stork' wheat. Four dates of planting which ranged from November 11 to January 29, and four rates of seeding, namely 40, 80, 120 and 160 kg/ha, were compared in a split plot design with four replications. In both seasons delayed planting reduced grain and straw yield. This decrease in yield was associated with decrease of heads/unit area and plant height. Delayed planting resulted in the decrease of number of seeds/head and spikelet and in the weight of seeds from each head for the 1978-1979 season only. The lowest grain and straw yields were produced by the lowest rate of seeding which also resulted in the lowest number of heads/unit area. In the 1977-78 season a seeding rate effect was observed for head size, number of spikelets and number of seeds/head.

119. EL SHAMMA,W.S., ALI,H.C. and ISMAIL,H.N. 1979
The influence of water treatment on the yield and its components of bread wheat (T . aestivum L.) and durum wheat (T . durum L.) and barley (H . vulgare).
Beit.Trop.Landw.Veter(F.R.G), 17:189-194.

Durum wheat cv. Italian 1304 were irrigated when the available soil moisture content in the root zone fell to 60, 30 or 15%. Grain yield and its components showed no significant difference between irrigation treatments, although the most frequent irrigations gave the highest yields. Grain yield, number of ears/plant and number of grains/ear varied significantly between yr. Grain yield and number of grains/ear showed significant yr X cv. interactions.

120. GANDO,A.O. 1983
Growth and potential size of wheat grain in Balcarceno INTA (T . durum Desf.) and San Agustin. INTA (T . aestivum).
Balcarce,Bs.As. (Argentina) 64 p.

121. GREGORI,E. and MICLAUS,M. 1981
Medium-term effects of different cultivations [T.durum and meadows] on some biological characteristics of a loamy-clay soil in Valdera (Pisa) Italy.
Ann.Ist.Sper.Studio Difesa.Soulo,(Italy) 11:183-204.

122. GREN,D.G. and READ,D.W.L. 1983
Water use efficiency of corn, sunflower and wheat with limiting soil moisture.
Canadian J.Plant Sci.(Canada), 63:747-749.

123. GRETZMACHER,R. 1979
Yield performance of spring barley (H . vulgare L.) and durum wheat (T . durum) under different sowing rates of experimental broadcast sowing trial. (De)
Bodenkultur (F.R.G), 30:151-180.

Durum wheat cv. Produr was sown at rates of 150, 300, 600, 1200 or 2400 seeds/m2. Increasing sowing rate resulted in a linear decrease in number of stems and ears/m2, ear length and number and wt. of seeds/ear; 100-grain wt, also decreased. The opt. sowing rate for yield/m2 was 1200 seeds/m2.

124. GRIGNAC,P. 1977
Durum wheat: a brief monograph.(Fr)
Bull.An.E.L'Ecole Meun.ENSMIC (France), 89-96.

After brief discussion of the origins (from Triticum monococcum X Aegilops speltoides) and center of diversity (Near East and Middle East), data are provided on the relative yields,

resistance to mealy endosperm, protein content, pasta color and resistance to overcooking of nine French durum wheats.

125. GUREOGUIEV ARIFI,A. 1978
Correlations between the tillering and hard wheat earing [in Morocco] (Fr)
Awamia (Morocco), 55:57-74.

The present study examines the durum wheat variety 2777 grown after different preceding crops and at various levels of fertilization, at Sidi Kacem rainfed conditions and at Afourer irrigated. It was found that, whichever the preceding crop and the amount of fertilizer used, spikes of mother-plants without tillers have a weak development. The spikes from mother-plants with tillers have bigger grains than spikes from mother-plants without tillers. In the case of a good tillering, heading is intense. It was also observed that fertilization increases the number of tillers, especially of the productive ones, and improves the other components of yield. It would be interesting to determine the time limit for the formation of productive tillers and to explain the fact that mother-plants with non-productive tillers give stronger spikes than those without tillers.

126. HADJICHRISTODUOLOU,A 1975
Durum wheat in Cyprus.
Proc.3rd Req.Wheat Workshop,Tunisia, 321-326.

The history and current status of durum wheat production and breeding in Cyprus are described.

127. HADJICHRISTODUOLOU,A, DELLA,A. and JOSEPHIDES,C.M. 1977
A new durum wheat variety, Aronas.
Techn.Bull.Agric.Res.Inst.(Cyprus), 14.

Aronas, from RAE-Tc4 X Stw 63/AA'S' was found to be the best yielding line among a number of introduced durum. It is earlier and shorter than the local durum variety Kyperounda and has larger grains. It is resistant to drought and lodging.

128. HANSON,H., BORLAUG,N.E. and ANDERSON,R.G. 1982
Wheat in the third world.
Boulder,Colorado,Westview.Press., 18:174.

129. HASSAN,I. and SAYED,M.O. 1984
Association of grain-filling characteristics with grain weight and senescence in wheat under warm dry conditions.
Field Crop Res.(USA), 9:323-332.

Three Triticum durum and 2 T. aestivum cultivars were studied during the 1980-81 and 1981-82 growing seasons. The T. durum cultivars had higher grain-filling rates (GFRs) than the T. aestivum cultivars, suggesting differences in photosynthetic rates and/or lower respiration rates. The high grain weights of some cultivars were associated with higher GFRs. Termination of grain filling and sensecence of foliage occurred independently but were cultivar specific. It is suggested that yield improvement programmes for areas with warm dry conditions should place emphasis on cultivars with high GFRs and short grain-filling durations. Such cultivars should be harvested before complete loss of green coloration to prevent shattering.

130. I.O.S.G.SWITZERLAND 1980
Durum wheat, determination of proportion of nonwholy vitreous grains (reference method).
Geneva (Switzerland).ISO.1980:2pp.

131. I.S.C. ITALY. 1977
Common wheat and durum wheat: Comparative tests in Italy.(It)
Infor.Agr.(Italy), 33:27013-27033.

132. JARADAT,A. and DUWAYRI,M. 1981
Effect of different moisture deficits on durum wheat seed germination and seedling growth.
Cereal Res.Commun.(A.U.B), 9:55-62.

Five durum varieties were compared in relation to germination percentage, speed of germination, germination recovery, seminal root number and length, coronal root length, total root length and weight, shoot weight and shoot: root ratio under different moisture stresses. Both moisture tensions and variety have shown effects on the studied parameters. Increasing moisture tension has caused significant reductions in the germination percentage, speed of germination, number of coronal roots, and length of root system. Seminal root number was not

affected. The varieties differed in their germination and root system characteristics. The local tall varieties, namely, Deiralla 2 and Hourani were superior in drought tolerance to the semidwarf Mexican varieties namely, Stork'S' and Cocorit 71. The variety F8 was intermediate. Local varieties possessed higher number of seminal roots and had longer root systems with a lower shoot: root ratio.

133. JURGENS,G. 1981
Results of several years research and field trials with durum wheat in the Rhineland palatinate.(De)
Getreide, Mehl Und Brot (F.R.G), 35:85-91.

Sowing 3 cm deep, at 450-550 viable seeds/m2 is recommended. Autumn sowing is possible with suitable cv. but quality is lower than with early spring sowing. P and K requirements were similar to those of spring wheat. Various trials on the effects of N application rates and dates on yield and quality, and the use of growth regulators, herbicides and fungicides are reported.

134. KARAK,M., GULER,M., UNIVER,I., PALA,M. and DURUTAN,N. 1980
The effect of sowing rates on yield and yield components of wheat cv. Bolal 2973, Haymana 79 and durum cv. Cakmak 79. (Tr)
Tarimsal Arastirma Dergisi (Turkey), 2:22-30.

Optimum sowing rates for cv. Bolal 2973, Haymana 79 and Cakmak 79 were 475,400 and 475 seeds/m2 resp, in field trials in central Anatolian plateau.

135. KAUWEIDER,A.K. and AL-HAMAWI,M. 1975
Durum wheat in Syria.
Proc.3rd Reg.Wheat Workshop,Tunisia, 361-366.

Durum wheat production, use, cultural practices, and varietal improvement in Syria are described.

136. KAYYAL,H. 1975
Program on durum wheat at the agronomic division of the ACSAD.(Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 96-102.

Includes economic importance of durum wheat in Arab countries (acreage, production, yield and trade), origins, characteristics, problems. Breeding and agronomy research work are also described.

137. KLING,C.I., SCHMUTZ,W. and SNOY,M.L. 1978
Yield and quality of durum wheat in relation to date of maturity.(De)
Bundesv.Alpen.Landw.(Austria), 6,-74.

Trials of 6 durum wheat cv. at 7 sites in S. Germany are reported. The number of days to ear emergence varied between yr and sites more than between cv. and was correlated with yield, grain protein content and 1000-grain wt.

138. KLING,CH. 1980
Is durum wheat cultivation promising? (De)
DLG-Mitteilungen (F.R.G), 95:1283-1284.

Yields of 6 durum wheat cv. averaged 3.85 t/ha in trials at 9 sites in Baden-Wurtemberg in 1976-8. Variations between sites were greater than those between cv. yields were highest at Ludwigsburg and Stockach, but at Stockach the profitability limit of 80% of the yield of Kolibri was not reached. N and chlormequat applications had no significant effect on yield.

139. KULKARNI,K.R., RAGHUMURTHY,M., RAJU,S. and SADASHIVAIAH,T. 1978
Relative irrigation requirement of dwarf durum and aestivum wheat under water constraint in black soils of Tungabhadra project.
Mysore J.Agric.Sci.(India), 12:404-408.

Four durum wheat cv. and a bread wheat were grown in 1970-71 and 1971-72 and given up to 5 irrigations. The bread wheat gave av. grain yield of 2.39 t/ha and consistently outyielded the durum wheats which yielded on av. 1.42-1.70 t/ha. Av. yields increased from 925 kg to 2.64 t/ha with increasing number of irrigations from 0 to 5, mainly due to an increase in plant population and number of grains/ear. Water supply was most critical at sowing, crown-root and flowering stages.

140. KUMAR,A., DHIMAN,S.D. and YADAV,S.K. 1983
Plant water relations, radiation

characteristics, canopy temperature, and yields of wheat genotypes under dry and wet soil moisture regions.
Veterinar Medizin (F.R.G), 21:31-36.

In a field trial in the winter of 1979-80, bread wheat and durum were grown on sandy loam soil without irrigation or with 6 applications of 60 mm water. Irrigation increased leaf water potential, stomatal diffusion resistance and plant ht. but decreased canopy temp. Irrigation increased grain yields.

141. KUMAR,P. and ASHOK KUMAR 1982
Growth and field behaviour of wheat varieties under dry and wet soil moisture environments.
Thesis Abstracts.(India), 8:3.

Three varieties were grown without postsowing irrigation and with irrigation at critical growth stages. With respect to grain yield, P1200 was suitable for wet and WH147 for dry conditions. The bread wheats P1200 and WH147 had higher leaf water potentials and stomatal conductance and lower stomatal frequencies than the durum wheat DWL5023.

142. KURTZIG.M.E. 1976
Drought damages Jordan's wheat [production]
Foreign Agric.(USA), 14:10.

143. LACROIX,B. and LELIEVRE,F. 1979
Analysis of factors affecting yield of durum wheat in trials in the Gharb.(Fr)
Homme.Terre et Eaux (France), 9:15-16.

Trials in the wet region of the Gharb (in 1975-76) showed that the main constraints limiting yields in new durum wheat cv. were the difficulties associated with soil preparation and suitable fertilizer application. Yields of 4 t/ha were achieved by use of improved cv. at high sowing rates with adequate N application at the start of heading.

144. LAL,R.B. and BHARDWAJ,R.B.L. 1982
Effect of row spacing on the yield of wheat varieties.
Indian J.Agron.(India), 27:276-281.

Yield components and grain yields of each of the 6 dwarf cv. of durum and bread wheat grown in rows 15, 20 or 25 cm apart were similar.

145. LAMLKIN,W.M. and MILLER,B.S. 1979
Use of sodium hydroxide to distinguish red from Club, white, and durum wheat varieties.
Cereal Foods World (USA), 24:450.

146. LELIEVRE,F., EL MOURID,M. and ABDANI,M. 1981
Cultivation of durum wheat without irrigation in the Doukkala. Results of a cultural survey to analyse the limitations of water deficit.(Fr)
Hommes,Terre et Eaux (France), 11:35-47.

A survey was conducted in 1977-80 in the Doukkala region, to assess the factors limiting yield. On 22 plots studied the chief factors were soil type and sowing date but in addition it was found that yield was reduced by 70-100% by water deficit in 1 yr in every 2. The need for greater N use and reduced water deficit was stressed. It was suggested that cultivations before sowing to reduce runoff, early sowing and selection of earlier maturing cv. could improve yields under arid conditions.

147. LOCACIO,B., SARNO,R. and STINGI,L. 1975
Effect of hoeing period upon the productive behaviour of durum wheat cultivated at differnet spacings.(It)
Riv. Agron. (Italy), 9:153-158.

In an experiment on the hoeing of durum wheat, the following treatments were compared: Hoeing: a) at shooting; b) at boot; c) at shooting and boot; d) no-hoeing controls. The effect of the following seeding methods in association with the above treatments were investigated: a) single rows 30 cm apart, 160 kg/ha seed; b) binate rows 50 cm apart 160 kg/ha seed; c) 30X30 cm dibblings, 80 kg/ha seed; d) 30X60 cm dibblings, 40 kg/ha seed. This investigation has shown that the weed competivity effect is present from the earliest stages of the biological cycle of the principal crop, and suggests that the best period for hoeing is during the shooting stage. Single rows 30 cm apart and the binate rows gave the best yields, which may, also, be partly due to the seed rate.

148. LULLI,L. and DELOGU,F. 1978
Differences in durum wheat growing and production as a consequence of [soil] levelling practices. Research done on

Poggi Bianchi series, a member of the fine clayey, mixed (calcareous), mesic family of typic xerothents. (De)
Ann.Ist.Sper.Studio.Difesa.S.Fir.(Italy) 9:139-161.

On a silty clay soil developed from Pliocenic sea sediments, supporting erosoin of the horizons, we tried to discover which pedological features influence hard wheat growth and production. From the data it is clear that soil contents of N, P2O5 and K2O do not exert influence on wheat behaviour.

149. MAAMOURI,A.R. 1975
Durum wheat in Tunisia. (Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 75-85.

Information is given about durum wheat production, uses, varieties, and breeding efforts in Tunisia.

150. MARENGHI,A. and GOVI,G. 1978
Influence of crop rotation and fertilizer treatment on the presence of pathogens in bread wheat and durum wheat and on the results of control. (It)
Consiglio Nazionali Dell Ricerche(Italy) 363-376.

151. MARIANI,G. 1979
Agronomic techniques of hard wheat.(It)
Agric.Ric. (Italy), 2:56-61.

152. MARIANI,G. 1981
Influences of the nitrogen factor on quantitative and qualitative production of [T . durum] in different conditions of peninsular Italy. (It)
Ann.Ist.Sper.Cerealicoltura. (Italy), 12:150.

153. MATUDELLI,M. 1981
Hard wheat (T.durum) cropping technique. (It)
Terra e Vita (Italy), 22:51-52.

154. MATVEEF,M. 1976
Scouring essays of durum wheat kernels with sulphuric acid. (It)
Tecnica Molitoria (Italy), 27:121-131.

155. MEDVEDEV,A.M. 1978
Breeding, seed production and techniques used in the cultivation of varieties of spring durum wheqt.(Ru)
Kuilbysh.kniz.izadet'stvo (USSR), 128.

This book contains papers delivered at an All-Union Congress of Durum Wheat Breeders held at Kinel' in the USSR during 1976.

156. MELINO,M. 1977
Grain growing in Capitanta (Italy) and the cultural problems of hard wheat.(It)
Terra Pugliese (Italy), 26:11-22.

157. MILANO D'ARAGONA,G.M 1982
Durum wheat in the north sown in spring: Interesting prospects.(It)
Infor.Agr.(Italy), 38:22626-22627.

Durum wheat cultivation in N. Italy is discussed in relation to sowing date, rate and depth, seedbed preparation, disease and weed control, choice of cv. and N rates. In 1981, grain yields of 4.9-6.5 t/ha was obtained with cv. Produra and Vatrebbia.

158. MONTANARI,M. and LOVATO,A. 1980
Effect of coating with fungicides and chlormequat on seed vitality in durum wheat, bread wheat and barley. (It)
Sementi Elette (Italy), 26:5-12.

Grain of two durum wheat cultivars and four bread wheat cultivars were soaked in a solution of chlormequat or mancozed or both, and grains of three barley varieties were treated with chlormequat or with a mixture of thiram and carboxin or with all three. Germination was assessed at up to twelve months after treatment. There were no intervarietal differences between the durum wheat varieties in response to treatment.

159. MOULE,C. 1980
Cereals [soft wheat, hard wheat, barley, oats, rye, buck wheat, maize, grain sorghum, rice, botany, varieties, cultivation techniques, French] (Fr)
La Maison Rustique (France), 318.

Soft wheat, hard wheat, oats, rye, buck wheat, maize, grain sorghum, rice-botany, varieties and cultivation techniques are described.

160. MOULINE,M. 1979
Estimation of cereal potential.(Fr)
Hommes,Terre et Eaux (France), 9:59-65.

The actual production of durum wheat, bread wheat, barley, maize, sorghum and rice in 1971-76 in 12 regions of Morocco is compared with the potential production estimated from the yields

obtained in demonstration trials and by the most efficient farmers. The actual total production was 4 235 255 whereas the potential production was 9 600 000 t, taking into account climatic variability.

161. MUDHELKAR,N.J. 1981
Evaluation of dwarf durum and aestivum wheats under varying planting dates in north eastern plains zone of India.
Indian J.Agron.(India), 26:32-36.

Grain yields of 4 soft wheat cv. and durum wheat cv. sown in mid-Nov. were higher than when sown earlier or later. The durum wheat cv. were inferior to soft wheat cv. in ear length and grains/ear, but were markedly superior in 1000-grain wt.

162. MacARTHUR,L.A., D'APPOLONIA,B.L. and BANASIK,O.J. 1981
The falling number test: What is it and how dose it work? [to detect sprout damage in wheat, hard red spring and durum wheat].
North Dakota Farm Research (USA), 38:15-18.

163. NICASTRO,C. 1977
Determination of the separation zone between durum wheat cultivation and the common wheat one.
Riv.Agric.Subtrop.Tropic. (Italy), 71:231-236.

The study of the bioclimatological relationship between yields of soft and durum wheat and different values of the meteorological elements must be conducted with the possibilty to forecast the probability of manifestation of adverse climatological conditions. Considering the environmental relationships of crops we must then consider the economical convenience to obtain the yield of crops. It consists in the utilization of the species (and, within the species, of the cultivar) which is better adapted to the environmental conditions.

164. NICASTRO,C. 1981
Crop production in arid climates.(It)
Riv.Agric.Subtrop.Tropic.(Italy), 75:91-99.

In controlled environment trials, DM yields of durum wheat cv. Creso increased with increase in temp. and soil moisture content. The relationship of these results to crop production in the Sahel is discussed.

165. NORDIN,Aa. 1976
Water flow in wheat seedlings after small water deficits.
Physiol.Plant.(Denmark), 37:157-162.

166. OBANNI,M. 1982
Study of intergenotypical interaction in barley mixing (H . vulgare L.) of six and two rows. Heredity of the vegetation weight at the Moroccan hard wheat.(Ar,Fr,En)
Inst.Agron.et Vet Hassan 2 (Morocco), 81.

167. OBEIDAT,M.M. 1980
Effect of seeding and nitrogen fertilizer rates on yield, yield components and other characteristics of two durum wheat varieties.
M.Sc.Thesis (Plant Prod.)Univ.Jordan.

168. OBEIDAT,M.M., DUWAYRI,M. and TELL,A.M. 1983
Influence of seeding rate and levels of nitrogen fertilization on growth and yield of Durum wheat under rainfed conditions.
Dirasat (Jordan), 11:91-107.

The purpose of the present study is to determine the effect of variety, seeding rate and level of nitrogen fertilization on yield, yield components, and other characteristics of wheat, at Jubeiha and Hisban, Jordan. The varieties tested were the local F8 variety and the introduced semi-dwarf variety Stork. The seeding rates were 40, 80, 120 and 160 kg/ha and nitrogen rates were 0, 30, and 120 kg.N/ha. Grain yield of the semi-dwarf variety Stork was higher than F8 by 26 and 38% in Jubeiha and Hisban, respectively. Straw yield of F8 was higher than the Stork by 4 and 16% in Jubeiha and Hisban, respectively. Stork gave higher values than F8 for grain yield/plant, number of heads/m2, number of fertile tillers/plant, grain/straw ratio, harvest index, number of grains/main tiller, weight of grain/main tiller and number of fertile florets/spikelet. The number of spikelet/spike was higher for F8. Yield was significantly increased by higher seeding rates in Hisban only, whereas nitrogen fertilization significantly increased straw yield without

significant effects on grain yield. Both seeding and nitrogen fertilization levels affected most characters studied. Interactions are also given.

169. ORPHANOS,P.I. and KRENTOS,V.D. 1980
Concentrations of N,P and K in leaves, straw and grain of wheat and barley as influenced by N and P fertilizers under semi-arid condition.
J.Agric.Sci.(UK), 94:551-556.

The effects of 0-105 kg N and 0-26 kg P/ha fertilizer application on the N, P and K contents of leaves, straw and grain of durum wheat cv. Kyperounda, wheat cv. Pitic 62 and barley cv. Athenais were determined. N linearly increased the N content of the leaves,straw and grain as well as the K content of leaves and straw, but slightly reduced the P content of the grain. Such increases of N and K content occurred beyond the N rates giving max. grain and sheaf yields. Increased K content of the straw resulting from fertilizer N was wasteful where the straw was removed as this accelerated the depletion of soil K. Durum wheat grain containing 2.8% N showed 6% yellow berry (mealy grains), but at lower N contents yellow berry could be high or low depending on location. P did not significantly influence the P content of any of the components analysed even though it increased grain and straw yields, particularly in the drier yr.

170. PACUCCI,G. and BLANCO,A. 1973
Agronomic evaluation and technological properties of new durum wheat lines and varieties in southern Italy.
Genet.Breed.D.W.Symp.Lib.Fac.Agric.Italy 447-467.

The results of the two years (1970-71 and 1971-72) series of variety trials, performed each year in two localities of southern Italy, are reported. The total number of lines and varieties tested was 30, ten of them common to all trials. Grain yield and kernel characteristics (yellow berry, test weight and 1,000 seed weight) were analyzed. The influence of two N-fertilizer levels (80 and 120 kg/ha) on the agronomic, technological and chemical characteristics of seven good yielding varieties has been also studied. The N-fertilizer influenced only dry gluten and protein content, while significant differences were observed among the varieties for all the characters examined. The interaction N-fertilizer x varieties was significant only for some characters in some trials. Correlations between technological and chemical characteristics were calculated and reported.

171. PAL,M., SAXENA,K.K., AGARWAL,J.P. and SINGH,R.P. 1979
Scheduling of irrigation for 'durum' wheat under restricted water supply in Bundelkhand region.
Indian J.Agron. (India), 24:58-60.

The grain yields of 7 durum wheat cv. compared to the rainfed crop yield of 1.88 t/ha (3yr av.) grown with irrigation at the (a) crown root initiation stage, 2 irrigations at (a) and the (b) milk-ripeness stage and 3 irrigations at (a), tillering and (b) were 2.34, 2.54 and 2.78 t/ha.

172. PAPY,F. 1979
Analysis of durum wheat and barley yields in different cereal regions of Morocco through their reactions to variations in annual rainfall.(Fr)
Hommes,Terre et Eaux (France), 9:69-71.

The relationships between rainfall distribution and grain yields and head number/m2 of durum wheat and barley were studied on the basis of data collected over 6-8 yr in 4 regions of Morocco.

173. PARIS,P. and GAVAZZI,C. 1978
Possibilities of expanding durum wheat production in northern Italy.(It)
Ann.Fac.Agr.Univ.Cattol.Sacro Cuore, 18:52-53.

Many studies were conducted over a period of 15 years concerning the expansion of durum wheat production in northern Italy. Some varieties were identified (Patrizio 6, Capeiti 8, Cont Morando, Cont Lambro, Cont Raineri and Valgerardo) and some agronomic practices were developed.

174. PARIS,P., GAVAZZI,C. and MONTALI,P. 1975
Influence of chemical soil fertility on ash percentage of durum wheat cultivated in northern Italy.(It)
Ann.Fac.Agr.(Italy), 14:350-387.

Two cropping trials - the former carried out in a greenhouse on six soils having different values of available phosphorus and potassium, and the latter in the field, based on a factorial design with N, P and K fertilizing arranged in a 2 x 33 layout - have shown that there is no relationship between increasing rates of soil P and K and ash percentages in the dry matter of durum wheat (Triticum durum Desf.) grain. Nitrogen is the nutrient that can modify the ash content, both by direct effects and through interaction with several other factors, such as variety and/or degree of shrivelling of the kernels.

175. PAROTTE,J.H. 1982
Situation of durum wheat in the world [production, commercialization, and reglementation in main cultivation zone] (Fr)
Industries des Cereales (France), 37-48.

176. PHOTIADES,J. and HADJICHRISTODUOLOU,A 1983
Sowing date, sowing depth, seed rate and row spacing of wheat and barley under dryland conditions.
Field Crops Res. (Netherlands), 9:151-162.

177. POKHREL,T. and DAVIS,D.D. 1982
Thermal effects on tillering and grain filling of selected wheats grown in southern New Mexico [T . aestivum , T . durum , cultivars, selection for cold resistance].
Bull.New Mexico Agric.Exper.Sta.(USA), 21.

T.aestivum, T.durum, cultivars-selection for cold resistance is described.

178. PRYOR,A. 1981
Sampling for yellowberry control [Durum wheat, related to irrigation and fertilization practices California, Arizona].
CA.Farmer.(USA), 254:32.

Durum wheat, related to irrigation and fertilization practices in Califorina, Arizona.

179. RAO,G. and BHARDWAJ,R.B.L. 1981
Consumptive use of water, growth and yield of aestivum and durum wheat varieties at varying levels of nitrogen under limited and adequate irrigation situations.
Indian J.Agron. (India), 26:243-250.

Increasing the number of irrigations from 1 to 2 or 5 increased the av. grain yields and consumptive use of water (CUW) by 3 wheat cv. and decreased water use efficieny (WUE). Increasing rates of nitrogen from 0 to 160 kg/ha markedly increased the yields and WUE and slightly increased CUW. The durum wheat cv. HD 4530 and soft wheat cv. HD 2160 and HD 2177 gave 2-yr av. yields of 4.66, 4.7 and 4.38 t.ha, resp. The CUW values were slightly higher in HD 4530 and the WUE values were higher in HD 2160.

180. RICHARDS,R.A. and PASSIOURA,J.B. 1981
Seminal root morphology and water use of wheat. 1: Environmental effects [drought resistance]
Crop Sci (USA), 21:249-252.

181. RIZZO,V. 1974
Possibilities and limits of applying supplemental irrigation to durum wheat. (It)
Ann.Ist.Sper.Agron. (Italy), 4:315-330.

The possibility and the efficiency of applying irrigation, under the environmental conditions of the Tavoliere Pugliese, at four different stages (sowing - critical period - milk - and wax ripeness stages) are discussed. Supplemental irrigation at sowing should be used whenever it becomes neccessary to offset occasional drought occuring at that time. The critical period i.e., the 15 days before coming into ear, is known to be the very stage in the biological cycle when the plant's susceptibility to drought is strongest. In practice, however, it was found that the month preceding heading time - April - is the spring month receiving more rainfall in the area, so that supplemental irrigation at that time should be regarded as quite exceptional. Water application during the milk stage did not prove to be significantly beneficial to the three trial years. No evidence was obtained that supplemental irrigation at the wax ripeness stage can actually check shrivelling which is instead better controlled by growing early varieties.

182. RIZZO,V. 1978
Some considerations about the

advisability of applying supplemental irrigation to durum wheat.
Quaderini.Ric.Sci. (Italy), 191-199.

183. RIZZO,V. 1980
Continuous wheat cropping in northern Apulia.(Fr)
Ann.Ist.Sper.Agron. (Italy), 11:215-221.

Research on the following aspects of durum wheat production in N. Apulia are discussed, effects of burning or ploughing-in of the wheat stuble on grain yields, weed control using herbicides, sowing and N rates, and precipitation and irrigation.

184. RIZZO,V. and BARI,V. 1981
The influence of climatic characteristics and cultivation practices upon the yield performance of some durum wheat varieties with different culm heights. (It)
Ann.Ist.Sper.Agron. (Italy), 12:115-116.

Five varieties were studied at Foggia, southern Italy, with three doses of nitrogen fertilizer and three sowing densities. The three tall varieties, namely Isa, Capeiti 8 and B52, had the highest yields.

185. ROBINSON,F.E., CUDNEY,D.W. and LEHMAN,W.F. 1979
Nitrate fertilizer timing, irrigation, protein, and yellowberry in durum wheat.
Agron. J. (USA), 71:304-308.

In field trials in 1975-77 in the irrigated area of the Imperial Valley, California, durum wheat cv. Cocorit 71 was grown and given 2 irrigation treatments and 0, 135, 202, 270 or 404 kg N as ammonium nitrate/ha (100%) at presowing, 50% at presowing + 50% at tillering or 33% at presowing, tillering and 33% at the boot stage). Grain protein content increased from 8.75 to 14.31% and from 9.63 to 14.83% with increasing N rate and from 12.21 to 13.79% and from 13.08 to 13.84% with increase in number of N applications in 1976 and 1977, resp. Yellow berry decreased by 16.4-18.5% for each percentage increase in grain protein content. In 1976 there was no significant difference in grain yields between the 2 irrigation treatments but in 1977 the water treatment gave a significantly higher grain yield.

186. SADEK,M.M., TALAAT,E H. and REFAI,F.Y. 1975
Present status of durum wheat in the Arab Republic of Egypt.
Proc.3rd Reg.Wheat Workshop,Tunisia, 327-335.

187. SAEED,A.S. and BA-ANGOO 1975
Wheat improvement in the People's Democratic Republic of Yemen.
Proc.3rd Reg.Wheat Workshop,Tunisia, 352-354.

188. SAYED,H.I. 1982
Response of wheat and triticale cultivars grown under field conditions to drought stress.
Wheat Infor.Serv. (Saudi Arabia), 42-47.

One triticale ,14 bread wheat and nine durum varieties were studied in 1979-80 at two sites, one subjected to drought stress and the other irrigated. The durum wheats CM18882 and Redhead S, with a high 1000-grain weight performed well at both sites.

189. SCARASCIA,M.G.T. 1974
Hard wheat: A wealth that modern techniques can render more plentiful.(It)
G.Agric. (Italy), 84:306.

190. SCARASCIA,V.M.E. and LOSAVIO,N. 1982
Climatic and soil conditions limiting durum wheat yield in southern Italy.
Ist.Agron.G.Coltiv.Erbacee. (Italy), 57-68.

Important factors constraining cereal production in southern Italy were drought caused by low and erratic rainfall, high evaporative atmospheric demand and, in some cases, limited soil depth. The relationship between these factors and leaf water potential and diffusive resistance to water loss in durum wheat during flowering is considered.

191. SCHITT,F. and WEBER,L. 1976
Agronomic value of durum wheat. (De)
DLG-Mittelungen (F.R.G), 91:838-839.

192. SENECHAL,F. 1975
Growing summer hard wheat in the north half of France. (Fr)
Agricole Francais (France), 23-25.

193. SENECHAL,F. 1981
Durum wheat culture. (Fr)
Cultivar. (France), 49-51.

Cultural practices to obtain the best quality as well as high yields in durum wheat are described.

194. SERRE,J.C., HERMELINE,M., FAUCON,D. and MARTIN,Ch. 1978
Result of trials of winter and spring hard wheats, 1977-78. season.(Fr)
Chartres (France), 17.

195. SHAMMA,W.S.El., ALI,H.C. and ISMAIL,H.N. 1979
The influence of water treatments on the yield and its components of bread wheat (T. aestivum L.) and durum wheat (T. durum L.) and barley (H. vulgare L.).
Beit.Trop.Landw.Veter. (F.R.G), 17:189-194.

Wheat cv. Kenya-Cular 1425, durum wheat cv. Italian 1304 and barley cv. Baladi 265 were irrigated when the available soil m.c. in the root zone fell to 60, 30 or 15%. Grain yield and its components showed no significant difference between irrigation treatments, although the most frequent irrigations gave the highest yields. Average yields were 2.03, 1.55 and 2.31 t/ha from Kenya-Cular 1425, Italian 1304 and Baladi 265, respectively. Yield components and interactions are also described.

196. SHARMA,R.H. and BHARDWAJ,R.B.L. 1980
Dry matter accumulation and nitrogen uptake by durum and bread wheats under limited and adequate irrigation supply.
Indian J.Agric.Sci. (India), 50:877-879.

A field study was carried out on sandy loam soil in the winter seasons of 1972 (wet) and 1973 (dry) with 2 durums ('HD 4519', Raj 911) and 1 bread wheat ('Kalyan Sona') under 8 irrigation treatments. Dry matter production was better in durum wheats under adequate irrigation in 1972 (102.4 mm rainfall) than bread wheat. The durums and bread wheat were at par in N uptake in 1972, but in 1973 durums registered higher N uptake than bread wheat.

197. SINGH,T., SHARMA,H.C. and SINGH,H. 1979
Response of durum and aestivum varieties of wheat to planting pattern. [India]
Haryana Agric.Univ.J.Res.(India), 9:9-13.

Field investigations carried out with durum and aestivum wheat varieties under varying planting pattern indicated that planting of erect growing durum wheat varieties Raj 911 and HD 4519 and dwarf aestivum varieties UP 310 and 1925 at a row spacing of 15cm, using 125 kg seed/ha, resulted in significantly higher yield than normal recommended seed rate of 100 kg/ha sown at row spacing of 20 cm. However, in the case of semi-dwarf wheat varieties Kalyansona and WG 377, usual row spacing of 20 cm coupled with 100 kg/ha was found significantly superior to lower or higher seeding rates and spacings.

198. SRIVASTAVA,J.P. and WINSLOW,M.D. 1984
Improving wheat and barley production in moisture-limiting areas.
RACHIS (ICARDA,Aleppo,Syria), 4:2-8.

Reviews production of cereals at dry land sites in Syria, including discussion on N and P fertilizers, following moisture conservation and rotation, early planting, weed control and use of improved varieties.

199. TAGLIASACCHI,A. and VOCATURO,R. 1977
Effect of seed ageing of Triticum durum cv. Cappelli on the length of mitotic cycle as measured by 3H-thymidine incorporation in the root meristem.
Caryologia (Italy), 30:225-230.

200. THOMAS,E.J. 1981
Effects of seeding and fertilization level on the yield of different types of wheat (T.durum Desf.) (Es).
Balcarce,Bs.As. (Argentina), 70.

201. TIWARI,J.P. and TIWARI,D.K. 1981
Root productivity of irrigated and rainfed wheat.
JNKVV Res.J.(India), 15:5-11.

The number and length of seminal roots, total root weight and 1000-grain weight were studied in ten varieties of Triticum durum and ten of T. aestivum.

Root weight was greater in five dwarf varieties of T. durum than in tall varieties of T. durum but the reverse was true for T. aestivum. Number of seminal roots and total root weight were positively correlated with 1000-grain weight.

202. TURK,M.A. 1981
Effect of seed size and seeding rate on yield and other agronomic characteristics of durum wheat.
J.Amman Univ.Jordan. Jan.1981 144p.

203. UGARTE AZOCAR,G.A. 1976
Influence of planting yellow seed on the yield and quality of the harvest of two wheat varieties. (T . durum Desf.) Quilafen and Candeaflen-5.(Es)
Quillota. (Chile) 1976.63p.

204. VENEZIAN,M.E.S. and LOSAVIO,N. 1982
Climatic and soil conditions limiting durum wheat yield in southern Italy.
Ist.agron.G.Coltiv.Erbacee.(Italy), 57-68.

In a study of physical factors constraining cereal production in S. Italy, drought caused by low and erratic rainfall and high evaporation rates was determined to be the most important factor. Interrelated with soil water availability was N fertilizer efficiency.

205. VERI,G. 1976
Energy balance and evapotranspiration of durum wheat in central Italy. (It)
Riv. Agron. (Italy), 10:202-208.

The diurnal energy balance on the basis of the Bowen ratio method of durum wheat cultivated in an area of the central Italy was examined near Rome during the heading period. The presence of new structural components (awned ears) caused a greater (20%) net radiation which however, was dissipated mainly by air convection without causing a burden to the water supply. In connection with the interaction of the environmental factors, a greater part of the energy was employed in evapotranspiration process with a water loss of about 4-5mm per day. Consequently lower amounts of energy employed in soil and air heating. Bowen ratio on a daily scale was always small (0.07-0.21) also giving indirect proof that water supply was satisfactory on the whole. At certain moments of all days, but in a longer and more substantial way on 23/5 there was an additional contribution of energy to the cultivation due to advective phenomenon.

206. VERONA,C.A., LOEFFLER,C.M. and FERNANDEZ,O.N. 1980
Effect of plant density on the yield nitrogen distribution in Triticum durum . (Es)
Rev.Invest.Agropec.(Argentina), 15:75-95.

207. VIS,H. 1978
Moisture stress and yield of durum wheat under dryland conditions in Tadla. (Fr)
Hommes,Terre et Eaux (France), 8:13-19.

Using data over 11 yr on the yield of durum wheat and rainfall under dryland conditions it was shown that the principal factor determining yield in the Tadla region of Morocco is rainfall in March. Correlation coeff, for the monthly deficit of rainfall (monthly rainfall-monthly evapotranspiration) and yield for Feb. April and May were non-significant whereas for March it was highly significant. The yield can be calculated with a high degree of precision by regression using rainfall and evapotranspiration for March.

208. VOROB'EV,V.F. and SOCHIVKO,N.I. 1979
Development and production of spring durum wheat under artificial light. (Ru)
Vestn.Sel'sk-Khoz Nauki. (USSR), 15-18.

209. WATSON,E.R., LAPIN,P. and BARRON,R.J.W. 1976
Effect of waterlogging on the growth, grain and straw yield of wheat, barley and oats.
Australian J.Exp.Agr.Animal Husb., 16:114-122.

210. WITTMER,G. 1978
Durum wheat: Variety, physiology and fertilizing. (It).
Terra Pugliese (Italy), 27:3-10.

211. WITTMER,G. 1980
Durum wheat: Variety, physiology and mineral fertilization (in south Italy) (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 11:221.

212. ZEIN EL ABIDIEN,A.N. and BAGDACSH,N. 1979

Experimental results of varieties, rate of seeding and fertilization of durum wheat under rainfed conditions in Aleppo, north Syria.
FAO,Rome,Italy., 45-49.

213. ZHELEV,Zh.G. 1981
Correlation between stem height, coleoptile length and sowing depth in some durum wheat cultivars. (Bg)
Rasteniev"dni Nauki.(Bulgaria), 18:13-16.

Seventeen durum wheat cv. of varying height and 1000-grain wt. were sown 5-7 and 10 cm deep. There was a positive correlation between stem ht. and coleoptile length. Germination percentage of dwarf cv. having shorter coleoptiles was decreased when sown deeper than 5-6 cm. The 1000-grain wt. had no significant effect on coleoptile length.

214. ZITELLI,G. 1979
Current position with durum wheat. More area cultivated and more production per unit area.(It)
Infor.Agr.(Italy), 35:7487.

There has been a decline of 20% in the area of soft wheat grown in Italy between 1950 and 1978 but there has been an increase in yield/ha of 25%. During the same period there has been an increase in the area of durum wheat grown (approx.1400 to 1500 ha) and an increase in yields (approx. 1 0 to 1.6 t/ha).

215. ZITELLI,G. 1980
Durum wheat special. Small scale cultivar trials carried out in different environments. (It)
Infor.Agr.(Italy), 36:12293-12295.

The area and grain yields of durum wheat, soft wheat and barley grown in N., Central, and S. Italy and on the islands in 1979 are given. The area of durum wheat grown in the provinces and the total grain yields are given for 1979. The area grown ranged from 600 ha in Veneto to 569, 900 ha in Sicily and the yields/ha from 1.54 t in Sardinia to 3.86 t in Lombardy.

216. ZITELLI,G. and MARIANI,B.M. 1974
Relationship between dwarfness/Norin 10 and agronomic trials in durum wheat used in breeding work.(It)
Ann.Ist.Sper.Cerealicoltura,Rome(Italy), 4:159-170.

Fertilizers, Nutrients

217. BRANDO,A., CIOCCA,L., STEFANIS,E.De., IANNUCCI,A. and LI DESTRI,O. 1980
Mineral fertilization and new varieties: An experimental contribution to the problem of durum wheat (T . durum) cultivation in south Italy (Capitanata). (It)
Ann.Ist.Sper.Cerealicoltura,Rome(Italy), 11:160-161.

The objective was to ascertain if the new varieties released at the half of the seventies, with shorter stem and resistant to pathogens, and therefore potentially able to profit by high doses of nitrogen fertilizer more than traditionally grown varieties (Capeiti 8, Appulo and for some aspects Isa 1), give the same positive response in Capitanata also, which has an environment drastically different from that where these new varieties were bred. The new varieties don't respond as expected to the increasing doses of nitrogen in fact, for each equal dose, the new varieties gave a yield lower than that of the traditional ones. It seems justifiable to consider that this behaviour represents another symptom of the insufficient adaptability of these new varieties to "Tavoliere di Puglia". At the highest dose of nitrogen (180 kg/ha) there is not significant increase in yield for either the traditional or the new varieties. Phosphorus and potassium don't induce any increase in yield. The results obtained for all are examined with respect to grain quality.

218. BRUNING,R.I. 1982
Flour and semolina quality characteristics, storage and handling.
Macaroni J.(USA), 64:6-8.

Two varieties of Triticum durum, Granato and Valsacco, were grown in pots with different quantities and different ratio of N and S. Increasing quantities of N and S result in higher content of these elements both in stovers and in grains. Alcohol soluble proteins show the highest increase in grain as a consequence of nitrogen fertilization.

Granato variety mobilizes more nitrogen compounds from stover to grain.

219. CUOOCOLO,L. 1973
Nitrogen fertilizer experiments with durum wheat on the Sele plain.(It)
Ann.Fac.Sci.Agr.Univ.Napoli.(Italy), 5:224-237.

Six varieties grown at five different fertilizer levels showed that the increase in yield effected by an increase in the nitrogen dose was not linear. Variety X fertilizer level interactions were observed.

220. D'EGIDIO,M.G., GALTERIO,G., MARDI,S., SGRULLETTA,D. and BRUNETTI,N. 1981
Response of two durum wheat varieties to sulphur nitrogen fertilizers. (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 12:13.

221. DASKALOV,G. and GYUROV,A. 1979
Effect of fertilizers on grain quality of durum wheat. (Bg)
Rasteniev'd Nauki (Bulgaria), 16:91-97.

Effects of various rates of N, P and K on vitreous grain, 1000-grain wt, chemical composition of grain and quality of macaroni flour and macaroni are described. N increases grain protein contents up to 18.58% and lysine to 495 mg/100 g grain.

222. DEIDDA,M. 1976
Effects of nitrogen fertilization on durum wheat in a typical Mediterranean environment (It)
Studi Sassaresi (Italy), 24:318-330.

The results of the experiments on the usage of nitrogen fertilization on durum wheat are presented. Some aspects are examined related to the quantities of nitrogen used at the time of supply, various types of fertilizers in relation to seasonal course, the nature of the soil, the preceding cultures and the different cultivars. The effectiveness of the fertilization is closely related to the water reserve, particularly during the biological phases following heading. Positive effects on the productivity of the ear and on the weight of the kernel are observed with a late supply of nitrogen, provided there is enough water supply in the soil. Besides the productive aspects, the effect of the nitrogen are also examined on the qualitative features of the seed, in particular on the yellow berry and on the protein content.

223. DEXTER,J.E., CROWLE,W.L., MATSUO,R.R. and KOSMOLAK,F.G. 1982
Effect of nitrogen fertilization on the quality characteristics of five north American amber durum wheat cultivar.
Can.J.Plant Sci.(Canada), 62:901-912.

The five cultivars were grown under an N regime of 0, 56 and 224, kg/ha. Application of 56 kg caused yield increases in Wascana and Wakooma, yield decreases in Macoun and Hercules, and no change in Ward. Application of 224 kg increased yield for all cultivars, with an average increase of 7.8%. There were significant differences between cultivars for several quality traits examined.

224. DHALIWAL,H.S., SINGH,D. and SEKHON,K.S. 1982
Relationship between yellow berry in durum and bread wheats and nitrogen fertilization of crop and protein content of grains
J. Res Punjab Agrci. Uni. (India), 18:351-358.

Triticum durum cv. DWL 5023 and T. aestivum cv. HD 2009 were grown during 1978-80 with 60, 120 or 180 kg N/ha. Grain protein content and yield increased with increased N fertilization. Highest grain protein content was obtained by split application of 120 kg N/ha. Yellow berry decreased as N rate increased.

225. ERDEI,P. and GYENES,I.G. 1981
Effect of fertilizers on grain yield and quality of durum wheats (T . durum Desf.)
Cereal Res.Commu. AUB, 9:119-128.

In Hungary durum wheat selection work started at the Szeged Institute in 1970. Since climatic conditions in Hungary are different from those of traditional durum wheat producing areas, the influence of lower temperatures, shorter days and higher precipitations during May, June and July was examined. Of all fertilizers employed, nitrogen has the higher positive influence on quality and yield, phosphorous and potassium applications, applied together or

separately, produce an invers effect. There is a favorable effect when they are applied together with high nitrogen doses.

226. KOREGAVE,B.A. and KOLHE,A.K. 1978
Response of wheat varieties to N and P under dry land conditions of Maharashtra.
Indian J.Agron.(India), 23:230-232.

The durum wheat cv. N-59 recommended for cultivation under rain-fed conditions showed no response to the application of N and P205, each at 0, 18.5 and 37 kg/ha when grown under rain-fed conditions on clay loam soil of Niphad and alluvial soil of Digraj during 1969-72.

227. LI DESTRI,O. and QUITADAMO,M. 1983
Slow-release nitrogen fertilizers and Triticum durum productivity. (It)
Infor.Agr.(Italy), 39:27649-27652.

During a period of three years (1979-81) a study was conducted on the durum wheat varieties Appulo, Creso, Produra and Valfprte. The results show that 120 or 180 kg N/ha applied in a slow release formula at sowing have similar effects on yield increase as a split application of the same amount of N.

228. LIKHTENBERG,A.I. 1977
Effect of fertilizers on yield of durum and soft spring wheats in Tselinograd province.(Ru)
Doklady O.L.Akad.Sel'sk.Nauk V.I.(USSR), 38-40.

Three durum and soft spring wheat cv. grown in N. Kazakhstan showed differential response to the application of P, and no response to applied N or K.

229. MONOPOLI,F.P. 1976
Fertilizing of durum wheat in north Italy.(It)
Terra et Vitta (Italy), 17:49.

230. MOSCA,G. 1979
Durum wheat in the Venice region.1: Effect of nitrogen fertilizer application on some varieties grown in the south. (It)
Agric.delle Venezie. (Italy), 33:343-366.

The highest-yielding durum wheat was Capeiti 8 there was a significant variety X nitrogen fertilizer rate interaction for grain yield. Trinakria had the highest crude protein content and highest gluten content.

231. NAZIR,M.S., MAHMOOD,S., ALI,G. and SIDDIQUE,M. 1979
Growth and yield of durum wheat as influenced by nitrogen and phosphorus application.
J.Agric.Res.(Pakistan), 17:17-22.

New durum wheat cv. Sham 2, Jori-69, and No.2031 were compared with standard cv. Chenab-70 at 3 fertilizer levels (0 or 100 lb N/ac. and 100 lb N + 50 lbs P205/ac) under field conditions. Total grain yield increased significantly as fertilizer increased. However no significant difference was seen between grain yield of the 4 cv.

232. PHOOL SINGH., DHIMAN,S.D. and SHARMA,H.C. 1982
Methods of nitrogen feeding to wheat and triticale.
Haryana Agric.Univ.J.Res. (India), 10:613-618.

Plants of Triticum aestivum cv. S-308. T. durum cv. Raj 911 and triticale cv. TL 22 were grown during 1973-4 and 1974-5 on sandy loam soil and various combinations of N fertilization, top dressing and foliar feeding were applied. Application of 60 kg N/ha at time of sowing with a further 60 kg/ha applied as top dressing produced higher yields of both wheat and triticale than 120 kg/ha applied basally or by foliar feeding. The 1000-grain wt, increased with foliar application. Max. LAI was observed between 80 and 110 days after sowing in both cereals, and was positively correlated with grain yield.

233. PRIMA,G.Di., SARNO,R. and STRINGI,L. 1982
Nitrogen,its role in controlling yield and quality of durum wheat in the warm-arid zone of Sicily. (Fr)
Inst.Agron.Gen.Coltiv.Erbacee (Italy), 121-137.

In two year experiments with five wheat varieties increasing N rates (40 to 160 kg/ha N) delayed heading, increased the number of heads per m2 and decreased mean grain weight. Increasing N rates also improved grain quality, reduced mealiness and increased gluten and protein content. Yields increased with

increasing N rates of 40 to 120kg/ha, although the differences obtained between 80 and 120 kg/ha were not always significant. N rates of 160 kg/ha decreased yields in all cases.

234. SAKKAL,R. and SUKKAR,A. 1983
Reactions of some barley and durum varieties to split nitrogen application. RACHIS (ICARDA,Aleppo,Syria), 12-13.

A study was conducted in 1981-82 at Tel Hadya to assess the advantages of splitting N application. Four rates of N fertilizer were applied to durum wheat varieties (Sahl Waha, Haurani and Graugans) in 3 ratios of splitting the total N between sowing and tillering applications. The results show the yield of durum wheats at any given rate of N was not affected by the ratio of splitting the application.

Variety Trials and Variety Descriptions

235. A.B.Pf. 1984
Summary of results of long-term trials,1983.(De)
Proc.Int.Symp.Vienna,Austria.IAEA., 77.

Tabulated data are presented on yield and other characters in trials of varieties of spring and winter bread wheat, spring durum wheat, and other crops at localities in Austria since 1978.

236. ABDURAHIMOV,H., ALIJEV,G.M. and RAHMANOVA,S.A. 1981
Production of hybrid forms of wheat and some of their characters.(Ru)
Sec Jnl Source:Refrativny Zhurnal(USSR). 12:268.

143 out of 622 varieties evaluated, were used in hybridization. Following 211 crosses, 4487 hybrid grains were obtained from interspecies hybridization of durum wheat, 3790 from interspecies hybridization of bread wheat and 1175 from intraspecies crosses between bread and durum wheat.

237. ALESSANDRONI,A. 1980
The durum wheat variety Berillo: a new product of the Experimental Institute for Cereal cultivation. (It)
Ann.Ist.Sperim.Cerealicoltura(Italy), 11:133-136.

Berillo is a large-grained, short-strawed winter variety with good resistance to mealy endosperm and a good protein content. It is highly resistant to lodging and to leaf diseases and is also cold resistant.

238. ALESSANDRONI,A., BAROCCIO,A. and INCORVALA,F. 1976
Effect of variety,environment and nitrogen fertilizer on aminoacid composition of grain protein in durum wheat. (It)
Ann.Ist.Sperim.Cerealicoltura (Italy), 7:105-125.

For 11 varieties tested at two sites with three different doses of nitrogen in two years, variation in yield and in the percentage of mealy endosperm, protein and aminoacids was attributable to all the sources of variability in the experiment.

239. ALESSANDRONI,A., CIOCCA,L., D'EGIDIO,M.G., STEFANIS,E.De. and GALTERIO,G. 1977
Protein composition of viterous and mealy endosperms in genotypes of *T. durum* at two levels of nitrogen application.(It)
Ann.Ist.Sperim.Cerealicoltura (Italy), 8:145-157.

Seven varieties were grown under 40 and 120 kg N/ha. Varieties more susceptible to mealy endosperm, had lower total protein content, lower contents of the fractions soluble in alcohol and a higher content of water-soluble protein than the more resistant varieties.

240. AMBOLLET,B. 1978
Spring cereal varieties. (Fr)
Prod.Agr.Francaise (France) 54:17-18.

Tabulated data are presented on 27 barley varieties, 15 oat varieties, 11 durum wheat varieties and 27 bread wheat varieties, of which four, one, two and five varieties respectively are new varieties entered in the official catalogue in 1978. The data include growth period, lodging resistance, resistance to *Erysiphe graminis*, *Puccinia striiformins*, *P. coronata* and *Rhynchosporium secalis*, and also baking quality (bread wheat), resistance to mealy endosperm and pasta colour (durum wheat), and protein content and kernel percentage (oats).

241. ANON. 1976
Agronomic and quality data for barley, oats, wheat and durum wheat.
Manitoba Agron.Annu.Conf. (Canada), 24-28.

Data are given on grain yield, agronomic characteristics and disease resistance for 4 durum wheat cv.

242. ANON. 1977
Demonstrative activity of the agricultural development agency of Venetia (Italy). Confirmation tests among some durum wheat varieties and some other common wheat varieties. (It)
Agricoltura dello Venezie(Italy), 31:607-610.

Creso was the best variety in terms of quality and quantity. During 1976/77 Creso was compared with 7 new varieties (Valnova, Valselva, Roccia, Rieite, Kid, Valgerardo and Tito). Valnova and Valselva performed well for grain yield, specific weight and yellowberry. Valnova and Valselva had the best disease resistance.

243. ANON. 1977
Spring Wheat. (Fr)
Perspectives Agricoles (France), 1:31-33.

1976 trials of six durum wheat varieties sown in spring showed the good performance of a new variety Tomclair. Agathe and Durtal also perform well. Wells superiority over Rakita is confirmed. Rikita has lower yields than Lakota. Although Agathe has a satisfactory pasta quality it gives a semolina which is not yellow enough. Durtal gives pasta which stick when over cooked. All laboratory tests carried out on Tomclair indicate that this variety also will not be suitable for semolina production.

244. ANON. 1978
Plots and demonstrative trials on winter cereals (soft, durum, barley, and triticale).(It)
Veneto Agricoltura (Italy), 1:1-9.

245. ANON. 1978
Varieties of winter cereals:research results 1977. Durum winter wheat. (Fr)
Perspectives Agricoles (France), 16:28-32.

Out of 7 varieties of durum wheat sown in autumn, 5 were confirmed: Bidi 17, Agathe, Tomchair, Lakota,Durtal. Valdur gives good yields and good quality but is very susceptible to lodging; Modur has good technological qualities; Poinville is resistant to lodging but does not hold well when cooked; Blondur is susceptible to lodging, has lower quality and productivity than Valdur.

246. ANON. 1978
pdating varieties. Description of the new wheat varieties (soft and durum, in Italy). (It)
Giornale di Agricoltura (Italy), 88:445.

247. ANON. 1978
Evaluation of varieties. (Fr)
Cultivar (France), 112:20-21.

In the tables yield for the following durum wheat varieties: Bidi 17, Agathe, Montferrier, Tomclair, Valdur, Mondur, Poinville, Blondur, Wells, Lakota, Rikita and Diabolo are described.

248. ANON. 1979
Agronomic and quality data for barley, oats, bread wheat, and durum wheat.
Agro.Annual Conference Dec.(Canada), 1:23-27.

Five years of data from trials in Manitoba are tabulated.

249. ANON. 1980
Surface increase of durum wheat varieties. Characteristics of durum wheat varieties. (Fr)
Semences et Progres.(France), 45-46.

250. ANON. 1980
Seasonal studies: durum wheat in spring. (Fr)
Perspectives Agricoles (France), 36.

251. ANON. 1980
Hard wheat, spring barley. Comparative tables of varieties, evolution of varieties, France. (Fr)
Cultivar (France), 42-44.

In the tables, yield for the following French durum wheat varieties: Bidi 17, Agthe, Kindur, Montferrier, Mondur, Chandur, Tomachair, Diabolo, Valdur, and Poinville are described.

252. ANON. 1981
Durum wheat in the north awaiting yield

data. (It)
Informatore Agrario.(Italy), 37:17099.

12 durum wheat cv. were grown at 12 sites in N. Italy in 1980-81. Mean grain yields are reported.

253. ANON. 1981
Hard wheat (in France). (Fr)
Motor.Techn.Agr.(France), 30-31.

254. ANON. 1981
Wheat cultivar (T.durum and T.aestivum). (It)
Giornale di Agricoltura (Italy), 91:38-48.

255. ANON. 1982
Winter cereal varieties 1981 trials. Durum wheat (Fr)
Perspectives Agricoles (France), 60:13-61.

Results of the trials carried out in 1981 by ITCF with durum wheat varieties at the three French farming zones.

256. ANON. 1982
New varieties of durum wheat and bread wheat. (It)
Informatore Agrario (Italy), 38:22642.

Two new durum varieties, Procace and Aldura, are listed.

257. ANON. 1982
Special autumn cereals. (Fr)
Semences et Progres (France), 32:30-45.

258. ANON. 1982
Repartition of cereal varieties in 1982. (Fr)
Producteur Agricole Francaise. (France), 58:38-40.

259. ARTAMONOVA,V.D. 1978
Results of breeding spring durum wheat in Kuibyshev province.
Vest.Sell'Skokhozyaistvennoi Nauki(USSR) 12:132-133.

Bezenchuk 141, is a very drought resistant variety with good grain quality, resistance to root rots and bacterial disease and a yield of 22.6 c/ha. Bezenchuk 139, from Bezenchuk 121 X Khar'kov 46, yields 33.1 c/h under irrigation and is highly resistant to Ustilago nuda, Erysiphe graminis and Puccinia recondita. It has a large grain with up to 96 per cent vitreousness.

260. AU.INST.AGRIC.SCI. 1977
Register of cereal and linum varieties in Australian Wheat. Durati [Durum wheat].
J.Austr.Inst.Agric.Sci. (Australia), 43:175.

The new durum wheat variety Durati (TAM 36A) has been released as a replacement variety for Duramba for growing in the higher protein wheat-belt areas of New South Wales and Queensland. Durati has a yield advantage over Duramba of 11%. The grain has a bright yellow colour, high mill yield and good dough strength and should be readily accepted by millers and pasta manufacturers. The pedigree is Zenati Bouteille/Wells//Mexican Dwarf (CIMMYT). Additional information is given on yield, agronomic traits, disease resistance and quality.

261. BAGULHO,F.C. 1975
Some quality factors of the new Portuguese durum wheat varieties. (Pt)
Melhoramento (Portugal), 26:57-69.

Information is given on the production of durum wheat and on the possibilities of improving its yield in Portugal. The cv. mainly grown is Capeiti 8, which was used as the control against 4 new cv. Faisca, Abegao, Maioral and Alforge.

262. BALLATORE,G.P., PRIMA,G.Di. and BONOMO,G. 1973
Agronomic evaluation of new durum wheat lines.
Genet.Breed.D.W.Symp.Lib.Fac.Agric.Italy 437-443.

Results of a five-year comparative trials (1967-1972) of new durum wheat lines obtained by the Institute of Agronomy, University of Palermo (Italy) are reported. The main agronomic characters are compared with control variety Capeiti 8. Results obtained can be summarized as follows: Straw production from the 17 lines was the same as, or more than, in the control. Lodging resistance was improved although the plants were often equal to, or even higher than the control. Of all the lines tested, 5 revealed a slightly heavier hectolitre weight than the control. 1000 kernel weight was heavier in most of the lines. Yellowberry percentage was lower everywhere. With reference to yield, three lines produced

higher values, while the rest was the same as, or even less than, Capeiti 8. In conclusion, lines EC08 BC3 (Hymera), BC5, BC4 (Trinakria), BC2, and PB1, showed greater yields, better lodging resistance, heavier hectolitre weight and 1,000 kernel weight, and total resistance to yellow berry.

263. BAROZZI,L. and ALESSANDRONI,A. 1982
Triticum durum : varieties compared. (It)
Terra e Vita (Italy)., 23:49-51.

264. BASSO,F. and LANZA,A.M.R. 1976
Bioagronomic and technological aspects of cultivars and lines of durum wheat. (It)
Sementi Elette (Italy), 22:17-26.

Of 22 varieties and lines compared with Cappelli, ISA1, Humera and Trinakria were the earliest reaching ear emergence in 139-141 days, while ISA1 and Ichnusa reached full maturity after 194 and 198 days respectively. Maristella and line 1696 were among those with the highest yields of grain and straw. ISA1, PB1, Ichnusa and Maristella had good grain quality and processing quality .

265. BEJLERI,R. 1981
Comparative study of wheat varieties at the cooperative of Belsh.
Buletini i Shkencave Bujpesore(Tirane), 2:23-28.

In trials in 1978-80 the best of 23 durum wheat varieties and lines were Kingfisher CD and Hercules X GIA, which were high yielding and resistant to diseases and lodging.

266. BEKE,B. 1980
Improvement and production of Triticum durum in Hungary. (Hu)
Magyar Mazogazdasag (Hungary), 35:71.

267. BEKE,B. and BARABAS,Z. 1981
The first Hungarian durum wheat varieties.
Cereal Res. Commu. (Hungary), 9:115-117.

Two alternative winter-type varieties, GK Minaret and GK Basa (GK Pasha), were produced using F2 material from the CIMMYT station in Ankara, Turkey. Both varieties are erect, medium early (240-250 days when sown in October in Hungary) and moderately winter hardy and have a yield potential of 4.5-5.0 t/ha. The straw is strong , lodging resistant and 70-80 cm tall in GK Minaret, strong and 85-95 cm tall in GK Basa. Cooking quality is good for Gk Minaret and moderate for GK Basa. Both varieties show resistance to Puccinia graminis and moderate resistance to P.recondita and Septoria (Leptosphaeria) nodorum.

268. BEKE,B. and SUTKA,J. 1983
Combining ability for frost resistance in durum wheat.
Cereal Res.Commu.(Hungary), 11:221-227.

A six-parental diallel cross including reciprocal was completed, and F1 hybrids and their durum wheat parents were used for the freezing test under controlled conditions. The general combining ability (GCA) was highly significant. No significant specific combining ability (SCA) was found. The high GCA:SCA ratio revealed a preponderance of additive genetic variance in the inheritance of frost resistance in durum wheat. No significant general reciprocal effect was obtained between the reciprocal crosses in this set of durum wheat varieties.

269. BEKE,B. and SZEBELLEDY,T. 1981
Selection of winter durum wheats (T . durum Desf.) in Hungary.
Cereal Res. Commu. (Hungary), 9:47-54.

In the trials Triticum durum lines, selected by breeders at the Cereal Research Institute from CIMMYT hybrid populations and other foreign (Italian, French, Soviet) varieties generally yielded 20-30% less than the most produced winter wheat cultivars Triticum aestivum. In spring sowing the durum lines and varieties yielded 50-60% less than the bread wheat and 20-30% less than the same durum genotypes sown in autumn. In the National Variety Testing Trials the durum cultivars and candidates, CK Leila GK Minaret, GK Basa, GK Aga of the Cereal Research Institute yielded 4.9-5.2 t/ha in the mean of 4 years. Thus their yielding ability is 15-20% lower than that of the control aestivum wheats Mv 4, Jubilejnaya 50, GK 3. The quality of the durums was tested by INRA (Montpellier, France) and on the basis of laboratory results their pasta quality was classified as excellent, good and satisfactory. With the exception of GK Aga all of the others

proved to be good during the cooking test. The results until now prove that it is possible to produce winter durum wheats in Hungary.

270. BELLO,M. 1976
The hard wheat problem in Italy. (It)
Cooperazione in Agricoltura (Italy), 23-32.

271. BENI,G. 1976
Varieties of durum wheat compared one with another. (Italy)
Infor.Agr.(Italy), 32:24785-24792.

272. BENI,G. 1981
Veneto a new suitable environment for obtaining increased yield. (It)
Infor.Agr.(Italy), 37:1744-1745.

Yields of 15 durum cv. at several sites are given.

273. BENI,G. 1984
Veneto. (It)
Infor.Agr.(Italy), 40:29-31.

Yield data are tabulated from trials of 13 durum wheat cultivars in the Veneto province of Italy in 1981-84. Valriccardo and Gabbiano were highest-yielding cultivars.

274. BIANCHI,A.A. 1981
"Valforte" in comparison with more diffuse cultivars. (It)
Infor.Agr. (Italy), 37:17455-17458.

Quantitative and qualitative characteristics of durum wheat cv. Valforte are compared with those of cv. Capeiti, Appulo, Cappelli, Trinakria, Creso and Valgerado.

275. BIANCHI,A.A. and CIRICIOFOLO,E. 1981
Varieties of bread wheat, durum wheat and barley sown in March in central Italy. (It)
Infor.Agr. (Italy), 37:14607-14616.

Trials were carried out in 1977 and 1979 at two localities on 24 durum wheat varieties in early March to assess their degree of spring habit. All the durum wheats headed; the highest yielding were Guasila, Valselva, Perla and Valsacco.

276. BIANCHI,A.A., CIRICIOFOLO,E., ARCHETTI,R. and STEFANINI,A. 1984
Eight years' trials of durum wheat varieties in Umbria. (It)
Infor.Agr. (Italy), 40:67-75.

Tabulated data are presented on the grain yields of between 9 and 31 varieties in trials at up to 8 localities in 1976/77-1983/84 and on the yields, height, single grain weight, hectolitre weight and percentage mealy endosperm of 52 varieties. Brief descriptions, including parentage, are given of the 19 highest yielding varieties. Latino, Appio, Valriccardo, Berillo and Karel are considered the most promising.

277. BIANCHI,A.A. and WITTMER,G. 1978
Report on the activities of sub-network on cooperative trials.
FAO. Rome (Italy), 1-23.

Field and laboratory data are reported on trials carried out in ten European countries, using 20 varieties in Mediterranean regions and another 20 varieties in colder environments.

278. BIANCHI,A.A. and WITTMER,G. 1980
Report on the activities of sub-network on cooperative trials of T. durum. (It)
Ann.Ist.Sper.Cerealicoltura.(Italy), 11:145-146.

279. BIANCOLATTE,E. and CECCHI,V. 1984
Hard wheat. (It)
Terra E Sole (Italy), 39:577-582.

25 hard wheat cv. were compared in trials at 38 sites in Italy in 1983-84. Cv Latino and Messapia in central Italy and Latino and Aldura in S. Italy gave the highest yields, with one of the standard cv. Trinakria, giving the lowest yields in both areas. 1000-grain weight and susceptiblity to Erysiphe graminis, Puccinia graminis and P. triticina were also recorded.

280. BIANCOLATTE,E., CECCHI,V., MARIANI,B.M., STEFANINI,A. and MANMANA,P.N. 1984
Durum wheat in central southern Italy: results of variety trials in the 1983-84 season. (It)
Infor.Agr. (Italy), 40:53-60.

Data on grain yield, 1000-grain weight, hectolitre weight, height and number of days to heading are tabulated for 25 varieties in trials at 38 localities in

1983-84. Yield data are also given for 14 varieties in 1981 and 1982, 21 varieties in 1983 and 25 in 1984. In addition, information is presented on the parentage of the varieties and on their degree of resistance to Erysiphe graminis, Puccinia graminis and P. recondita.

281. BIANCOLATTE,E., CECCHI,V., PROCACCINI,M. and MANMANA,P.N. 1977
Comparative trials of durum wheat in central and southern Italy and the Islands. (It)
Infor.Agr. (Italy), 33:28031-28044.

282. BIANCOLATTE,E., CECCHI,V., VALLEGA,V., ZITELLI,G. and MANMANA,P.N. 1981
The results of trials conducted in 1980-81 in central-southern Italy and in the islands. (It)
Infor.Agr.(Italy), 37:17423-17426.

25 durum wheat cv. were grown at 30 sites and results are given from (a) 11 sites on the islands and S. Italy and (b) 14 sites in central Italy.

283. BIANCOLATTE,E., CECCHI,V., VALLEGA,V., ZITELLI,G. and MANMANA,P.N. 1982
The results of trials carried out in 1981-82 in central and southern Italy and in the islands. (It)
Infor.Agr. (Italy), 38:22631-22641.

Yield and other data (including height, dates of heading and maturity, 1000-grain weight, hectolitre weight, and incidence of Puccinia recondita and Erysiphe graminis) are tabulated for 25 varieties of durum wheat at 27 localities. The highest yielding overall were Karel, Valnova and Valforte.

284. BIANCOLATTE,E., FORNI,C., ZITELLI,G., MANMANA,P.N. and STEFANINI,R. 1980
Durum wheat: Results of experimental trials in central, southern, and insular Italy in 1979-80. (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 11:148.

285. BOGGINI,G. 1976
Particular aspects of durum wheat cultivated in north Italy.(It)
Ann.Ist.Sper.Cerealicoltura,Rome(Italy), 8.

286. BOGGINI,G. 1976
Hard wheat in north Italy. (It)
Conoscere Per Produrre (Italy), 3:9-25.

287. BOGGINI,G. 1979
Cultivation of durum wheat in the north. (It)
Infor.Agr. (Italy), 35:7509-7511.

Yield data are tabulated for 15 varieties at 15 localities in Italy.

288. BOGGINI,G. 1980
The cultivation of durum wheat (T . durum) in north Italy. (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 11:150.

289. BOGGINI,G. 1980
Durum wheat in north Italy. (It)
Terra e Sole (Italy), 35:637-639.

In field trials in 1978-80 at 18 sites in N. Italy, 12 durum wheat cv. were grown. Cv. Tito was the best adapted cv. followed by cv. Creso, Gabbiano, Valnova and Valgerardo.

290. BOGGINI,G., BENI,G. and SNIDARO,M. 1982
Durum wheat to the north of the Po river. (It)
Infor.Agr.(Italy), 38:22313-22314.

Yield data are given for ten varieties at eight localities in 1982. Gabbiano, Valnova, Valriccardo, Creso and Tito showed the most promise.

291. BOGGINI,G., BORGHI,B., CATTANEO,M., CORBELLINI,M. and CORINO,L. 1977
Bread wheat and durum wheat screened in comparative trials. (It)
Infor.Agr.(Italy), 33:27013-27033.

Fifteen durum winter varieties were grown at 19 sites in 1975-76. The varieties Valnova, Tito (Titus), Valsacco and Creso (Croesus) were superior in yield to the other varieties.

292. BOGGINI,G., CARDILLO,F. and ZANGARA,L. 1979
Technological trials on hard wheat. (It)
Sementi Elette (Italy), 25:11-16.

In field trials in 1976-7, 14 wheat cv. were grown at (a) S. Angelo Lodigiano, (b) Budrio, (c) Lonigo and (d) Rome. Av. grain yields ranged from 3.34 t/ha in

cv. Marysa to 6.58 t in cv. Argelato at (b), from 4.33 t in cv. Aniene to 5.40 t in cv. Fabian at (c) and from 2.13 t in cv. David to 3.56 t in Magnifico at (d).

293. BOGGINI,G. and DALLI,A. 1980
Durum wheat is losing its share in the north. (It)
Infor.Agr. (Italy), 36:12315-12320.

Data are provided on characters including grain yield and hectolitre weight for 15 varieties at 18 localities in Italy in 1979-1980.

294. BOGYO,P., SCARASCIA,M.G.T., SIGURBJORNSSON,B., BAGMARA,D. and BOZZINI,A. 1973
The FAO/IAEA/CREN, Near east uniform regional trial of radio-induced durum wheat mutants 1966-70.
Genet.Breed.D.W.Symp.Lib.Fac.Agric.Italy 349-370.

This report summarizes the work over five years of a trial which was carried out at 35 locations, mainly in the Mediterranean region. Of the mutants GRA145 (later released as the variety Castel del Monte) was the over-all best yielder, closely followed by the mutant GAB125 and the variety Capeiti. During the last year of the trials, three dwarf lines Cairo, GVZ300 and GVZ385 (the last two are Vallega's and Zitelli's selection) were introduced and one of these showed great promise with high yields, good kernel size and resistance to lodging. The correlations between the different characters measured in each entry have been analyzed. Raw correlations were calculated for the over-all data, within years and also within varieties. Of these characters, the period of ripening (i.e., the number of days elapsed from heading to maturity) seems to warrant further investigation.

295. BOUCHOUTROUCH,M. 1979
Improvement of autumn cereals: Results and perspectives. (Fr)
Homme,Terre et Eaux (France), 9:47-48.

Since 1968 two durum wheat cv. have been released by the Station des Cereales d'Automne. These gave yields 40% higher than the control.

296. BOZZINI,A. and MOSCONI,C. 1976
Creso: a new durum wheat of interesting agronomic features. (It)
Genetica Agraria (Italy), 30:153-162.

Creso is a new variety of durum wheat coming from a cross between a CIMMYT durum line (YE54 - N10B14) Cp2-63- TC2 and a mutant line Cp B144 isolated in the variety Cappelli. It has short straw (80-90 cm), high lodging resistance, resistance to stripe rust, leaf and stem rusts, high response to N fertilization, good seed size and quality. Results of several agronomic trials, performed in several locations of central Italy during 5 years, are presented. Yields range from 30 to 100 q/ha, with an average of around 50 q/ha. This varity seems to be an interesting breakthrough in the yielding capabilities of durum wheats in central Italy.

297. BUYUKLI,P.I. 1978
New botanical varieties of winter durum in Moldavia. (Ru)
Sec.Jnl.Source: Referat.Zh.(USSR), 7:65-271.

From various crosses, awnless types designated vars. Mutico-leucomelan, Mutico-reichenbachii and Mutico-alexandrinum and awned types designated vars. Rubero-lubicum and Nigro-leucomelan were selected.

298. BUYUKLI,P.I. 1979
Short-strawed forms of winter durum wheat. (Ru)
Sec.Jnl.Source:Referat.Zh.(USSR), 8:110.

299. CANTRELL,R.G. and DICK,J.W. 1983
Durum wheat improvement update.
Macaroni J.(USA), 65:32-34.

300. CATIZONE,P. and VIGGIANI,P. 1975
Variable sensitivity of hard wheat toward herbicides. (It)
Infor.Fitopatl. (Italy), 25:35-39.

301. CIMMYT MEXICO. 1976
Summary of the first-fourth elite durum yield trial (EDYT).
Infor.Bull.CIMMYT (Mexico), 78.

302. CIMMYT MEXICO. 1978
Results of the 8th international durum wheat screening nursery (IDSN)1976/77 and 1977/78.
Infor.Bull.CIMMYT (Mexico), 55:105.

Data are presented on the grain yields,

agronomic performance and disease susceptibility of 288 and 243 durum wheat cv. grown at 41 and 54 sites in 1976-7 and 1977-8, respectively.

303. CIMMYT. 1974
Results of the tenth international durum yield nursery.(IDYN)
Infor.Bull.CIMMYT (Mexico), 64:63.

Data are presented on the grain yields and agronomic performance of 22 durum wheat, 1 bread wheat and 1 triticale cv. grown at 50 sites throughout the world.

304. CIMMYT. 1974
Results of the fifth international durum yield nursery (IDYN),1973-1974.
Infor.Bull.CIMMYT (Mexico), 21:66.

305. CIMMYT. 1974
Results of the ninth elite durum yield trial (EDYT).
Infor.Bull.CIMMYT (Mexico), 57:21.

Data are presented on the grain yields, agronomic performance and disease susceptibility of 25 durum wheat cv. grown at sites in 11 countries.

306. CIMMYT. 1975
Report of the sixth international durum screening nursery.
Infor.Bull.CIMMYT (Mexico), 26:4.

307. CIMMYT. 1975
Results of the fourth international durum yield nursery 1972-1973.(De)
Infor.Bull.CIMMYT (Mexico), 19:39.

308. CIMMYT. 1975
Durum wheats in center-northern Italy.(It)
Italia Agr.(Italy), 112:115-117.

Two new durum wheat varieties are described. Sabato Visco (Forlani X Cappelli and Loro X Cappelli) has a low yellow berry percentage, high 1000 kernel weight and high hectolitre weight. Polesine (Forlani X Capeiti and Capeiti) is a short and early variety.

309. CIMMYT. 1975
Report of the first to fifth international durum screening nurseries (IDSN).
Infor.Bull.CIMMYT (Mexico), 18:14.

310. CIMMYT. 1976
Results of the sixth international durum yield nursery (IDYN)1974-1975.
CIMMYT (Mexico): 53pp.

311. CIMMYT. 1976
Results of the seventh international durum yield nursery (IDYN)1975-1976.
Infor.Bull.CIMMYT (Mexico), 31:84.

In world-wide trials at 45 sites, 23 durum wheat lines were compared.

312. CIMMYT. 1977
Results of the eighth international durum yield nursery.
Infor.Bull.CIMMYT (Mexico), 42:58.

Twenty two new durum wheat cv. 1 bread wheat cv. 1 triticale cv. and 1 local durum wheat cv. were grown at 36 sites in 25 countries. Grain yield, grain quality, agronomic and disease data are presented.

313. CIMMYT. 1978
Results of the fifth-seventh elite durum yield trials (EDYT)1974-1977 [T . durum]
Infor.Bull.CIMMYT (Mexico), 47:46.

314. CIMMYT. 1978
Results of the ninth international durum wheat yield nursery. (IDYN) 1977-78.
Infor.Bull.CIMMYT (Mexico), 50:75.

Data are presented on the grain yield, agronomic performance and disease susceptibility of 23 durum wheat, 1 bread wheat and 1 triticale cv. grown in 1977-8 at 50 sites in 33 countries.

315. CIMMYT. 1979
Results of the tenth international durum wheat screening nursery (IDSN)1978-79.
Infor.Bull.CIMMYT (Mexico), 59:34.

Data are presented on the grain yields, agronomic performance and disease susceptibility of 287 durum wheat cv. grown at 33 sites in 27 countries. The 20 highest yielding cv. gave grain yields ranging from 3.91 to 4.81 t/ha

316. CIMMYT. 1979
Results of the fifteenth international spring wheat yield nursery (ISWYN) 1978-79.
Infor.Bull.CIMMYT (Mexico), 55:103.

317. CIMMYT. 1980
Results of the eleventh international durum screening nursery (IDSN)1979-80.

Infor.Bull.CIMMYT (Mexico), 12:22.

Data are presented on the grain yields, agronomic performance and disease susceptibility of 16º durum wheat cv. grown at 27 sites in 26 countries.

318. CIMMYT. 1980
Results of the eleventh international durum yield nursery (IDYN) 1979-80.
Infor.Bull.CIMMYT (Mexico), 71:63.

Data are presented on the grain yields, agronomic performance and disease susceptibility of 48 durum wheat, 1 triticale and 1 bread wheat cv. grown at 47 sites in 35 countries.

319. CIMMYT. 1981
Results of the tenth elite durum yield trial.
CIMMYT (Mexico)· 49pp.

320. CIMMYT. 1981
Results of the twelfth international durum yield nursery.
CIMMYT (Mexico): 57pp.

321. CIMMYT. 1981
Results of the twelfth international durum screening nursery.
CIMMYT (Mexico): 39pp.

322. COPPOLA,L. 1978
Durum wheat: The selected seeds are fundamental (It)
G.Agric.(Italy), 88:218.

323. CORTAZAR,S.R. 1980
Response of bread and durum wheat in the north-central zone of Chile in the years 1975/76/ 77. (Es)
Agric.Tecnica (Chile), 40:105-110.

Av. grain yields and hl wt. from 32 trials carried out on bread and durum wheat in the N.-central zone of Chile are analysed

324. DECKARD,E.L., LUCKIN,A., JOPPA,L.R. and HAMMOND,J.J. 1977
Nitrate reductase activity, nitrogen distribution, grain yield, and grain protein of semi-dwarf near isogenic lines of T. aestivum and T. turgidum.
Crop Sci (USA), 17:293-296.

Standard height 'Chris' and six near-isogenic semidwarf selections of hard red spring wheat (T.aestivum L. em Thell) and five pairs of durum lines (T.turgidum var. durum L.) near-isogenic for plant height were grown under non-lodging conditions. The objective was to determine if the semidwarf character affected nitrate reductase activity, distribution of reduced N, grain yield, or grain protein (percent and total). There were no significant differences among the hard red spring semidwarf selections for any of measured characters. There were significant differences among pairs of durum lines for most of the measured characters. The gene or genes for semidwarfism did not significantly alter enzyme activity, distribution of reduced N, or any of the production parameters, with the exception that the semidwarf durum lines exhibited slightly higher percent grain protein values than their standard counterparts. Significant correlations between nitrate reductase activity and grain yield or grain protein (percent or total) were noted. These data suggest that the effectiveness of nitrate reductase assays as a selection criterion should not be reduced in populations segregating for plant height.

325. DEKOV,D. 1982
A study on grain yield and quality of introduced durum wheat cultivars. (Bg)
Rasteniev'd Nauki,(Bulgaria), 19:13-19.

The French durum wheat cv. Rikita, the Italian cv. Tito and the Bulgarian standard cv. Apulicum 233 gave 3-yr av. grain yields of 5.05, 5.1 and 4.41 t/ha, resp. Because of high grain yield and quality Rikita is suitable for commercial cultivation. Tito has low grain quality.

326. DELLA,A., FARIAS,R.M. and JOSEPHIDES,C.M. 1980
Barley and durum wheat in Cyprus.
Plant Genet.Res.Newsl.IBPGR, FAO., 2-6.

327. DICHEVA,S. 1981
The yield structure and the productive potential of some winter durum wheat cultivars.
Plant sci (Bulgaria), 18:9-16.

The cultivars Apulicum 233, No. 2726, No. 1452/51 and No. 192(PRB); Tito (Italy); Rikita (France) and CK-225 (SFRY) were studied in 1978 to 1980. During the period of study the cultivars

Tito and Rikita produced highest and most stable yield (for a 3 year average), and No. 2723, 2270 and 2726 (for a 2 year average). These cultivars are comparatively resistant to lodging. Cv. Tito is highly productive, but due to its low technological properties it can not be recommended for extention, seed production or breeding. The cultivars Rikita, No. 2725 and No. 2723 are high yielding, meet the requirements of the Bulgarian State standards in respect to technological characters and should be extended.

328. DICK,J.W. 1982
Basic structure of durum wheat emphasizing its unique chemical, physical and quality characteristics. (It,
Technica Molitoria (Italy), 23:459-467.

329. DICK,J.W., WALSH,D.E. and GILLES,K.A. 1974
The effect of field sprouting on the quality of durum wheat.
Cereal Chem.(USA), 51:181-188.

330. DIFELICE,G., FEDELI,A.M. and MATTEI,C. 1976
Examination of the production of wheat and hard wheat in Italy. (It)
G.Agric. (Italy), 86:459-465.

331. DONNELLY,B.J. and MANSOUR,T.M.M. 1977
Durum wheat and its milled products: effect of variety and environment on the phytic acid content.
Cereal Foods World (USA), 22:483.

332. DOUSSANAULT,G. 1982
Research on wheat quality. (Fr)
INRA, France, 51-63.

333. GILL,K.S., BHULLAR,G.S., SHARMA,Y.R. and BHATIA,A. 1980
The screening of germplasms of the durum wheat for their reaction to the prevalent races of the yellow and brown rusts in the Punjab state.
Crop Improvement (India), 7:43-48.

Fifty two lines proved resistant to both Puccinia striiformis and P. recondita.

334. GUSEIN-ZADE,A.A. and KHALILOVA,Z.G. 1977
Yield of some durum wheat varieties from world collection of the Vavilov Institute of plant industry(VIR)under Azerbaijan condition. (Ru)
Genet.Selekt. (USSR), 3:142-143.

Most of the Italian varieties studied had high values for grain weight from the main ear, including Mal3 and Maliani 11a; varieties from Portugal (Verdeal Rijo), Chile (CBP437) and Turkey (Kara Kilcik(Black Awn)) also had high values for the character. For 1000-grain weight best were VZ187 from Italy and K20869 from Turkey. These varieties have been used in hybridization work with local varieties to breed high-yielding forms.

335. HADJICHRISTODUOLOU,A 1973
Capeiti, a new durum wheat variety for Cyprus.
Techn.Bull.Agric.Res.Inst.(Cyprus), 10.

Capeiti is higher yielding than Kyperounda and has shorter straw with better lodging resistance. The grains are larger and , in trials at 30 sites in 1966-1972, heading averaged eight days earlier than Kyperounda.

336. HADJICHRISTODUOLOU,A 1979
Genetic and environmental effects on vitreousness of durum wheat.
Euphytica (Netherlands), 28:711-716.

The local variety kyperounda, the Italian variety Capeiti 8 and 18 lines originating from CIMMYT were grown at three sites in Cyprus and the effects of genotype, nitrogen application and site were investigated under rainfed conditions. All three factors affected vitreousness but genotype was the most important. Screening for vitreousness was more effective when conducted without the addition of nitrogen and at sites where vitreousness was generally low. A tendency for large-seeded varieties to produce highly vitreous grains was noted.

337. HADJICHRISTODUOLOU,A, JOSEPHIDES,C.M. and KARIS,A. 1982
Performance of the new durum wheat variety 'Mesaoria' under rainfed conditions.
Techn.Bull.Agric.Res.Inst.(Cyprus), 11.

Mesaoria, selected from a CIMMYT F3 line, Anhinga S Volunteer D31728-0L is 7 cm shorter than Aronas and similar to that variety in earliness. In 23 trials in 1975-81, the average yield of

Mesaoria equalled that of Aronas and exceeded that of Kyperounda by 43%. The grain was vitreous under all conditions and had a significantly higher carotene content than Aronas.

338. HADJICHRISTODOULOU,A and KARIS,A. 1983
Karpasia,a high yielding new durum wheat variety with improved grain quality characteristics.
Techn.Bull.Agric.Res.Inst.(Cyprus), 7.

A selection of durum wheat from CIMMYT material outyielded the commercial varieties grown from 8% to 48%. Its plant height was 80 cm, 1000-grain weight 40 gr, volume weight 80 kg/hl, vitreousness 95%, carotene content 6.5 ppm and grain protein 15%. It utilized rainfall best producing 12 kg grain/ha/mm and gave very high yields also with supplementary irrigation. It was released as a commercial cultivar under the name Karpasia.

339. HUGHES,L.A., OLASO,,F. and SUPERVIELLE,B. 1977
Comparison between two varieties in durum wheats (T . durum Desf.) in five seeding rates. (Es)
Balcarce,Bs.As.(Argentina), 102.

340. I.S.C. ITALY. 1976
From Pisa to Oristano:Here is the behaviour of 20 varieties (durum wheat in central, southern and insular Italy) (It)
Infor.Agr.(Italy), 37.

341. I.S.C. ITALY. 1982
New varieties of soft and durum wheat (T . durum and aestivum). (It)
Infor.Agr.(Italy), 38:22642.

342. I.T.C.F. FRANCE. 1978
The spring cereals varieties: barley, oats, hard wheat, common wheat. (Fr)
Perspectives Agricoles (France), 21:12-40.

343. I.T.C.F. FRANCE. 1981
Winter cereals varieties: results of 1980 trials. (Fr)
Perspectives Agricoles (France), 3-79.

344. I.T.C.F. FRANCE. 1982
Spring cereal varieties, trails 1981. (Fr)
Perspectives Agricoles (France), 55:20-42.

345. INNOCENTI,A.M., BITONTI,M.B. and BENNICCI,A. 1983
Cytophotometric analyses and in vitro culture test in the embryo first node of old T . durum caryopses.
Caryologia (Italy), 36:83-87.

346. INRA FRANCE. 1978
Protocols of notations: Notations of soft wheat and hard wheat diseases, notations of climatic accident. (Fr)
INRA France., 22.

347. INRA FRANCE. 1981
Varieties bulletin 1981: cereals and provisional descriptive notes on varieties registered in October 1980 and January 1981. (Fr)
INRA-CNRA Versailles (France), 172.

348. IRVINE,G.N. 1978
Quality and yield objectives for Canadian durum wheat. (De)
Getreide, Mehl und Brot (F.R.G), 32:145-146.

349. IRVINE,G.N. 1978
Amber durum varieties. (Fr)
Can.Grain Com.(Canada) Report.

350. ISABAEV,S.Ya. 1978
Best samples of spring wheat for the western Kazakh SSR. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 4-6.

150 samples of T. durum were studied in variety trials in 1973-6 in W. Kazakhstan. Most of the highly drought resistant cv. were characterized by a short duration of the emergence-heading period and some cv. of this group also gave high grain yields. Samples of high-quality gluten were found amongst the studied wheats.

351. JOPPA,L.R. and WILLIAMS,N.D. 1982
Registration of Largo, a greenbug resistant hexaploid wheat (Reg.no G.P.176).
Crop Sci.(USA), 22:901-902.

Largo (CI 17895) was selected from a cross between 'Langdon' durum (T. turgidum L., 2n = 28) and a plant introduction, PI 268210 (T. tauschii (Coss.) Schmal 2n = 14). Triticum tauschii formerly Aegilops squarrosa L., contains the D-genome and durum has the A- and B-genome. Largo has a single dominant gene for resistance to biotype

C of the greenbug (Schizaphis graminum, Rondani). Largo is also resistant to the newly discovered biotype-E.

352. KIRICHENKO,F.G., PYL'NEV,V.M. and PALAMARCHUK,A.I. 1982
New short-strawed variety of winter durum wheat, Parus.(Ru)
Nauch Techn.Byul.Vses.S.Genet.Inst.USSR. 3-7.

Parus, from ([221/63 X pollen mixture] X Khar'kov 1) X Oviachik 65, is an awned variety with white vitreous grain and good resistance to shedding. Its macaroni quality is good. It reaches a height of 75-85 cm and is resistant to lodging, cold and drought. Parus also shows resistance to Puccinia recondita, Ustilago nuda and Tilletia. It is a midearly variety which, in trials during 1977-81, yielded 49.2 c/ha.

353. KONZAK,C.F. 1974
Registration of Wandell durum wheat.
Crop Sci.(USA), 14:910.

'Wandell' durum wheat was developed at Washington State University, from F5 population derived from the cross DWF/'Langdon'// Langdon. Yield, agronomic traits, disease resistance and quality are described.

354. KOSTIN,V.V. and KAZARTSEVA,A.T. 1979
New varieties of winter durum wheat bred at the P.P.Luk'yannenko Institute of Agriculture in Krasnodar. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 7:55-70.

Descriptions are given of Leucomelan 2 and Kristall 2 which have outyielded the standard, Novomichurinka, by 0.6-0.7 c/ha. Kristall 2 combined high yield with good grain quality.

355. LAING,D.R. and FISCHER,R.A. 1977
Adaptation of semidwarf wheat cultivars to rainfed conditions.
Euphytica (Netherlands), 26:129-139.

356. LAZZARI,L.B. 1981
Emilia-Romagna: good yields notwithstanding Fusarium and the cold. (It)
Infor.Agr.(Italy), 37:17448-17450.

1980-81 grain yield data for 12 durum wheat cv. at 7 locations in Italy are presented.

357. LEHMAN,W.F., QUALSET,C.O. and GIBBS,L.K. 1978
Production and performance of common and durum wheats at the University of California, Imperial Valley Field Station, El Centro, in 1976-77 and 1978.
Agron.Progress Rep.CA. (USA), 15.

358. LEHMAN,W.F., QUALSET,C.O. and GIBBS,L.K. 1980
Production and performance of common and durum wheats at the University of California, Imperial Valley Field Station, El Centro, in 1977/78/79 and 1980.
Agron.Progress Rep.CA.(USA), 12.

359. LEISLE,D. 1978
Coulter durum wheat.
Can.J.Plant Sci.(Canada), 58:551-552.

Coulter is a new durum wheat cultivar developed from the cross D.T. 188/D.T. 224//D.T. 182 at the Agriculture Research Station, Winnipeg, Manitoba. Coulter is similar to the cultivar Hercules in resistance to disease and lodging. It is 1.5 days later and slightly shorter-strawed. The major agronomic attribute of Coulter is its higher yield performance in the black soil zone of Manitoba and Saskatchewan.

360. LONGCHAMP,J.Y. 1980
Spring cereal varieties, tests 1980. (Fr)
Perspectives Agricoles.(France), 17-28.

361. LONGCHAMP,J.Y. 1980
Winter cereals. A selection of varieties. Durum wheat varieties. (Fr)
Producteur Agricole Francaise (France), 25-26.

Agronomic and quality characteristics of the French varieties Mondur, Tomclair, Agathe', Diabolo, Valdur, Montferrier, and Bidi 17 are described.

362. LONGCHAMP,J.Y. 1981
Choosing wheat and barley varieties. (Fr)
Producteur Agricole Francaise (France), 57:23-35.

Yield, agronomic traits, disease resistance, and quality traits are described for the following French durum

wheat varieties: Chandur, Diabolo, Kidur, Agathe', Mondur, Montferrier, Valdur, and Bidi 17.

363. LONGCHAMP,J.Y. 1981
Spring cereals: varieties of quality. (Fr)
Producteur Agricole Francaise (France), 57:25-28.

Productivity, agronomic traits, disease resistance, and quality traits are described for the following French durum wheat varieties: Mondur, Valdur, Diabolo, Agathe', Chandur, Poinville, Kidur and Tomclair.

364. LONGCHAMP,J.Y. 1983
Description of 1982 and 1983 varieties. (Fr) agronomic value]. (Fr)
Bull.Fed.Nat.Agric.Multipl.Semn.France, 44-49.

365. LONGCHAMP,J.Y. 1983
Varieties of winter cereals in France, 1983-84: soft wheat, hard wheat, barley, oats, triticale. (Fr)
Producteur Agricole Francais.(France), 59:46-50.

366. LONGCHAMP,J.Y. 1984
Spring cereals. Choosing your variety. (Fr)
Producteur Agricole Francais(France), 60:20-24.

Tabulated data are presented on characters including growth period, lodging resistance, tillering, resistance to shedding and to sprouting in the ear, height, disease resistance and grain quality in 13 bread wheats of alternative habit, 15 spring bread wheats, 33 spring barleys, 18 spring durum wheats and 17 spring oats. Recently released durum varieties include, Amidur, Casoar and Primadur.

367. LONGCHAMP,J.Y. 1984
Which variety to choose. (Fr)
Producteur Agricole Francais (France), 60:25-29.

Tabulated data are presented on characters including earliness, degree of alternative habit, resistance to lodging, cold, sprouting in the ear, shedding and diseases and on baking quality in 74 winter bread wheat varieties (including 13 recently bred ones). Similar data are also presented for 18 durum wheat varieties (including 3 recently bred ones), 18 six-rowed and 23 two-rowed winter barley varieties (including one and 8 recently bred ones respectively), 9 winter oat varieties. The 7 rye varieties (one recently bred) and 5 triticale varieties. The date of entry in the French variety register is also given.

368. MALIANI,C. 1974
Montanari, Jucci and Raineri. Three hard wheats already tested by now. (It)
Infor.Agr.(Italy), 30:17059-17060.

369. MARIANI,B.M. and MANMANA,P.N. 1983
The crop environments (for T. durum) in central-southern Italy: what are the right varieties? (It)
Infor.Agr.(Italy), 39:27630-27632.

In trials over several years and locations of 22 durum wheat varieties, Karel was high yielding, particularly in favorable environments, and Valnova and Valselva were high yielding and stable. Trinakria had the highest protein content, followed by Valriccardo. Protein content varied little among the environments.

370. MATHUR,V.S., SATYAWALI,D., KULSHRESHTHA,V.P., AMAVATE,J.S. and SETHI,A.P. 1983
New wheat for central India.
Seed & Farms (India), 9:5-6.

The new durum wheat cv. HD 4530 and soft wheat cv. HD 2236 and HD 2278 showed a grain yield potential of 5.46, 5.76 and 5.95 t/ha and gave 3-yr av. yields of 4.05, 4.05 and 3.84 t/ha, resp. These cv. are highly resistant to most diseases. Information on grain quality is given.

371. MAUMENE, LAROCHE, CODRON, MORICE and FEYT 1976
Spring cereal varieties. 1981 trials [barley, durum wheat, soft wheat, oats, new varieties cultivated in France, behaviour per region. (Fr)
Perspectives Agricoles (France), 20-42.

Durum wheat, barley, soft wheat, oats, new varieties cultivated in France, behaviour per region.

372. MAYORGAV,J. 1978
SNA-3: New variety of durum wheat (T.durum) (Es)
Campesino (Chile), 109:14-15.

373. MOROZOV,N.N. and YANCHENKO,V.I. 1980
Forms of durum wheat with a combination of useful characters. (Ru)
Selkts.Semenov.(USSR). 22-23.

On the basis of a trial of over 600 forms of Triticum durum and about 40 forms of T. dicoccum in Siberia during 1975-77, lists are given of the best ones for earliness, yield, lodging resistance, resistance to Puccina recondita and P. graminis and protein content.

374. MOSCA,G. 1979
Durum wheat on the Venetian plain. 2: Four years evaluation of recently bred durum wheat varieties. (It)
Agric.delle Venezie. (It), 33:410-430.

In a trial of 35 varieties and 18 lines in 1972-76, Valsacco and Sansone had high and stable yields; Valriccardo was promising for its grain quality.

375. MOVCHAN,G.I. 1983
Durum wheat cv. Luganskaya 7. (Ru)
Selekts.Semenov.(USSR), 29-30.

The new drought-resistant durum wheat cv. Luganskaya outyielded the standard cv. in different regions of the Ukraine. Its highest yield with irrigation was 6.32 t/ha.

376. MUDROVA,A.A. 1979
Economic and biological evaluation of lines of winter durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 5:176.

Of the 50 lines and varieties evaluated in comparative varietal trials the highly hardy form Leucomelan 199N264 was the best. Eleven lines with good yield and resistance to lodging and Puccinia were also identified.

377. N.I.A.B. UK. 1983
Detailed descriptions of varieties of wheat, barley, oats and rye.
NIAB.UK, Cambridge. 1983,178pp.

Details of parentage, breeder and identifying characters are given for 35 winter wheats, seven spring wheats, 13 two-rowed winter barleys, five six-rowed winter barleys, 51 spring barleys, seven winter oat varieties, 24 spring oat varieties, seven winter ryes, one spring rye and three durum wheats. Electrophoretic data are tabulated for the wheats. The varieties listed are those which may be entered in the UK Seed Certification Scheme for Cereals.

378. NAJI,I. 1982
Farmer's field verification trials in Syria.
RACHIS (ICARDA,Aleppo,Syria), 14-15.

Farmers field verification trials were done in 3 climatic zones in Syria to test the yielding ability and disease resistance of promising bread wheat, durum and barley lines and their relative performance and adaptability under on-farm conditions. In irrigated zones the durum variety Sahl was superior to the check for the third year. In zone A (precipitation to more than 350 mm) all the varieties gave a better yield than the check. In zone B (precipitation 250-350 mm) all lines were superior to the check. In zone C (precipitation 250 mm and less) no differences were observed among the entries.

379. PARIS,C., AMBOLLET,B. and LONGCHAMP,J.Y. 1979
Varieties of winter cereals. (Fr)
Perspectives Agricoles (France), 8-25.

380. PATTAKOU,V. 1978
New durum wheat varieties in Greece.(De)
Getreide, Mehl Und Brot. (F.R.G), 32:113-116.

Greek varieties Limnos and Electra were compared with Capeiti and Cocorit for the trial period 1974-77. In further trials at 35 sites in 1976 with eight varieties and in 1977 at 21 sites with seven, Cocorit was highest yielding in both years. Data on 1000-grain weight, protein content, vitreousness and quality are presented for the varieties and breeding lines in trials during 1976-77.

381. PETROV,D., DICHEVA,S. and BANCHEVA,Zh. 1981
Yield structure and productive potential of some winter durum wheat cultivars. (Bg)
Rasteniev'd Nauki. (Bulgaria), 18:9-16.

In 1979-80, the new Bulgarian cv. No. 2723, No. 2770 and No. 2726, the Italian cv. Tito and the French cv. Rikita gave

highest av. grain yields. These cv. are resistant to lodging. All the cv. except Tito, produced grains of good technological qualities.

382. PHATTHAKUN,CH., MANAT LEECHAWENGONG and SRIMUN BUNYARAT 1977
Yield trial of common wheat and durum wheat [in Thailand].
Annual Res.Rep.1977 (Thailand), 293-300.

383. PHATTHAKUN,CH., WITHHUN KHANTHIKUL and SRIMUN BUNYARAT 1978
Yield trial of common wheat and durum wheat [in Thailand].
Annual Res.Rep.1978 (Thailand), 1-11.

384. POCOMUCHA TAPIA,E. 1980
Yield and chemical analysis of 25 varieties and hybrids of hard wheat (T . durum L.) (Es)
Huancayo (Peru) 1980:74p.

385. POKROVSKII,N.V. and MAMIROV,N.M. 1978
Varieties of durum wheat for Uzbekistan.(Ru)
Selekts.Semenov.(USSR), 42.

Leucurum 3, selected from the Turkish form K16034, is a drought resistant variety which overwinters better than Altyn. It reaches a height of 89 cm and has ears 5.5 cm long with some 15 spikelets and 32 grains per ear. It is resistant to bunt and loose smut and only slightly susceptible to yellow and stem rusts. It yields 14.9 c/ha of grain with a protein content of 14.1 per cent.

386. PRADEL,J. 1979
Hard wheat: The different varieties and culture regions.France. (Fr)
France Agricole (France), 35:15.

Descriptions of several French durum varieties.

387. PUNKAR. 1982
Wheat in Maharashtra, India.
RACHIS (ICARDA,Aleppo,Syria), 23.

Several new varieties of durum wheat and bread wheat have been released for general cultivation in Maharashtra, India. Local land races of durum wheat are available upon request.

388. PURI,Y.P., QUALSET,C.O., BAGHOTT,K.G., VOGT,H.E. and LEHMAN,W.F. 1976
Modoc, a new durum wheat for northern California.
CA.Agric. (USA), 30:8-9.

Description is given of the characteristics and performance of Modoc, a high-yielding, short-statured durum var. developed for the Tulelake area, California. Modoc is a hybrid D7069 X Leeds. The milling quality of grain produced from the field scale plantings and from small-plot yield trials was evaluated. Results were: wt. of 1000 kernels, 46.9 g, kernel size - large 75%, medium 23%, wheat protein , 13.4%, purified semolina, 48.6%, colour score, 91, and visible colour, 9.5. Results indicate that Modoc has very good promise for use in pasta products.

389. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1979
Vic: High yielding, strong gluten durum.
North Dakota Farm Res.(USA), 37:7-11.

A new durum wheat cv. Vic, combining high grain yield and strong gluten characteristics is described.

390. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1979
Edmore...North Dakota's first strong gluten durum.
North Dakota Farm Res.(USA), 36:14-18.

The breeding grain yield, disease resistance, and milling and spaghetti quality of Edmore, a strong gluten durum wheat cv. are described. Edmore was approx. equal in grain yield to cv. Ward and lower than cv. Cando. It is of normal ht. with improved grain wt., good test wt., high vitreous grain content, large grain size, high protein content and excellent spaghetti colour.

391. QUICK,J.S., JOHNSTON,R.A., VASILJEVIC,S. and HOLM,Y. 1980
Recent advances in evaluation of durum wheat quality.
Int.Wheat Genet.Symp.Madrid Spain 1980, 729-739.

392. QUICK,J.S., MILLER,J.D. and DONNELLY,B.J. 1976
Registration of Cando durum wheat.
Crop Sci. (USA), 16:885.

'Cando' (Triticum turgidum L. var. durum), CI 17438, is a spring durum wheat developed by the North Dakota Agric. Exp. Stn., North Dakota State Univ., Fargo, in cooperation with the ARS, USDA. Cando was selected from the cross D65152/D6148 made in 1966. Grain yield, agronomic traits, disease resistance, and quality characteristics are described.

393. QUICK,J.S., MILLER,J.D. and DONNELLY,B.J. 1977
Registration of D6962 durum wheat germplasm.
Crop Sci. (USA), 17:190.

'D6962' (Triticum turgidum L. var. durum), CI 17437, is a spring durum wheat developed by the North Dakota Agric. Exp. Stn., North Dakota State Univ., Fargo in cooperation with the ARS, USDA. D6962 was selected from the cross 'Leeds'/D65152 made in 1966. D65152 is D61130/Leeds, a durum semidwarf. It is an early semidwarf variety with excellent quality and good disease resistance, but is lower yielding than other leading varieties in North Dakota (USA).

394. QUICK,J.S., WALSH,D.E., LEBSOCK,K.L. and MILLER,J.D. 1974
Registration of Ward durum wheat.
Crop Sci.(USA), 14:607.

'Ward' (Triticum Desf.), CI 15892, is a spring durum wheat developed cooperatively by the North Dakota Agricultural Experiment Station and the Agricultural Research Service, U.S. Department of Agriculture. It was selected from the cross 'Langdon' /3/Ld357//CI7780/Ld362/4/Br180/ 'Wells.' Grain yield, agronomic traits, disease resistance, and quality characteristics are described.

395. QUICK,J.S., WALSH,D.E., LEBSOCK,K.L. and MILLER,J.D. 1975
Registration of Rugby durum wheat.
Crop Sci.(USA), 15:604.

'Rugby' (Triticum turgidum L. var. durum), CI 17284 , is a spring durum wheat developed cooperatively by the N.D. Agric. Exp. Stn. and the ARS, USDA. It was selected from the cross 'Langdon' /3/Ld357//CI7780/Ld362/4/Br180/ 'Wells.' Grain yield, agronomic traits, disease resistance, and quality characteristics are described.

396. QUICK,J.S., WALSH,D.E., LEBSOCK,K.L. and MILLER,J.D. 1976
Registration of Crosby durum wheat.
Crop Sci. (USA), 16:125.

'Crosby' (Triticum turgidum L. var. durum), CI 17282, is a spring durum wheat developed cooperatively by the North Dakota Agric. Exp. Stn. and ARS, USDA. It was selected from the cross 'Langdon'*2/St464//'Leeds'. Grain yield, agronomic traits, disease resistance, quality characteristics are described.

397. QUICK,J.S., WALSH,D.E., LEBSOCK,K.L. and MILLER,J.D. 1976
Registration of Botno durum wheat.
Crop Sci. (USA), 16:124.

Botno (Triticum turgidum L. var. durum), CI 17283, is a spring durum wheat developed cooperatively by the North Dakota Agric. Exp. Stn. and ARS, USDA. It was selected from the cross 'Langdon' /3/Ld357//CI7780/Ld362/4/Br180/ 'Wells'. Grain yield, agronomic traits, disease resistance and quality characteristics are described.

398. RASULOV,D.K. 1980
Best forms of durum wheat in irrigated spring stands in the south of Uzbekistan. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 17-18.

Tabulated data on number of fertile tillers, 1000-grain weight, number of grains per ear and grain yield are presented for the best of 300 varieties tested during 1977-78. They are: Lulinlich, 1-28-85, Niphad 5-67-14-9, USMP 13, Vora, 455, a local variety from Syria and a local variety from Kazakhstan.

399. RASULOV,D.K. 1982
Valuable samples of durum wheat. (Ru)
Selekts.Semenov.(USSR), 19.

400. RESTUCCIA,G. 1978
Changes in the varietal view [durum wheat] in Italy. (It)
G. Agic.(Italy), 88:351.

401. RONCHI,A.G. and BOGGINI,G. 1983
And in the Marche (Italy) 100,000 hectares are invested by now in T. durum. (It)
Infor.Agr. (Italy), 39:27635-27637.

Sixteen durum wheat varieties were tested at 6 locations in central Italy. Valforte, Valriccardo and Valnova were consistently the highest yielders. Japigia was the most promising new variety. Berillo, Karel and Olinto were the most susceptible to Erysiphe graminis. Valriccardo and Valforte the less susceptible. Cerso, Rodeo and Karel were resistant to lodging.

402. ROSSI,L. 1978
Progress of new Italian durum wheat variety development for the Mediterranean zone.
FAO, Rome (Italy), 478-480.

In 80 field trials in central Italy in 1970-6, the new durum cv. Creso and Tito yielded on av. 5.88 and 5.84 t grain/ha, resp., compared with 5.4 and 4.06 t/ha in bread wheat and the traditional durum cv. Capeiti.

403. RUDENKO,M.I. 1978
Newer varieties of Triticum durum Desf.
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 41.

Durum wheat varieties introduced from Chile are described.

404. SAVITSKAYA,V.A. 1978
New varieties of spring durum wheat and associated agronomic practices in western Siberia. (Ru)
Vestn.Sel'sk-khoz Nauki (USSR), 132.

Almaz (Diamond), obtained from a complex cross involving Triticum durum and T. dicoccum, is a late. lodging-resistant variety with good resistance to Puccinia recondita and moderate resistance to Ustilago nuda. It yields up to 66 c/ha under irrigation.

405. SAVITSKAYA,V.A. 1980
Results and prospects of breeding durum wheat.(Ru)
Selekts.Semenov.(USSR), 17-18.

Descriptions are given of three varieties (Agust, Atlan, Almaz) recently bred.

406. SAVITSKAYA,V.A., ESMENOVA,M.V. and LETOVA,G.M. 1982
Agronomic, biological and technological evaluation of a collection of wheat forms in Omsk. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 1:79.

407. SCOTTI,G. 1977
Program varieties of ITCF. (Fr)
Bull.Infor.Liaison Synprodur (France), 17.

The varietal trials of the 1975 harvest of Blondur, Mondur, Randur, Poinville give the following results: For Blondur and Mondur, the weight of 1000-grain and smut resistance are comparable to Lakota; technological charactristics are excellent. Smut resistance of Randur and Poinville is good; the yellow index is comparable for the first to that of Wells; for the second to that of Durtal. In both cases tenacity is moderate.

408. SENECHAL,F. 1977
Agronomical characteristics of new durum wheat varieties. (Fr)
Bull.Infor.Liaison Synprodur,(France), 11-13.

Four new durum wheat varieties: Valdur, Mondur, Blondur and Poinville are registered on the spring durum wheat list. Their yield, established for 3 years, is examined by comparison with Lakota and Durtal. Their behaviour when sown in autumn is also taken into account.

409. SHAHINE,A.H. 1976
Response of two wheat species [T. durum and T. aestivum cv. vulgare] to gamma irradiation in successive generations.
Agric.Sci.Moshtobor (Egypt), 5:61-71.

410. SILANO,V., VITTOZZI,L. and ADE,P. 1978
Biochemical aspects of the nutritional and technological improvement of durum wheat. (It)
Ann.Ist.Sper.Cerealicoltura. (Italy), 170.

411. SILVA ALVAREZ,J. 1974
Behaviour of a semi-durum wheat variety Platifen, and two durum wheat varieties Candelafen 5 and Quilafen related to different planting times. (Es)
Quillota. (Chile), 89.

412. SISODIA,N.S., SINGH,S.P. and SHEOPURIA,R.R. 1980
Registration of Jairaj wheat.
JNKVV Res.J. (India), 14:113.

Jairaj is a hard, spring variety of Triticum durum from crosses involving T. Polo, Yaglute, Pitic, Z, B and W. It is semidwarf, medium early and gives good quality flour. It is resistant to 16 races of Puccinia graminis, seven of P. recondita and 13 of P. striiformis.

413. SODINI,I. 1978
Results of the demonstrative trials of durum wheat in the south of Italy. (It)
G.Agric. (Italy), 88:443-446.

414. SRIVASTAVA,J.P. and AHMED,S. 1984
Improved durum wheat and bread wheat varieties released for cultivation in Syria.
RACHIS (ICARDA,Aleppo,Syria), 3:26-27.

A new durum wheat variety was approved for release October 1983. The durum wheat Waha is renamed Sham-1. The pedigree is PLc'S'/Ruff 'S'//bta 'S"/Rott. Grain yield, agronomic traits, and adaptation are described.

415. SUNDERMAN,D.W. and O'CONNELL,B. 1983
Registration of Irridur durum wheat (Reg.No.667).
Crop Sci. (USA), 23:188.

This spring variety was developed from a cross involving Yaktana 54, Norin 10, Brevor, Sel 21-1c, Sinaloa 2, Thatcher and Sentry. It is a semidwarf, midseason variety and has moderately stiff straw. In yield it has equalled Wandell and Borah. It is resistant to prevalent races of Puccinia striiformis and P. recondita.

416. TAPU,Z. 1980
Topaz - a semi-dwarf durum winter wheat cultivar. (Ro)
Plante Tehnice,Fundulea (Romania), 45:31-43.

The new durum wheat cv. Topaz (a) was compared with cv. Apulicum 233 (b) at Fundulea and at 14 sites throughout SW Romania. Grain yields were significantly higher for (a) than (b). Cv. (a) was shorter, more winter hardy and more resistant to lodging and to stripe and leaf rust than (b).

417. TAPU,Z., NEGULESCU,F., IONESCU-CONJOCARU,M. and OPROIU,E. 1982
Results obtained in the breeding of the winter durum wheat.
Ann.Inst.C.P.C.Plante Tehn.Fund.Romania, 49:39-51.

In 4 years' trials at a total 10 sites, 3 semidwarf winter durum lines all outyielded Topaz, used as control, by between 9% and 13.5%, and all surpassed it in 1000-grain weight. The most productive, DF144-75, from a cross between Arnaut de Transilvania and a complex Mexican hybrid, was particularly well suited to cultivation in southern parts of Romania, where it yielded up to 5.33 t/ha. It was 5 days earlier than Topaz, more resistant to cold and lodging, and more tolerant of Septoria tritici [Mycosphaerella graminicola] and Fusarium nivale [Micronectriella nivalis].

418. TORJE,D., MOLDOVEANU,G., TIMARIU,A. and PROPESCU,S.I. 1976
Varieties of durum wheat recommended for the production of pasta products. (Ro)
Prod.Veg.Cereale.Plante.Tehn.Romania., 28:9-17.

In Romania trials of various spring and winter lines and varieties, Odesskaya Yubileinaya and Apulicum 233 gave good agronomic and technological results and the Romanian line DF-14-17 was promising, with short stature and good resistance to lodging.

419. TOWNLEY-SMITH,T.F., HURD,E.A. and LEISLE,E.A. 1983
Macoun durum wheat.
Crop Sci. (USA), 23:1015.

420. TOWNLEY-SMITH,T.F., HURD,E.A. and PATTERSON,L.A. 1983
Wascana durum wheat.
Crop Sci. (USA), 23:1014.

421. TOWNLEY-SMITH,T.F., HURD,E.A. and PATTERSON,L.A. 1983
Wakooma durum wheat.
Crop Sci. (USA), 23:1015.

422. UKHANOVA,O.I., BELOUSOVA,E.M. and RYZHKOVA,A.I. 1979
High-yielding varieties of strong and durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:89.

Descriptions of the best varieties grown in the USSR are given including information on their technological qualities.

423. VALLEGA,J. 1977
Durum wheat: Let us describe our varieties. (It)
Infor.Agr. (Italy), 33:26649-26697.

The cultivation of durum wheat in Italy in the 60s onwards is reviewed and the current situation, based on the cultivation of new high-yielding varieties, with resistance to lodging and diseases and the capacity for efficient use of fertilizers, is outlined. The main characteristics of 34 varieties are described.

424. VALLEGA,J. and ZITELLI,G. 1973
New high yielding Italian durum wheat varieties.
Proc.Symp.Genet.Breed.D.W.Bari,(Italy), 373-399.

Cappelli was crossed with many varieties, in particular F2 selections from several segregating populations from Mexico, which derived from Triticum aestivum, including Norin 10, crossed with a Mexican T. durum and back crossed to a North Dakota T. durum, LD930, with resistance to Puccinia graminis. All the varieties are between 70 and 80 cm tall, are very resistant to lodging, their heading dates range from mid-early to mid-late. Yields are high and resistance to mealy endosperm, grain shrivelling, Puccinia graminis and P.recondita is good. Valnova, Valselva and Valgerardo are immune to Erysiphe graminis. Commercial and industrial quality is also good. Results of various yield trials from 1966 to 1973 are reported.

425. VENEGAS,V.C. 1982
Behavior of species and varieties of ceareals under different levels of nitrogennous fertilization. (Es)
Simiente (Chile), 52:61-67.

426. WINSTEL,K. 1983
Comparing the cultivation of durum wheat (T . durum) and winter wheat (T . aestivum). (De)
Gesunde Pflanzen (F.R.G), 35:85-90.

427. WITTMER,G. 1980
Report of the sub-network on cooperative variety trials [on T . durum] (It)
Ann.Ist.Sper.Cerealicoltura,(Italy), 11:224-225.

428. WITTMER,G. 1980
The new durum wheat (T . durum) varieties in central and southern Italy: Negative and positive aspects. (It)
Ann.Ist.Sper.Cerealicoltura, (Italy), 11:219.

429. WITTMER,G. 1981
Report on durum wheat variety trials in Europe. (De)
FAO, Rome (Italy): 32pp.

430. YAKUBTSINER,M.M. and ABDURAGIMOV,G.Yu. 1979
Durum wheat cv.'Mugan'. (Ru)
Selekts.Semenov. (USSR), 34.

The new durum wheat cv. Mugan is high-yielding, highly resistant to drought, resistant to grain shattering, yellow and brown rusts, and the macaroni quality of its grain is satisfactory. It is adapted to Azerbaijan, Georgia, Uzbekistan, Turkmenia, Tagikstan and Caucasus. Its grain yields are 25-27% higher than that of the standard cv. Shark in areas of scanty rainfall, and 18.5% higher in areas of normal rainfall.

431. ZITELLI,G. 1979
Durum wheat:Results of national trials carried out in north, central, south Italy and the Islands. (It)
Terra E Sole (Italy), 34:684-691.

In field trials in 1979-80 in central Italy, S. Italy and on Sicily and Sardinia, 25 durum wheat cv. were grown and compared for grain and protein yields, agronomic characteristics and disease resistance.

432. ZITELLI,G. 1980
Durum wheat. Results of national trials conducted on the Islands and in southern and central Italy. (It)
Terra E Sole (Italy), 35:627-635.

433. ZITELLI,G. 1981
Hard wheat (T.durum): Results of tests carried out in central and insular Italy. (It)
Terra E Sole (Italy), 36:646-655.

Yield, agronomic traits and disease resistance are tabulated for 25 varieties of durum wheat at 25 locations. The highest yielding overall were Karel, Orosini and Valnova. The earliest varieties were Mora, Isa I, Prodera and Trinakria.

434. ZITELLI,G. and VALLEGA,J. 1978
New durum wheat varieties, yielding capacity and the quality of these new varieties. (Abstract)
Proc.8th Durum-Teigwaren, (F.R.G).

Field data have shown that the variety Trinakria is superior to all other Italian varieties in protein content followed by Valfiora, Cappelli, Valgiorgio, Valgerardo, Valselva, Creso and Valnova. The new bred high yielding varieties like Valgerardo, Valgiorgio, Creso, Valnova and Valselva have about the same cooking quality, some time equal or even better than Cappelli. However, it is not enough and varieties with higher pasta quality, need to be bred.

435. ZITELLI,G. and VALLEGA,J. 1978
Yield and quality of new durum wheat cultivars in Italy. (De)
Getreide, Mehl und Brot.(F.R.G), 32:165-168.

In trials during 4 yr with 19 durum wheat cv., grain yields ranged from 2.7-3.2 t/ha in cv. Visco S to 4.3-5.5 t in cv. Valnova and grain protein content was highest in cv. Polesine. Cv. Trinakria although lower yielding than 10 other cv. had a high grain protein content and good quality characteristics for spaghetti making.

Breeding

436. AHMAD,H., SHAH,S., MEHDI,S.S. and NAZ,R.M.A. 1980
Correlation of plant characters in durum wheats.
Pak.J.Sci.Res (Pakistan), 32:1-4.

The grain yield of durum wheat cv. was positively correlated with the number of spikes/plant and negatively correlated with plant height.

437. AKHMEDOV,B. and PALAMARCHUK,A.I. 1981
Electrophoretic analysis of gliadin in varieties and breeding lines of winter durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 7:197-0

Spring and winter varieties and 500 winter lines were studied by means of starch gel electrophoresis. The following bread wheat gliadin blocks controlled by chromosomes of genomes A and B and associated with good frost resistance were found: Gld 1A1 with a frequency of 18%, Gld 1B2 with a frequency of 13% and Gld 6A3 with a frequency of 8.2%. Lines with the block Gld 1A1 exceeded all the other material in frost resistance. Many gliadin blocks were found in the winter durum wheats which do not occur in bread wheat.

438. ALAHAYDOIAN,E.K. 1983
Variability on yield and yellowberry in lines of a diallel cross of durum wheat (T. turgidum L.).
Diss.Abstr.Intern.(USA), 43:2444.

Grain yield and yellowberry (YB) [mealy endosperm] were evaluated in about 75 randum F4 lines of T.turgidum [T.durum] from an 8 X 8 diallel grown at two sites (Measa, Arizona, and Davis, California). Selection for yield by the following methods appeared to be promising: (1) within a cross the top 5, 10 and 33% of the lines were selected and the mean of the selected lines were compared with the cross mean and with the higher-yielding parents and (2) selection was according to positive and negative general combining ability effects. Heritability of YB was low and YB appeared to be polygenically controlled.

439. ALESSANDRONI,A. 1978
Study of experimental designs in unreplicated preliminary trials of durum wheat. (It)
Ann.Ist.Sper.Cerealicolura (Italy), 9:125-136.

Some plot designs described in literature for evaluation in early generations and line selection in wheat breeding programs are discussed. Various line testing procedures were compared in a twice replicated field trial, with systematically arranged control varieties in every fourth plot. Results reported suggest that the moving mean of 12 adjacent line plots gives more control of the experimental error than using frequent control mean to adjust the yield. Adjustments with repeated controls resulted more efficient for heading and test weight evaluation, but use of moving mean also appeared acceptable.

440. ALVAREZ,R. 1980
Discovery of durum wheat varieties by means of SDS-polyacrylamide gel. (Fr)
Rap.Stage IUT,Marseille (France), 31.

The electrophoresis method in starch gel, normally used to detect varietal composition of a batch of durum wheat did not distinguish well between certain varieties. On the other hand, vertical electrophoresis on SDS polyacrylamide gel could differentiate French durum wheats which are not discernable by starch gel electrophoresis. However some American varieties still remain indistinct whichever method is employed.

441. AYDEM,N. 1982
The wheat breeding programme and recent improvements in Turkey.
Ege Uni.Zirat Fakultesi Dergisi(Turkey), 19:57-59.

Some varieties developed and/or grown in Turkey since the inception of wheat breeding in 1926 are surveyed. The data presented relate to both bread and durum wheats.

442. BAJAJ,Y.P.S. 1980
Enhancement of the in vitro development of triticale embryos by endosperm of durum wheat.
Cereal Res.Commu.(India), 8:359-364.

443. BAJAJ,Y.P.S., GILL,K.S. and SANDHU,G.S. 1978
Some factors enhancing the in vitro production of hexaploid triticale (T.durum X Secale cereale).
Crop Improvement(India), 5:62-72.

444. BEKE,B. 1981
Breeding and growing durum (Macaroni)wheat in Hungary. (Hu)
Hu.Agric.Rev.(Hungary), 32:15.

The breeding work leading to the release of GK Minaret and GK Basa [GK Pasha] is described.

445. BELIN PERUFFO,A., PALLAVICINI,C., PINTON,R. and POGNA,N.E. 1982
Analysis of wheat varieties by gliadin electrophoregrams. 3: Catalogue of electrophoregrams of 22 Italian durum wheat (T . durum) varieties.
Genetica Agraria (Italy), 36:365-374.

Polyacrylamide gel electrophoresis of gliadin proteins proved to be a suitable procedure for identification of 22 durum wheat varieties grown in Italy. Based on relative band mobility, a catalogue of electrophoregram formulas and a systematic key for routine varietal identification have been elaborated. The presence of multiple gliadin patterns within some cultivars does not prevent varietal identification by gliadin electrophoregrams. Analysis of gliadin patterns partly corroborates previous findings by other authors who revealed a relationship between gliadin profile and gluten strength.

446. BHATIA,A., BHULLAR,G.S. and GILL,K.S. 1979
Combining ability in durum wheat (T . durum Desf.).
Cereal Res.Commu.(India), 7:49-54.

General combining ability (GCA) was a significant source of variation for all seven yield components measured, whereas specific combining ability (SCA) effects were only significant for yield, ear and peduncle lengths, and plant height. Variance due to SCA only exceeded that due to GCA for yield. Recurrent selection is recommended on the basis of the measured combining abilities.

447. BLANCO,A. 1982
Effects of intergenotypic competition on plant height in hybrid bulks of durum wheat (T . durum Desf.). (It)
Riv.Agron (Italy), 16:379-383.

The effect of intergenotypic competition in F2 through F7 bulk generations was studied in populations developed from the crosses between a short-statured variety (Creso) and two standard height varieties (Appulo and Maristella) of durum wheat (Triticum durum Desf.). The bulks had been advanced each generation in competitive yield plots at 100 Kg/ha seeding rate, without artificial selection. Height of spaced plants from F2, F4, F6 and F7 bulk populations grown in the same environment was recorded at maturity. Mean plant height increased from F2 to F7 in both crosses because of the decreasing frequency of semi-dwarf plants. Variances increased in the populations Appulo X Creso and decreased in the populations Maristella X Creso. Apparently, changes in bulk populations heterogeneous for plant height grown in southern Italy were due to the

significant effects of intergenotypic competition.

448. BLANCO,A. 1982
Intergenotypic comprtition effects on height in bulk populations of durum wheat (T . durum Desf.). (It)
Riv.Agron (Italy), 16:379-383.

The short variety Creso was crossed with the tall varieties Maristella and Appulo and bulk F2-F7 populations were formed without selection. Mean height increased from the F2 to F7 in the populations owing to a decrease in the frequency of semidwarf plants. The variance for height increased in the populations from Appulo X Creso and decreased in those from Maristella X Creso.

449. BLANCO,A., PORCEDDU,E. and GRECO,B. 1977
Observation on the adequacy of cytoplasmic sterile lines and male fertility to the production of hybrid durum wheat. (It)
Genetica Agraria (Italy), 31:181-189.

20 cytoplasmic male sterile lines and 130 F1 hybrids from crosses of 13 different male sterile lines and 10 male fertility restoration lines have been evaluated. Plant height, number of the upper internode, spike length, spikelet number per plant, pollen fertility, bagged and unbagged spike fertility have been examined. At least 5 male sterile lines and 2 male fertility restoration lines appear adequate for a backcross program with Italian durum wheat varieties.

450. BLANCO,A. PORCEDDU,E. and SCARASCIA,M.G.T. 1975
Evaluation of durum wheat male sterile lines with cytoplasm of Triticum and Aegilops species. (It)
Ann.Fac.Agr.Bari (Italy), 27:295-301.

20 durum wheat male sterile lines with cytoplasm of T. timopheevi, T. zhukovskyi, T. dicoccoides var. nudiglumis, T. macha, Ae. speltoides, Ae. bicornis, Ae. sharonensis and Ae. umbellulata were evaluated. Pollen and spikelets fertility data pointed out that at least 13 lines are completely male sterile (average number of kernels per spike: 0.00-0.04) and consequently suitable for backcross program with Italian durum wheat varieties.

451. BLANCO,A., SIMEONE,R., TANZARELLA,O.A. and GIORGI,B. 1978
Production Of trisomics in T . durum Desf. by the conversion technique.
Caryologia (Italy), 31:487-491.

Four lines of T. aestivum 'Chinese Spring' (female) (2n = 42) nullisomic for chromosomes 2D, 6D and 7D and tetrasomic for 2A, 6A, 7A and 7B were crossed with T. durum 'Cappelli' (male) (2n = 28), the F1s (2n = 35) being back crossed to the male parent in order to eliminate the six chromosomes of genome D. The 36 BC1 plants with 2n = 29, were analysed at metaphase I to distinguish the true trisomic from monosomic addition lines with one chromosome of genome D. At least one trisomic plant in each BC1 family was obtained.

452. BOGYO,P., RUSSEL,T.S. and KONZAK,C.F. 1973
The analysis of genotype-environment interaction on durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari, (Italy), 413-432.

In this paper, it is suggested that the means of the two local varieties supplied by the cooperators could also serve as an environmental index, in Finlay-Wilkinson regressions. Supposedly the best local varieties were included in each test and thus be regarded as measures of environmental potential.

453. BORANBAEV,S. 1981
Study of the breeding value of durum wheat varieties by means of diallel crosses. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:65-249.

Melanopus 269175, 269170, and Hordiforme 46938 were the best parents to use to increase number of spikelets per spike and number of grain per ear. In producing short-strawed hybrids, the best results were obtained using 269170 and 45406 as parents.

454. BOUCHOUTROUCH,M. and TOURKMANI,H. 1975
Durum wheat improvement in Morocco. (Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 350-351.

The Agronomic Research Department has established the durum breeding program with the objective of creating varieties

having good response to high rates of nitrogen, and resistance to rusts, Septoria, powdery mildew and Hessian fly. The new types must also have abundant tillering and highly fertile spike. This program has provided interesting results and a variety (number 52/71) is undergoing seed increase. This variety, named "Hadj Mouline", is very productive, dwarf, highly fertile, tolerant to leaf rust and stem rust but is susceptible to Septoria. Though the fertility of the spike is high, kernel size is small. The cooperation of CIMMYT and the Moroccan Agronomic Research Department concerning durum wheat resulted in the release of Cocorit which is resistant to lodging, tolerant to rusts, but susceptible to Septoria.

455. BOZZINI,A. 1973
Natural survival of tetraploid wheats in varietal mixtures.
Proc.Symp.Genet.Breed.D.W.Bari, (Italy), 103-112.

A population composed by 7 lines of T. durum, 1 of T. carthlicum, 1 of T. aethiopicum and 1 of T. dicoccum was grown in bulk during 8 years. In each line one or more genetic markers were present, allowing an easy identification of plants belonging to each line and of eventual hybrids. Each year a sample of the population was analyzed, in order to obtain the survival in competition of each line and natural hybrids. Two varieties demonstrated to be very good competitors. Two lines showed the poorest survival, while the other 6 varieties showed an intermediate and various degree of competitivness. Theoretical and practical implications of the results obtained are discussed.

456. BOZZINI,A. 1973
Analysis on bunt resistance in some tetraploid wheat.
Proc.Symp.Genet.Breed.D.W.Bari, (Italy), 511-514.

Results of five years of analysis for bunt (Tilletia tricoides) resistance of several Italian and foreign tetraploid wheats are presented. The analysis demonstrated the presence of a broad variability, with infection levels varying from a few units to up to 95%. Several lines showing high degree of bunt resistance have been identified. A series of analyses performed in order to establish the inheritance of the resistance present in some lines, showed a rather simple pattern. Among the populations tested it was possible to select, in some crosses, lines with rather high agronomic performance associated with high level of bunt, mildew and rust resistance.

457. BUYUKLI,P.I. and GEORGIEV,N.A. 1974
The synthesis of new forms of winter durum wheat in interspecific hybridization. (Ru)
Bull.Akad.S.RSSmold.Ser.Biol.I.Khim.USSR 5:39-44.

The F1 hybrids between bread and durum wheat occupied an intermediate position as regards phenotype. Many disturbances occurred during meiosis, leading to a reduction in fertility. In the F2, forms resembling the initial species segregated together with intermediate forms. Stable forms with thick straw and an improved ear were obtained from among the F2-F3 plants. The durum wheats obtained gave higher yields than the standard variety Rubezh (Frontier).

458. BUYUKLI,P.I. and GEORGIEV,N.A. 1976
Breeding winter durum wheat in Moldovia.(Ru)
Tr.Kishinev,Sel'Sk-Khoz.Inst.(USSR), 169:46-50.

Selections made from complex interspecific hybrids were hardier than those from single hybrids. They were resistant to lodging and diseases such as powdery mildew and brown rust and had larger ears and vitreous grain with a 1000-grain weight of 40.0-45.5 g. Their macaroni quality was high.

459. BUYUKLI,P.I. and GEORGIEV,N.A. 1976
The production of short-strawed forms of winter durum wheat. (Ru)
Nauch.Tekhn.Byul.Se.Genet.Inst.(USSR), 29:11-13.

By means of distant intraspecific hybridization, stable short forms with a high yield, strong straw and resistance to lodging were bred under Ukrainian conditions.

460. C.N.R.BARI 1976
Variation in agricultural characteristics in a world durum wheat

collection. (It)
Ric.Sci.C.N.R (Italy), 45:52-53.

A study was conducted on 2400 durum wheat accessions from 25 different countries to assess the relationship between 6 agronomic characters: growth habit, culm elongation and heading time, plant height, internode number and culm thickness-their frequency and diversity.

461. C.N.R.BARI 1976
Evaluation of male sterile lines of durum. (It)
Ric.Sci.C.N.R (Italy), 46:496.

A study was conducted on some male sterile lines of durum wheat with cytoplasm from different species, and on some male fertility restorer lines. Data were collected on a great number of characters, particularly on spike characters. Four lines combined an almost complete male sterility with good agronomic characteristics. Two lines restoring male fertility in the experimental environment were identified.

462. C.N.R.BARI 1976
Phenotypical variability for flowering time and yellow berry percentage in durum wheat population. (It)
Ric.Sci.C.N.R (Italy), 45:55.

In 1973 a study was conducted on variability in five durum wheat populations from Sicily. Results seem to indicate a relationship between yellow berry percentage and flowering time. The same lines were grown in 1973/74 at two locations. Large differences were present between populations and locations for both characters.

463. C.N.R.BARI 1976
Male sterility of durum wheat lines with different cytoplasm.
Ric.Sci.C.N.R (Italy), 45:55-56.

Some male sterile lines of durum wheat were obtained by back crosses of T. durum with the different Triticum and Aegilops species. Those lines were evaluated for male fertility and spikelet fertility. All lines had normal vigor; only one line (Ae umbellulata, T. durum) had a low culm number and was very late. 13 lines were sterile with male fertility values between 0.00 and 3.05. 7 lines had male fertility values between 40 and 70%. Values for spikelet fertility confirmed sterility of some lines with an average kernel number between 0.00 and 0.04.

464. CASUCCI,M. 1982
Durum wheat (T . durum) in Foggia looking for new models (genetic improvement, Italy). (It)
Terra e Vita (Italy), 23:50-51.

465. CHKHAIDZE,L.K. 1981
Dynamics of the development of some populations of durum wheat under extreme conditions. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 3:12.

Cultivation under extreme conditions at 1750 m above sea level in Bakuriani, Georgian SSR, caused marked changes in the morphological characters of Triticum durum vr. apulicum 'Shavikha' and T.durum vr. coerulescens 'Shavitavtukhi'. Cytological analysis revealed changes in chromosome number accompanying some of these morphological changes (from 2n = 28 to 2n = 14 or 42). It is concluded that both gene and genome mutations may be involved in the changes observed.

466. CIMMYT MEXICO. 1976
Durum wheat [Breeding].
CIMMYT report on wheat improvement 11-16.

467. CIMMYT MEXICO. 1978
CIMMYT. Report on wheat improvement 1976.
CIMMYT Mexico 1978. 234pp.

Progress in the breeding of bread wheat, durum wheat, barley and triticale is reported including drought studies and quality in durum wheat.

468. CORTAZAR,S.R. 1982
Wheat breeding for the north-central zone of Chile. (Es)
Agric.Tecnica (Chile), 42:339-345.

The most important requirements for a suitable variety are resistance to lodging and various diseases. Because of changes in the relative importance of the physiological races of the chief pathogens present, the useful life of a variety is, on average, less than five years.

469. DAALOUL,A. 1975
Sub-committee report: durum wheat improvement.
Proc.3rd Reg.Wheat Workshop,Tunisia, 310-313.

This report summarizes the importance of durum wheat and varietal distribution, problems and needs in the Mediterranean region.

470. DAINEKO,O.P. and PODOSOCHNAYA,Z.M. 1981
Results of work on breeding durum wheat at the Krasnoyarsk Institute of Agriculture. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 9:188.

Two varieties, Raketa (Rocket) and Angara, were bred in Siberia from material obtained by crossing Triticum durum with forms of T.dicoccum from Transbaikalia. Angara outyields Raketa, is more resistant to lodging, and has large uniform grain.

471. DAL BELIN,P.A. and POGNA,N.E. 1981
Gliadin pattern heterogeneity within foundation seed samples of Italian durum wheat varieties.
Genet.Agr.(Italy), 35:191-194.

Foundation seed samples from twenty-five Italian durum wheat varieties were analysed to obtain an estimate of the inherent variability for gliadins separated by polyacrylamide gel electrophoresis. Twelve or 48% of the varieties were heterogeneous showing two or more gliadin electrophoregrams. As all patterns within each variety were different from any of those of the durum wheat varieties examined it was concluded that they may largely correspond to biotypes distinguishable by electrophoresis.

472. DAS,P.K. and DASGUPTA,T. 1980
Studies on selection for higher yield in durum wheat (T . durum Desf.) under late sown rainfed condition of west Bengal.
Indian Agriculturist (India), 24:11-22.

Analysis of data revealed that selection for number of days to 50% flowering or number of grains per panicle is likely to generate a correlated response in other components directly related to yield, viz, number of fertile tillers, panicle length, grain weight per panicle and 250-grain weight.

473. DAVYDOV,S.E. 1974
The development of characters and properties in durum wheat hybrids under different cultivation condition. (Ru)
Tr.VNLL Zern.Kh-Va (USSR), 6:186-222.

During 1967-1969 a study was made of the inheritance and variability of various characters. Heterosis appeared for several characters. Regardless of the conditions of cultivation, the most stable character was number of spikelets per ear. Grain weight per plant was more variable. Under local conditions, drought resistance was closely correlated with hardiness. One of the characters associated with the survival rate was the earlier and better development of the root system.

474. DAVYDOV,S.E. and KRAVCHENKO,N.A. 1978
Problems of breeding durum wheat in the north of Kazakhstan.
Kuibysh.Kniz.izadet'stvo.(USSR), 45-49.

Red-grained forms have proved to be useful breeding material, giving high-yielding hybrids in crosses with white-grained forms. From a cross of the white-grained Khar'kov 46 with the local red-grained Murtsience 1, the promising variety Shortandinskaya 71 was selected.

475. DEGHATES,M. and MAAMOURI,A.R. 1982
Cereal improvement program of the National Agronomic Research Institute of Tunisia (durum & bread wheat, triticale, oats) Special report. Agricultural Experiment Station, Oregon State University. (USA)
Rep.Exper.Station, Oregon Univ.(USA), 237.

176. DEKAPRELEVICH,L.L. and NASKIDASHVILI,P.P. 1979
Production of new botanical varieties of bread wheat by crossing Triticum aestivum L. with T . durum Desf. (Ru)
Bull.Acad.Sci.Georgia (USSR), 94:689-691.

477. DEODIKAR,G.B., PATIL,V.P. and RAO,V.S.P. 1979
Breeding of Indian durum and dicoccum wheats by interspecific hybridization

with 4N triticum species.
Indian J.genet. Plant Breed.(India), 39:114-125.

This report describes research with major emphasis on interspecific hybridization among the various tetraploid species. Crosses have been attempted using locally adapted genotypes of T. durum and T. dicoccum with other tetraploid species like T. aethiopicum, T. certhicum, T. dicoccoides, T. dicoccum, T. polonicum, T. pyramidale, T. timopheavi, and T. turgidum. The cytogenetics and practical utilization of these interspecific hybrids are described.

478. DEPACE,C. and BLANCO,A. 1979
Variability of agronomic trait in genetically distant durum wheats.
Proc.5th Int.Wheat Genet.Symp.New Delhi. 680-695.

A set of six varieties (female parents) was diallelically crossed to a set of five varieties of different origin. Parents and F3 progenies were grown in the field and data on size of the flag-leaf, heading, and ripening time were recorded on single plant. Analysis of variance showed that while the female arrays significantly varied ($P<0.05$), except for ripening time, the male arrays generally did not. However, the interaction between arrays was highly significant ($P<0.01$). This indicates that the breeding value of the male parents also differed. Additive and dominance variance components, narrow sense heritability as well as phenotypic genetic correlation coefficients are presented. These results support the possibility of breeding short narrow leafed plants with early ripening and high yield. It was concluded that utilization of distant germplasm is advantageous as it allows breakage of linkage groups.

479. DEPACE,C., QUALSET,C.O., BLANCO,A., SCARASCIA,M.G.T. and GENG,S. 1981
Biometrical analysis and inferences for genetic improvement in durum wheat.
Agronomy Abstracts (USA), 103.

The aim of the paper is to know the potentialities of a multivariate approach for analyzing data from 9 x 9 dialled scheme in durum wheat in order to gain information on selection criteria and families to be selected. F1 and F2 generation means were used. Variance-covariance components were estimated for each source of variation of the diallel analysis (GCA,SCA,Error and Total). The factor analysis showed consistent results over the four variance-covariance matrices. This indicates that if the underlying linear model shows no departure from additivity the technique is useful to information about selection criteria either based on phenotypic values or genotypic effects. The choice of F1 families to be used in selection programs was made by the aid of the canonical analysis. A set of data chosen to represent a "model variety" enabled a direct comparison among crosses and the model variety for selecting plants that seem genetically promising. This has been done by the aid of a multivariate approach to the problem by using the variance-covariance matrices for the characters with significant GCA and SCA effects respectively. Potentialities of the methods and tactics for selection procedure in the following generations are suggested.

480. DEPACE,C. and SPAGNOLETTI,Z.P.L. 1980
Variation and covariation in populations of T . durum . (It)
Genetica Agraria (Italy), 34:149-191.

In populations of durum wheat variation and covariation between characters were studied. First variability between and within families was tested; their genetic and environmental correlation coefficient were calculated and on these matrices factor and canonical analysis were performed. Factor analysis shows the probable polymorphism in the population. Canonical analysis gives evidence on discriminant ability between families of each considered character. Narrow sense heritability estimates were performed by using the canonical analysis results. Moreover analyzing the frame-work of the factors based on environmental correlation matrices, some useful suggestion on safeguard of genetic resources and plant breeding were obtained.

481. DHONUKSHE,B.L. 1983
Use of F2 in combining ability studies in durum wheat.

J. Maharashtra Agr. Univ. (India), 8:51-53.

The possibility of using the F2 generation in combining ability analysis was explored in a 9 X 9 diallel cross of durum wheat (Triticum durum Desf.) for yield and eight other component characters. The F2 analysis gave results similar to those obtained from F1 analysis with regard to general combinig ability variances as well as effects. There was only a slight change in the relative order of general combiners from F1 to F2 generations. This indicated that in durums, reliable estimates of general combinig ability variances and effects could be obtained from F2 generation. This however, was not so with specific combining ability variances and effects. A marked decline in the magnitude of specific combining ability variances and effects was observed in the F2 generation.

482. DHONUKSHE,B.L. and RAO,M.V. 1979
Heterosis in durum wheat.
Indian J.Genet. Plant Breed. (India), 39:285-291.

Yield and yield components were investigated in 36 F1 hybrids obtained by crossing nine wheats of Indian , American or Mexican origin. Compared with the midparental value and with the better parent , heterosis for grain yield ranged from -3.52 to 136.7% and from -18.02 to 80.05%, respectively and 24 hybrids showed heterosis over the high parent.

483. DIONIGI,A. 1973
The progress of research on durum wheat in Italy.
Ann. Ist. Sper. Agron. Bari (Italy), 401-409.

The progress in breeding durum cultivars of different maturity types (Early, Late-early, and Late) for northern and southern Italy are described.

484. DOLGUSHIN,D.A. and TARAN,L.D. 1983
Conversion of spring into winter wheat under regulated conditions in the phylotron. (Ru)
Nauch-Tekhn.Byul.Vses.Se.Gen.Inst.(USSR) 12-15.

485. DONNELLY,B.J. 1977
Durum research at NDSU.
Macaroni J.(USA), 59:21-27.

486. DOROFEEV,V.F. 1978
World collection of spring durum wheat and its use in breeding. (Ru)
Vestn.Sel'sk-Khoz Nauki.(USSR), 130.

487. DUTLU,C. and SOLEN,P. 1984
Recent developments in durum wheat improvement in Turkey.
RACHIS (ICARDA,Aleppo,Syria), 4:49-50.

In the past decade there was a shift from durum wheat to bread wheat production due to the introduction of high yielding bread wheats. Thus in 1969 Turkey initiated an extensive durum breeding program to work on resistance to major diseases and high yield potential. In 1975-76 a new variety, Gediz-75 (LD 35 7E- 1-2 X AI "S") was released for the coastal region. In the south eastern region a variety, Dicle-74 was recommended for release in 1973-74. In the winter durum area Cakmak 79 and Tunca 79 were released in 1979. Gokgoll 79 was released as a spring durum.

488. DUWAYRI,M. 1983
Selection for coleoptile length and plant height in early generations in durum wheat.
Proc.6th Int.wheat Genet.Symp.(Japan), 701-707.

The durum varieties Wascana, Mexicali 75 and Hourani which differ in their plant height and coleoptile length, were crossed to investigate the possibility of selection for plant height in early generations by coleoptile measurement in F2 generations. The F2 seeds were germinated and classified into groups according to their length. Seedlings were transplanted in the field in 1981-82 and 1982-83 seasons and different agronomic characteristics were measured on the individual plants. Plant height means of the different coleoptile classes corresponded very well with the mean of coleoptile length indicating the advantage of selection for height by the measurements of coleoptile length in the laboratory. Heritability estimates were high for plant height, peduncle length and heading date. Negative association was found between plant height and heading date. Positive correlation existed between plant height and grain yield in one of the crosses and between plant height and 100 seed weight for three crosses in 1982.

489. EL SHARKAWI,A.M.A. and ALI,A.M.M. 1977
Classification of some Triticum ssp. (T . aestivum , T . dicoccum and T . monococcum).
Egyptian J.Bot.(Egypt), 20:153-158.

490. FABRIANI,G. 1975
Topical research for improvement of durum wheat quality in Italy. (Fr)
CIIA,Paris (France), 19-27.

491. FAO, ROME 1976
Report of the consultation on the establishment of the European research network on durum wheat, Bari, Italy, 28-30 April.

492. FEDOROV,P.F. and ZUSMANOVICH,T.G. 1975
Breeding winter durum wheat. (Ru)
Tr.Kazakhsk.Nll Zemledeliya (USSR), 11:30-37.

A high seed set (70-95 per cent) was obtained. When bread and durum wheats were crossed very hardy but insufficiently high-yielding forms of winter wheat were obtained. To improve their yield, these forms were crossed with high-yielding durum wheats and also with high-yielding varieties of bread wheat.

493. GASIOROWSKI,H. and POLISZKO,S. 1977
A wheat endosperm microhardness index.
Acta Alimentaria (Hungary), 6:113-117.

494. GERMANOV,I.V. 1979
Production of an intensive variety of durum wheat. (Ru)
Selekts.Semenov.(USSR), 16-17.

In breeding work in Bulgaria, complex crosses, including interspecific hybridization, have been used; forms yielding some 90 c/ha have been obtained. The desired number of grains per ear was obtained from crosses with Triticum turgidum, the desired 1000-grain weight from T.turanicum and T.polonicum, and the desired disease resistance from T. dicoccum, T. militinae, T. carthlicum and T. zhukovskyi.

495. GIL,J., MARTIN,L.M. and CUBERO,J.I. 1982
Genetics of height and its components in durum wheat.Pt.2.
Genetica Agraria.(Italy), 36:101-106.

A study of crosses between two tall cultivars and two semidwarf cultivars revealed that height is controlled by two genetic systems: a qualitative system with a single locus semidwarfism being partially recessive, and a quantitative system acting on the uppermost internode.

496. GILL,K.S., BHULLAR,G.S. and BHATIA,A. 1980
Combining ability in durum wheat (Triticum durum Desf.).
J.Res.Punjab.Agric.Univ.(India), 17:243-247.

Eight characters were studied in a diallel of eight lines. General combining ability (GCA) variance was significant for peduncle length. For the other characters, GCA variances and specific combining ability variances were significant. Nonadditive gene effects were important for yield, number of spikes/plant, number of grains/spike, spike length and grain weight. Additive gene effects were important for number of spikelets/spike, height and peduncle length.

497. GILL,K.S. and BRAR,G.S. 1977
Variability and correction for grain protein and other economic traits in durum wheat (T . durum Desf.).
J.Res.Punjab Agric.Univ.(India), 14:391-394.

Heritability estimates among 23 strains, introduced from Egypt, Ethiopia, Italy and Tunisia, for plant height, number of days to heading, 1000-grain weight, sedimentation value, ash content, grain protein content and grain yield per plant are given. The genotypic coefficient of variability and the expected genetic advance were fairly high for plant height, sedimentation value, ash content, grain yield per plant and 1000-grain weight, but low for grain protein. Grain protein had a significant positive phenotypic correlation with sedimentation value and a negative association with number of days to heading and number of spikes per plant.

498. GIORGI,B. and MOSCONI,C. 1982
Short-straw mutants and other dwarfing gene source used for the improvement of wheats and barley in Italy.

Vienna,Austria,IAEA., 53-64.

In durum wheat semidwarf varieties were developed by the introduction of the Norin 10 gene Rht1. Tabulated data are presented on yield and height of several semidwarf mutants of durum wheat.

499. GLUKHOVTSEVA,N.I. 1978
Use of forms of durum wheat in breeding spring bread wheat.
Kuibysk.Kinz.Izadet'stvo.(USSR), 98-102.

High combining ability in crosses with bread wheat has been shown by the following durum wheats: Hordeiforme 1404, Hordeiforme 189, Raketa (Rocket), Akomlinka, Lakota and Wells. The useful interspecific hybrids bred include Ethroleucon 1086, obtained by back crossing the durum wheat Bezenchuk 102 with the bread wheat Erythrosperum 841. It has white grain of a size and vitreousness similar to that of durum wheat. It is highly drought resistant and under rainfed conditions outyields Saratov 36 and Saratov 210 by 3.6 C/ha. It is resistant to Puccinia recondita and Erysiphe graminis.

500. GRIGNAC,P. 1973
Action of leaf rust (P . recondita f.sp. tritici) on durum wheat yield and breeding for rust resistance.
Proc.Symp.Genet.Breed.D.W.Bari, (Italy), 489-495.

Leaf rust causes a decrease of the duration of the roots variable according to the severity of the attack, the varieties and conditions of the environment. The grain shrivelling is in direct relation to the rapid death of the roots. In our breeding programme, we have considered only horizontal resistance, the evolution of the races being very rapid. Genes of resistance present in T. vulgare were used. After 3 cycles of selection, a few lines have a good leaf rust resistance and interesting agronomic and technological characteristics. It is possible to obtain high yields with durum wheat in places where leaf rust is severe. But Fusarium culmorum becomes actually a more important problem than leaf rust.

501. GRIGNAC,P. 1976
Varietal improvement of durum wheat (T . durum Desf.) in France. (Fr)
Semaine d'etude-cereliculture,(France), 55-67.

Durum wheat improvement in France tries to create varieties adapted to intensive cultural practices starting from a little diversified material, selected for drier areas. Selection methods vary according to the origin of the population (intervarietal or interspecific crossings). The "bulk method" is employed more and more or single seed descent during the early generation. Progress has been made on resistance to lodging, productivity, rust resistance and powdery mildew. In order to increase selection efficiency a cooperation has been instituted between private breeders and INRA.

502. GRIGNAC,P. 1976
Durum wheat [T . durum Desf.] improvement in France.
Fac.Sci.Agron.C.Rech.Agron(Belgium), 55-77.

In France, durum wheat improvement is conducted in order to create well adapted varieties for intensive crop culture. Selection is made from a narrow genetic base, in material adapted for dry country. Choice in methods of selection depend on the variability of the population coming from crosses between durum varieties or between durum and bread wheats. We use more and more bulk method or the single seed progeny method during the first generations of selection. Productivity, lodging resistance, rust and mildew resistance have been ameliorated. Collaboration between INRA and private plant breeders has been established in order to increase the efficiency of the selection.

503. GRIGNAC,P. 1978
Breeding durum wheat (T.durum Desf.)in France.(Fr)
Ann.Inst.Nat.Agron. (France), 8:99-109.

Breeding of Triticum durum in France is reviewed. Breeding methods used include hybridization between durum wheat and bread wheat, and also intervarietal crosses.

504. GUBAREVA,N.K., RUDENKO,M.I. and CHERNOBUKOVA,A.D. 1979
Comparative analysis of durum wheat varieties by means of electrophoretic gliadin banding patterns. (Ru)

Genetike i Selektsii.(USSR), 63:24-31.

94 Soviet and 79 foreign varieties were analysed. Varieties with a common origin were found to have similar banding patterns. Of the Soviet varieties, 38 had patterns peculiar to them alone. The remaining 56 fell into twelve groups. Of the foreign varieties, 27 had unique patterns, the remaining 48 falling into six groups.

505. GUPTA,R.R., AHMED,Z. and ZAIUDDIN, AHMAD. 1982
Selection parameters for some developmental and component traits in durum wheat.
Indian J.Agric.Sci.(India), 52:278-284.

Selection criteria were evaluated for 14 traits in 125 F1s and 125 F2s. Maximum genetic gain was observed for plant height, leaf senescence, grain number/spike, spikelet number/spike and 100-grain weight in both generations. High heritability with high genetic gain was found for plant height, spikelet number/spike and 100-grain weight. Estimates of relative selection efficiency revealed the importance of direct selection through flowering period, maturation period, spike number, spike length and grain number/spike and indirect selection through grain weight/spike and 100-grain weight, to maximize grain yield.

506. HADJICHRISTODUOLOU,A 1983
Edge effects on yield, yield components and other traits in mechanized durum wheat and barley trials.
J.Agric.Sci.(U.K), 101:383-387.

Trials were conducted during 1979-82 under semi-arid conditions in a Mediterranean-type environment to study the edge effects in mechanized durum wheat and barley cv. trials when uncropped pathways were left between plots. Varietal differences in edge effects on grain yield were in most trials not significant. Thus, edge effects did not distort significantly the relative ranking of cv. Edge effects were significant for all traits studied and higher in grain and straw yields. These effects were also higher in drier seasons. The over-estimation of grain yield from whole plots was 13-18% in relatively high rainfall seasons and 29% in a dry season.

507. HANCHINAL,R.R. and GOUD,J.V. 1982
Development of D genome monosomic addition lines in durum wheat cv. Bijaga yellow.
Wheat Infor.Serv.(Japan), 6-11.

The seven D monosomic lines of Triticum aestivum 'PbC591' were crossed as female to Bijaga Yellow. In the F1 the plants with 34 chromosomes (14II = 61) were selected and backcrossed to Bijaga Yellow. Plants with 14II = 1I were selected and backcrossed twice more to Bijaga Yellow. The transmission frequency of monosomic addition chromosomes was quite low and the monosomic addition lines were partially or completly sterile.

508. HANCHINAL,R.R. and GOUD,J.V. 1983
Development of monosomic lines in durum wheat.
Wheat Infor.Serv.(Japan), 3-8.

Lines of Triticum aestivum 'PbC591' monosomic for chromosomes 1-7 of genomes A and B were crossed to T. durum 'Bijaga Yellow'. For purposes of backcrossing to Bijaga Yellow, plants with 13II + 2I and 13II + 1I were selected in the F1, BC1 and BC2 generations, respectively. The frequency of monosomic plants in BC3 progenies ranged from 0 to 4.55% (average 1.68%).

509. HEGAZI,K.F. and MORISI,I.R. 1977
Heterosis and combining ability of certain aspects influencing protein in durum wheat.
Agric.Res.Rev.(Egypt), 55:50-60.

Combining ability studies for protein content, shrivelled seeds and yellow berry seeds percentages in diallel crosses involving seven diverse durum wheat varieties are reported. The general as well as specific combining ability variances were highly significant. However, the magnitude of general combining ability variances was more than of specific combining ability variances. The magnitude of specific combining ability variances was less in F1'S than that in the parents in some crosses, but the effects were significant.

510. IL'INA,L.G. and VASIL'CHUK,N.S. 1978
Results and prospects of breeding spring durum wheat in the Volga area. (Ru)

Vestn.Sel'Sk-Khoz.Nauki.(USSR), 131.

Saratov 40, bred by crossing Melanopus 69 with an F1 hybrid from (Leucurum 983 X Melanopus 69) X Saratov 34, yields 20.4 c/ha and has good technological qualities. Saratov 47, from Melanopus 26 X khar'kov 46, yields 32.6 c/ha and has good drought resistance, large vitreous grain and lodging-resistant straw.

511. JOPPA,L.R. and MAAN,S.S. 1982
A durum wheat disomic-substitution line having a pair of chromosomes from T. boeticum : Effect on germination and growth.
Can.J.Genet.Cytol.(Canada), 24:549-557.

Durum wheat selection 56-1 was crossed with an accession of Triticum boeoticum Boiss, and a F2 plant had 13 pairs plus 2 univalents (13" + 2') at metaphase I. In subsequent generations, plants with the chromosome configuration 14" + 1' were selected. Plants with 14" + 1' produced two types of seed. Approximately 78% of the seeds had purple pericarp and the rest were amber. Purple seeds failed to germinate unless they were soaked overnight in a one mg/l solution of gibberrellic acid (GA3). The seeds with purple pericarp had 28 chromosomes including a pair of T. boeoticum chromosomes which were substituted for 4B chromosomes from durum wheat. The disomic-substitution plants were dwarfs and male-sterile. Amber seeds had the chromosome constitution 13" + X" + 4B' (X = the T. boeoticum chromosome) and produced malefertile, normal height plants. Chromosome pairing relationships indicated that the T. boeoticum chromosome had no more homology with wheat chromosomes 4A, 4B, and 4D than they had with each other. The T. boeoticum chromosome compensated for the loss of durum chromosome 4B except for a locus affecting GA.

512. JOPPA,L.R. and WILLIAMS,N.D. 1979
A disomic-5D-nullisomic-5B substitution line of durum wheat.
Crop Sci.(USA), 19:509-511.

A vigorous and fertile line was produced by crossing a monosomic-5B monosomic-5D line with a 5D-addition-disomic line of the durum wheat Langdon. Because of the absence of the Ph gene on chromosome 5B, homeologous pairing occurs. The line is best maintained as disomic-5D monosomic 5-B

513. JOSEPHIDES,C.M. 1984
Effect of chromosome 1B on quality and agronomic characteristics of durum wheat, Triticum turgidum L. var. durum .
Diss.Abstr.Inter. (USA), 45:1083.

Chromosome 1B from the strong-gluten durum wheat cultivars Edmore and Kharkov 5 and chromosome 1D from T.aestivum cv. Chinese Spring were substituted into the weak-gluten durum wheat cultivar Langdon. Agronomic traits, including yield, were similar in Langdon and the 3 disomic substitution lines. However, in some cases the absence of chromosome 1D in Langdon had a definite effect on test weight, grain weight and grain size. The Edmore and Chinese Spring substitution lines had improved microsedimentation, mixogram pattern, spaghetti cooked weight, spaghetti firmness score, dough mixing time, loaf volume and crumb grain and texture, similar to values obtained for Edmore and Vic.

514. KALATT,A.R., DINCER,N. and YAKAR,K. 1973
Problems associated with breeding spring and winter durum in Turkey.
Genet.Breed.D.W.Symp.Lib.Fac.Agric.Italy 327-334.

The spring durum program is underway and preliminary results are quite encouraging. In the southeast large scale screening programs have identified a few lines with promise which will suffice until the recently initiated breeding program is productive. The winter durum breeding program is severely hampered by the lack of winter or cold resistant types: however, efforts are currently underway to resolve this problem. Types with better water use efficiency will probably have to be developed by a cooperative effort of breeders, physiologists, agronomists, etc.

515. KALIEV,A.Kh. and NURGASENOV,T.N. 19.9
The problem of converting spring durum wheat into winter wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 1:283.

Spring durum wheat was converted into winter wheat, by exposure to impulse-concentrated sunlight and corona discharge. Treatment of grain prior to autumn sowing increased the percentage of surviving plants in spring.

516. KALTSIKES,P.J. and LEE,J. 1973
Interrelationships among yield and related agronomy attrubutes in durum wheat (T . turgidum L. var. durum).
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 285-295.

Correlations, multiple regression and factor analyses were conducted on grain yield and a number of related agronomic attributes in the parental, F1 and F2 populations originating from a 10-parent diallel cross in durum wheat. In both generations all agronomic characters were highly associated with yield; most of these characters were also correlated amongst themselves. Four common factors were extracted which explained 96% and 97% of the total variance among the 10 correlated characters in the F1 and F2 populations, respectively. Grain yield, the number of spikes and kernels per plant all had high loadings on the most important factor. Based on both generations, number of spikes per plant, plant height and kernel weight were the most potent predictors for grain yield.

517. KANDAUROV,V.I., TUMAIKIN,N.S. and MOROZOV,N.N. 1978
Aspects of agronomic technique and breeding spring durum wheat in the Altai. (Ru)
Vestn.Sel'sk-Khoz Nauki.(USSR), 132.

Varieties bred at the Altai Agriculture Institute include Leucurum 44, which is early and highly resistant to lodging, and Altaika, selected from Khar'kov 46, which has lodging resistance. The main breeding method used was intervarietal hybridization, using Khar'kov 46, Altaika and Leucurum 44 as female parents and Canadian, American and Chilean varieties as male parents.

518. KAYYAL,H. 1973
Agroecological characteristics of the T . durum Desf. varietal type Haurani and possibilities of improving it. (Fr)
Ann.Amelior.Plantes (France), 23:245-257.

Haurani, the main variety grown in Syria, was studied at Toulouse. It is a short-day spring type, fairly early and very drought resistant, and has high spikelet fertility, short stature and fairly good resistance to lodging. It is, however, susceptible to diseases and has small grains of only moderate quality. In crosses with various lines, heterosis was observed for 1000-grain weight, number of grains per ear, number of grains per spikelet and grain weight per plant. Absence of sterile spikelets proved to be a dominant character.

519. KETATA,H. 1984
Comparative study of durum (T . durum Def.) and bread wheat (T . aestivum L.EM.Thell) lines.
RACHIS (ICARDA,Aleppo,Syria), 3:36-41.

Three durum and three bread wheat crosses were studied to determine the relative performance of F3-derived F4 and F5 lines. The results show that, compared to bread wheat, durum generally possesses heavier kernels but produce fewer tillers/unit area and may have slightly more kernels/spike. Durum does not seem to have an intrinsically lower yield potential than bread wheat.

520. KHANGIL'DIN,V.V. 1981
Introgression of blocks of genes from Triticum dicoccum into T . durum . (Ru)
Nauch-Techn.Byul.Vses,Se.Genet.Inst.USSR 16-19.

Segregation ratios in the F2 and F3 an interspecific hybrid between T. durum 'Bezostaya 54' and the local T. dicoccum population Kaltasinkaya are described. Information is presented on the yield components of Kaltasinskaya x Bezostaya 54. Which showed wide variation in number of grains per ear, and in crosses between Kaltasinskaya and another durum wheat variety, Bashkirskaya Bezostka, from which the highest-yielding hybrids were selected. Chromosome 5A of Bezostaya 54 appeared to play an important role in the control of hollow straw.

521. KHANGIL'DIN,V.V., NIKONOV,V.I. and SHAYAKHMETOV,I.F. 1979
The use of Triticum dicoccum schubl. in breeding durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 3:168.

By crossing T. durum with T. dicoccum, short-strawed erectoid forms of durum wheat with resistance to lodging and unfavourable environmental conditions, solid straw and high grain yield were obtained.

522. KHRAMOVA,N.A. and KRUPNOV,V.A. 1979
Experimental breeding of spring durum wheat fertility restorers.
Sec.Jnl.Source: Referat.Zh. (USSR), 6:212.

A study was made of the fertility-restoring capacity of durum wheat lines with Rf genes from Triticum timopjeevii, T. dicoccum and material combining Rf genes from both donors. The fertiliy-restoring capacity of the complex hybrids was higher than of the other forms and proved stable under different conditions.

523. KINGMA,G., QUINONES,M.A. and ANDERSON,R.G. 1975
CIMMYT'S international role in improving durum wheat.
Proc.3rd Reg.Wheat Workshop,Tunisia, 29-36.

Durum or macaroni wheats occupy a significant portion of the total wheat acreage of the world. Statistic on production are extremely difficult to obtain since durum wheat is lumped with bread wheats in reporting. However, estimates as high as 30 million metric tons for world production are recorded for certain years. The major producing countries are the USA, Argentina, Canada, Italy, Algeria, Morocco, Ethiopia, Turkey, Syria, USSR and India. Many other countries also grow significant proportions of their wheat acreage to durums. The main product use includes pasta products (macaroni, spaghetti, etc.) couscous and a number of flat breads. CIMMYT's interest in durum wheat improvement began in the 1950's when the availability of Norin-10 dwarfing genes of the winter and spring wheats offered an opportunity for the development of superior agronomic types. During this period crosses were effected between the earlier released Mexican tall varieties Tehuacan and Barrigon-Yaqui with the early dwarf wheats. The older varieties had considerable drought tolerance and large seed. These crosses resulted in such dwarf durum releases as Oviachic 65 and Chapala 67 in Mexico and Quilafen in the Chilean program. Further improvement was required in these varieties. In general they were too late and some sterility was still present, inherited from the early dwarf bread wheat parents. They did, however, have real merits in their dwarfness, straw strength, fertilizer response and tillering. Unfortunately, many of the varieties available as parent material had been developed in the more temperate regions and day length sensitivity was common. Varieties, therefore, had to be rendered day length insensitive through crossing to day length insensitive materials if varieties were to be produced suitable for growth in the semi tropic and near semi tropic countries for which CIMMYT has its main obligation.

524. KLATT,A.R., DINCER,N. and YAKAR,K. 1973
Problems associated with breeding spring and winter durums in Turkey.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 327-334.

525. KOSTENKO,A.I. 1981
Breeding spring durum wheat for the steppe of northern Black Sea area. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:250.

Methods and results of recent breeding work in this area of the Ukraine are described. Details of the method used to breed Nakat is described.

526. KOS[illegible]N,V.V. and MUDROVA,A.A. 1977
Methods of breeding winter durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:140.

A breeding method involving three way crosses of the type (Triticum aestivum (witer type) X T. durum (winter or spring variety)) X T. durum is described. Because of the low grain set obtained, at least 2000 florets needed to be pollinated in each cross. Data on yield in the newly bred durum wheats Leucomelan 2 and Kristall are presented.

527. KOZLOV,Yu.D. 1978
Problems of breeding spring durum wheat in the Volga area.

Kuibysh.Kniz.Izadet'stvo.(USSR), 11-15.

Some of the varieties bred are mentioned and briefly described, including Saratov 47 and Bezenchuk 139.

528. KRUSE,A. 1983
Fertile hybrids between wheat and barley, using durum wheat as a mother plant and common barley as the father plant and 2n=42. (Da)
Ugeskrift for Jordbrug (Denmark), 128:49-51.

529. KUMAR,P., AHMED,Z., KATIYAR,R.P. and KHANNA,A.N. 1977
Studies on combining ability and heterosis in macaroni wheat (Triticum durum Desf.). In Genetics and wheat improvement. 7th Durum and triticales, ed. A.K.Gupta.
Oxford and IBH Publishing Co.(India), 218-244.

Nonadditive gene effects predominated in the 12 strains studied. Grando and Raj 911 were the best parents when main-spike length, 100-grain weight and yield were considered together. MPO156 was superior in other attributes. Some association was seen between specific combining ability effect and heterotic response.

530. KUMBHAR,M.B., LARIK,A.S. and HATIZ,H.M.I. 1982
Biometrical association of yield and yield components in durum (T . durum) and bread wheat (T . aestivum).
Wheat Infor.Serv.(Japan), 35-38.

The relationships between yield and yield components in durum and bread wheat were studied by simple correlation coefficient, path coefficient analysis, multiple covariation and partial regression analyses.

531. KUZ'MIN,N.A., NIKULICHEVA,F.A., PIVOVAROVA,V.V. and MORKOVIN,V.V. 1978
Problems in the production and breeding of spring durum wheat in the central Chernozem zone. (Ru)
Kuibysh.Kniz.izadet'stvo. (USSR), 86-89.

In a study of 17 forms selected from various crosses, line 5623 from Raketa X Chakinskaya 226 yielded 448 c/ha , while lines 3407 and 3478 from Saratov 40 X Raketa plus Khar'kov 46 plus Saratova 36 plus Zavolzh'e performed well under drought conditions. Promising bread wheats were produced by crossing Triticum durum with T. aestivum.

532. LA FIANDRA,D., BENEDETT-ELLI,S., SPAGNOLETTI,Z.P.L. and PORCEDDU,E. 1981
Identification of durum wheat varieties by means of electrophoretic analysis. (It)
Agric.Italiana (Italy), 111:107-117.

By an electrophoretic analysis of the gliadin content of the seed, 36 durum wheat cv. were identified.

533. LEIHNER,D.E. and ORTIZ,F.G. 1978
Improvement of durum wheat-plant type, yield potential and adaptation.
Euphytica (Netherlands), 27:785-799.

CIMMYT has achieved improvements in durum wheat by exploiting the variability of the tetraploid species in numerous crosses and by testing germplasm at many sites throughout the world. High-yielding, widely adapted durum wheats with short straw, good fertility and adequate earliness have been selected for distribution to the major durum-wheat growing countries. Current breeding aims include adjusting agronomic traits such as leaf angle and straw strength, and increasing spike fertility and size to produce more grains per unit area. Diversification of the developmental pattern and incorporation of drought tolerance should widen adaptation still further.

534. LUBNIN,A.N. 1980
Effectiveness of hybridizing durum wheat with other wheat species. (Ru)
Selekts.Semenov. (USSR), 13.

During 1977-78 seven durum wheats, Triticum dicoccum, T.persicum and the bread wheat Sayanskaya 55 were crossed in a diallel scheme. Hybrid grain set was highest in T.durum X T.dicoccum (33.7%), T.persicum X T.aestivum (22.9%) and T.durum (20.2%). Higher grain sets were obtained when the species with the lower ploidy was the maternal parent than in the corresponding reciprocal. The highest grain set from selfing the F1 plants was obtained in T.durum X T.dicoccum.

535. LUKASZEWSKI,A.J. and GUSTAFSON,J.P. 1981
The influence of several wild rye secale

species on the endosperm development of hybrids resulting from crossing the species to Triticum durum .
Genetics. (USA), 97:567.

Species differing in amounts of telomeric heterochromatin were crossed to T.durum and the resulting hybrids were treated with colchicine. Significant differences in the production of aberrant endosperm nuclei occurred between the hybrids. The S.africanum hybrid had the lowest percentage of aberrant endosperm nuclei while the S. cereale and S. dighoricum hybrids had the highest percentage. S.africanum had the lowest and S.cereale and S.dighoricum had the highest amounts of telomeric heterochromatin. S.africanum was at least one to two cell divisions faster in its development than any of the other hybrids.

536. MARTIN,L.M. and CUBERO,J.I. 1979
Genetics of quantitative characters in Triticum turgidum var. durum Desf. (Es)
Comun.INIA.Serie Prod.Veget.(Spain)No.23 92.

537. MARTYNYUK,R.T. and GALOCHKINA,Z.N. 1978
Choosing parental forms for hybridization in durum wheat. (Ru)
Selekts.Semenov. (USSR), 20-21.

Of 165 varieties studied in northern Kazakhstan during 1971-75, the highest yielding under favourable conditions were Lokata, Bezenchuk 105, K15808 and K20036, and under drought conditions Saratov 37, Bezenchuk 105, Akmolinka and 37104. The best varieties were used in hybridization. The highest yields were obtained from hybrids involving Khar'kov 46, Tselinnaya, Plastovaya 6, Melanopus 26 and Saratov 34, viz. Tselinnaya X Khar'kov 46, Khar'kov 46 X Melanopus 26, Melanopus 26 X Plastovaya 6.

538. MEHDI,S.S. and SHAH,S. 1979
Variability and correlation studies in durum wheat.
Pakistan J.Sci.Res.(Pakistan), 31:26-28.

In 35 durum types there was enough variability in 6 traits except in ears per plant. Fifteen coefficients show the degree of correlation between six agronomic characters. Yield was positively and significantly correlated with plant height and ears per plant; and positively and non-significantly correlated with grains per ear and 100-grain weight. Plant height and ears per plant and 100-grain weight seem to be the best criteria for selection in durum types studied.

539. MIECZKOSWKA,E. 1978
Multiline varieties as a chance in hard wheat breeding.
Hodowla Roslin.(Poland), 18-19.

540. MILORADOVA,N.L. 1978
Prospects of cultivating durum wheat in Ural'sk province. (Ru)
Kuibysh.Kinz.Izadet'stvo (USSR), 65-67.

At the Ural'sk agricultural experimental station in Kazakhstan, 649 crosses have been made, 267 of them involving a foreign variety. The most promising lines were selected from crosses involving Melanopus 26, Saratov 40, Khar'tov 51, Narodnaya (Michurinist), Odessa, Yubileinaya and forms from Chile, Morocco and Portugal.

541. MIRGASANOV,N.M. 1979
Study of the correlation between plant height and ear and plant yield in intraspecific hybrids of winter durum wheat. (Ru)
Sec.Jnl.Source: referat.Zh. (USSR), 4:189.

In most of the F2 hybrids studied, no significant correlation was found between height and number of grains per ear or per plant. The most useful crosses for selecting high-yielding short-strawed material were Apulikum yardymlinskii (Yardymly Apulicum) (K153/3-62) X CB8016, Teucan 67 X Sary (Yellow) and Teucan 67 X Apulikum yardymlinskii (K153/3-62).

542. MANNARIELLO,V. 1974
Replanting durum for 23 consecutive years. (It)
Terra E Vita. (Italy), 15:33.

543. MANNARIELLO,V. 1974
Hard wheat: A wealth of the south [Italy]. (It)
Terra E Vita. (Italy), 15:32-33.

544. MASKIDASHVILI,P.P. 1979
New forms of Triticum durum Desf. with branched ears. (georgia)
Bull.Acad.Sci.Georgian USSR.,

93:149-152.

In the progeny of T. durum 'Coerulescens 19/28' X T. aestivum 'Akhaltsikhis Tsiteli Dolis Puri', plants with hybrid necrosis, red hybrid chlorosis and hybrid dwarfness segregated, together with various forms with branched ears.

545. NASR,H.G. and HADDAD,N. 1977
Variation and covariation in segregating populations of three durum wheat crosses.
Cereal Res.Commu. A.U.B, 5:315-324.

Variances and covariances were measured for eight traits from the parents and F2 and F3 generations of the three Triticum durum crosses. The results indicated wide ranges and significant variation for grain yield in crosses 1 and 2, for number of tillers/plant, number of kernels/main spike, number of kernels/spikelet and kernel weight in cross 1, for number of spikelets/main spike in crosses 2 and 3, and for number of days to heading and plant height in all three crosses. Heritability estimates were generally high for number of days to heading, intermediate to high for plant height, intermediate for yield (low in cross 3) and number of spikelets/main spike and low for the other characters. Single phenotypic correlation coefficients indicated that grain yield was positively correlated with tillering, number of kernels/main spike, number of spikelets/main spike and number of kernels/spikelet.

546. NIEHAUS,W.S. and QUICK,J.S. 1983
Effect of population density on height selection in durum wheat.
Cereal Res.Commu.(USA), 11:143-145.

A simulated segregating height mixture composed of three Triticum durum wheats (one part Ward (normal height), two parts D73121 (medium height) and one part Calvin (semidwarf)) was planted at two densities (21.5 and 43 plants/m2) during 1978. Plants were visually evaluated and grains from 100 plants of each height class from each density were grown in spike rows in 1979. The success rate for height selection was equally effective at both densities and for all heights.

547. PACURAR,I. and PAPU,Z. 1983
The winter wheat durum - a crop in extention in our country's agriculture. (Ro)
Cereal Si Plant Tehnice (Romania), 12-17.

548. PANDEY,H.N. and RAO,M.V. 1983
Role of temperature in restoration of fertility in Triticum durum X T. timopheevii hybrids.
Z.Pflanzenzuchtung (F.R.G), 91:70-73.

Eleven varieties of T. durum were crossed as both male and female parents with T. timopheevii. Selfing of F1 plants showed these hybrids to be 100% male-sterile under both temperature regimes used. When F1 plants were backcrossed to their respective T. durum parents, fertility improved with increased temperature and more grains were set at 24.8 centigrade (64%) than at 19.7 centigrade. Grain set in crosses having T. timopheevii as male increased by 30 and 20% at low and high temperatures, respectively. Only one fertile plant carrying resistance to Puccinia sp. from T. timopheevii was recovered from 371 BC1 grains sown.

549. PAVLOV,P. and DEKOV,D. 1973
A study of the varieties of durum wheat (T.durum Desf.) as breeding resources.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 201-208.

The results of an agro-botanical study over 270 introduced landraces and varieties of durum wheat during the period 1962-1972 are given. The varieties investigated originate from 30 different countries and belong to 29 botanical varieties. As a result of the study, a number of varieties possessing important biological and economical characters such as early maturity, good winter hardiness, productive tillering, resistance to rusts, powdery mildew and other characteristics have been studied in order to use them as breeding materials for the purpose of further selective improvement of durum wheat. All varieties investigated proved to have lower lodging resistance and grain yield than the control Apulicum 233 and have no immediate application therefore in Bulgaria.

550. PERUFFO,A. and DAL,B. 1981
Differential analysis of durum wheat varieties Capeiti 8 and Patrizio 6 using electrophoretic techniques. (It)

Sementi Elette (Italy), 27:11-13.

The grain gliadins of the two varieties, both deriving from the cross Eiti X Sen. Cappeli and which are morphologically indistinguishable, were studied using polyacrylamide gel electrophoresis both with and without the addition of sodium dodecylsulphate (SDS). Both varieties were found to be heterogeneous. Electrophoresis both with and without SDS showed that, while most of the 130 grains studied of both varieties belonged to one biotype, one grain of 'Cappeti 8 and four of Patrizio 6 belonged to a second biotype. Electrophoresis with SDS showed the existence of three biotypes in Patrizio 6 and of two in Cappeti 8.

551. PERUFFO,A., DAL,B., BOVO,G. and POGNA,N.E. 1981
Gliadin pattern heterogeneity within foundation seed samples of Italian durum wheat varieties.
Genetica Agraria (Italy), 35:191-194.

Out of 25 varieties 12 had two or more gliadin banding patterns shown by polyacrylamide gel electrophoresis. None of the patterns were the same as those of the other varieties and it is suggested that they largely correspond to biotypes of the varieties.

552. PERUFFO,A., DAL,B., PALLAVICINI,C., PINTON,R. and POGNA,N.E. 1982
Analysis of wheat varieties by gliadin electrophoregrams. 3: Catalogue of electrophoregram formulas of 22 Italian durum wheat varieties.
Genetica Agraria (Italy), 36:365-374.

On the basis of total band number and relative band mobility, the 22 varieties were divided into four main groups, two also containing subgroups. Electrophoregram formulas are given for each variety. All varieties, even those which had multiple gliadin patterns, were electrophoretically distinct. They can be easily identified by the electrophoregram formulas.

553. PHATTHAKUN,CH., SRIMUN BUNYARAT and MANAT LEECHAWENGONG 1979
Common wheat and durum wheat breeding. (Thai)
Dep.Agric,Bangkok (Thailand), 42-43.

554. PHATTHAKUN,CH., SRIMUN BUNYARAT and SUPHAWAT THIPPHAYARA 1978
Common wheat and durum wheat breeding [in Thailand].
Annual Res.Rep.1978 (Thailand), 12-23.

555. PORCEDDU,E., PACE,C.de., SPAGNOLETTI,Z.P.L. and SCARASCIA,M.G.T. 1980
Genetical variability in F3 families from genetically distant durum wheat (Triticum durum) varieties. (It)
Genetica Agraria (Italy), 34:182-183.

Genetic variability was studied within each of 54 F3 families obtained by crossing in factorial way 15 varieties according to North Carolina mating design II (6 x 9). The female parents were Italian pedigreed varieties and male parents were Mexican varieties or Mexican derived varieties. Three dimensional characters of flag leaf (width, length and sheath length), uppermost internode and plant length, heading and ripening time were evaluated. Results obtained provide means to test the rising polymorphism in the F3 families and to estimate the amount of genes for which the parental varieties differed.

556. PORCEDDU,E. and SCARASCIA,M.G.T. 1974
Seedling growth characteristics in varieties, mutant lines and crosses of durum wheat.
Proc. FAO/IAEA.Eucarpia meet.Bari Italy, 261-273.

A number of durum wheat lines, including cultivated varieties from different geographical origin, mutant lines and their mother varieties, dwarf and semi-dwarf lines with Norin and Brevor genes, together with some of their F2's were sown in darkened plant growth chamber for studying the response of the first developmental stages, namely the coleoptile length to a graded set of temperatures. The results seem to indicate that different temperatures induce highly significant variation; lines were significantly different in their overall response to the temperatures, but they behave differently at different temperatures. The coleoptile of long culm varieties attains in general high or intermediate lengths, while short straw lines present a great range of variability, including

lines with the shortest and the longest coleoptile. Mutants and mother varieties show a long coleoptile, whereas semidwarf lines have a short or intermediate coleoptile.

557. PURI,Y.P., QUALSET,C.O. and VOGT,H.E. 1978
Registration of Modoc durum wheat.
Crop Sci.(USA), 18:916.

Modoc wheat, Triticum turgidum L.(durum group), was released in 1975 by the California Agric. Exp. Stn. Modoc originated from the cross UC 69494/'Leeds', made at Davis in 1969. The yield, agronomic traits, disease resistance and grain quality of Modoc are described.

558. PURSS,T. 1977
Durum wheat breeding.
Agic.Gaz.N.S.Wales (Australia), 88:1[illegible]-15.

Durum wheat breeding program at Tamworth is outlined with reference to grain yield, pasta quality and resistance to Puccinia recondita, P. graminis and Alternaria.

559. PUZYREVA,V.A. 1980
Triticum persicum initial material for breeding durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 8:195.

Hybrids of T. durum with T. persicum had a high grain yield per ear and large grains. Populations from a cross between T. persicum and the durum wheat Khar'kov 46 had the highest yield.

560. QUICK,J.S. 1973
Breeding for yield, quality and disease resistance in durum wheat at North Dakota State University.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 313-323.

The breeding program primarily utilizes an accelerated pedigree method. Greenhouse and winter nurseries at southern locations are combined with selection and testing in North Dakota to allow variety release in 8 to 10 years. This method has produced through variety releases during the past 10 years a 15% increase, 3 days earlier maturity, 5 cm height reduction, 30% increase in kernel size, 3% increase in spaghetti color and high levels of resistance to leaf spotting diseases, leaf rust, and stem rust. Major varieties in North Dakota are Leeds and Wells. New varieties released since 1971 are Rolette and Ward. Efforts are being made to develop semidwarf, photoperiod insensitive varieties.

561. QUICK,J.S. 1979
Durum wheat improvement.
Macaroni J.(USA), 61:6-10.

A new durum cultivar called Vic has shown excellent grain yield and general agronomic performance. Considerable progress has also been made in the transfer of strong gluten to advanced experimental durums. A high positive correlation has been obtained between yellow reflectance score and pigment content; consequently, semolina color evaluation and inheritance was successfully conducted. The semidwarf were found to be particularly poor in seedling vigor. Large breeding nurseries were grown, and a crossing program and generation advance was completed in the greenhouse. Marked progress has been made in yield improvement and disease resistance in semidwarf durum. Improvements in plant type, straw strength, and earliness have also been accomplished.

562. QUICK,J.S. 1981
Durum improvement update.
Macaroni J.(USA), 62:4-10.

Varieties tested in 1979-1980 at North Dakota State University were evaluated for yield, specific gravity, grain weight, heading date, height and lodging. The sedimentation test with SDS has been applied successfully in a quality evaluation program which also includes semolina colour measurement. Appropriate selection methods starting with the F2, screen for semolina yellow colour and strong gluten. Sprouting resistance, seed vigor, and grain yield are the objectives of future research.

563. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1979
Calvin...an improved semidwarf durum.
North Dakota Farm Res.(USA), 36:19-23.

The breeding grain yield, disease resistance, and milling and spaghetti quality of Calvin, an improved semidwarf

durum wheat cv. developed in North Dakota, are described. Calvin had a high yield capability similar to that of cv. Cando and had a higher test wt., grain wt. and grain size.

564. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1980
Registration of Calvin durum wheat (Reg.No.636).
Crop Sci. (USA), 20:826.

'Calvin' was selected from the cross Leeds X D65152 and combines short straw with good milling and spaghetti characteristics.

565. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1980
Registration of Edmore durum wheat (Reg.No.637).
Crop Sci. (USA), 20:827.

'Edmore' was selected from the cross D6530 X D65114. It is a day-length sensitive, medium-height plant, with high grain yield, strong gluten, resistance to Puccinia graminis and Helminthosporium sativum and good milling and processing quality.

566. QUICK,J.S., DONNELLY,B.J. and MILLER,J.D. 1980
Registration of Vic durum wheat (Reg.No.638).
Crop Sci. (USA), 20:827.

'Vic' selected from the cross Edmore X Ward, is day-length sensitive, of medium height and combines the strong gluten and resistance to Helminthosporium sativum of Edmore with the high yield, wide adaption and strong straw of Ward.

567. QUICK,J.S., MILLER,J.D. and DONNELLY,B.J. 1976
Cando...North Dakota's first semidwarf durum.
North Dakota Farm Res.(USA), 33:15-18.

568. QUINONES,M.A. 1974
Durum wheat yield per unit area, stability, climatic adaptation and fit to cropping rotations.
Italia Agricola (Italy), 112:80-85.

The effort of CIMMYT's durum wheat breeding program to develop widely adapted, high yielding, disease resistant varieties with acceptable quality are described.

569. QUINONES,M.A., VARUGHESE,G. and AMAYA,A.A. 1973
Breeding for yield, yield stability, disease resistance and quality in CIMMYT durum program. (Abstract)
Proc.Syp.Genet.Breed.D.W.Bari (Italy), 311.

570. RAM,H., AHMED,Z., KATIYAR,R.P. and RAM,L. 1977
Diallel cross analysis for combining ability in macaroni wheat (Triticum durum Desf.). In genetics and wheat improvement. 7th durum and triticales, ed. A.K.Gupta.
Oxford and IBH Publishing Co. (India), 211-217.

In a study of the F2 and F3 from a diallel cross involving twelve lines, estimates of general and specific combining-ability variances were highly significant for all the traits studied except specific combining ability for ear-bearing tillers and grain weight per spike. Jori C69, MP0156 and MACS42 showed good general combining ability (GCA) for yield and its components. Selection of cross combinations on the basis of performance rather than estimates of combining ability is advocated.

571. RASULOV,D.K. 1980
Initial material for breeding durum wheat under irrigation in the south of the Uzbek SSR. (Ru)
Genetike i Selektsii (USSR), 68:49-53.

During 1977-79, 645 varieties were studied in the Kashkadar'ya province of Uzbekistan. The earliest were VZ178, VZ-B, Harai Djebeli, RD3-2, CB8020, UCMP 13 and Cocorit 71. Resistance to Puccinia recondita and P. striiformis was shown by VA185, Malaini 17, CBB004, 4B231. Leeds, 451, 461 and kara kilcik [Black-awned]. Lists are also given of varieties resistant to heat and drought, varieties with a high content of protein and lysine, and varieties combining high yield with lodging resistance.

572. ROBERTSON,D.M., WAINES,J.G. and GILL,B.S. 1979
Genetic variability for seedling root numbers in wild and domesticated wheats.
Crop Sci. (USA), 19:843-847.

Genetic variability for seedling root number within the genus Triticum was

characterized to determine if this trait could be used in wheat breeding. Average seedling root numbers were determined in the laboratory for 143 accessions of wheat. Significantly different mean numbers were found within each ploidy level and, in most cases, within each species or variety. The highest mean root number, 6.45, was found in an accession of T. turgidum of T. turgidum var. durum, the lowest, 2.50, in accession of T. araraticum. Seed weight was positively correlated with mean root number (r = 0.71) but within each ploidy level accessions having similar seed weights and significantly different mean root numbers were found. Progeny tests of 15 diploid and seven tetraploid accessions showed that seedling root number was stable from one generation to the next.

573. RUDENKO,M.I. and ARTAMOV,V.D. 1978
Prospects and results of breeding durum wheat for irrigated agriculture. (Ru)
Kuibysh.kniz.Izadet'stvo. (USSR), 57-64.

This outline of breeding work in the Volga area, lists useful breeding material with good macaroni qualities, viz Bezenchuk 105, Bezostava 54 and Plastovaya 13 and with resistance to Ustilago nuda, viz, Hordeiform V238, Raketa, Luce 206, Lakota, Wells and Candsal 19. Promising hybrids include Wells X Bezenchuk 105, Lakota X Berenchuk 115 and USMP13 X Melanopus 611-37/3.

574. RUDENKO,M.I., YARINA,G.N. and MEL'NIKOV,A.F. 1977
Breeding value of durum wheat varieties under different conditions of cultivation in the Volga area. (Ru)
Byull.Vses.L.Inst.Rast.N.I.Vavilova.USSR 38-12.

Seventy Soviet and foreign varieties were evaluated during 1971-73 in Kuibshev province. The earliest were Picture, Hercules, Leeds and Pabellon 67, the last three of these combine lodging resistance with good yield. Drought resistance was shown by Melanopus 26, Melanopus 69, Kustanai 14, Bezenchuk 116, Kara Kilcik CB8004, Lakota and Well. The best for macaroni production were Khar'kov 46, Bezenchuk 105, Kustanai 14, CB8004, Wells, Tehuacan 60 and Dural.

575. S"BEVA,Z. 1981
Crossability of hexaploid and octaploid forms of triticale and secalotricum with Triticum durum Desf. (Bg)
Genetika i Selektsiya (Bulgaria), 14:81-88.

The cross compatibility of 56 durum varieties with 35 8x and 42 6x wheat-rye amphidiploids, was poor. Grain set was better when wheat was the maternal parent, but the hybrid grain had low viability. Octoploids gave a higher grain set as seed parents than hexaploids but grain viability was higher when hexaploids were used. Grain set was higher in primary than secondary amphidiploid seed parents, but the reverse was true of grain viability. Rye cytoplasm in forms of secalotricum used as seed parents had no negative effect on grain set but led to reduced grain viability. Crossability in hybrids of the amphidiploid (2n = 56) x T. durum type was improved by treating the ears before pollination with 0.01% vitamin B complex.

576. SALTYKOVA,N.N. 1977
Intraspecific hybrids of durum winter wheat. (Ru)
Sel'sk-khoz.Biol.(USSR), 12:25-28.

Intraspecific hybridization of durum winter wheats gives better combinations of commercially valuable characteristics and properties than interspecific hybridization does. Winter hardiness of intraspecific hybrids increases less than in separate combinations of interspecific crosses. Yielding ability proved to be higher in intraspecific crosses. The growing period of intraspecific hybrids is shorter by 1-13 days.

577. SARAVIA,G. 1979
Evaluation of flour wheat lines,hard wheat lines and triticale lines. (Es)
Boletin Tecnico Informativo (Bolivia), 15.

578. SAVITSKAIA,V.A. 1977
Establishment of an ideal intensive variety of durum wheat for the eastern regions of the country. (Ru)
Selekts.Semenov. (USSR), 8-13.

A study was made of 197 high-yielding lines derived from 13 F5 hybrids (including interspecific forms) in order

to establish a model for varieties suitable for cultivation under irrigation in Siberia. The best lines selected from the F2 of these crosses of the best tall lines from Chile and Mexico were tested under Siberian conditions. Midseason and midlate forms with long or moderately long straw (80-90 cm) gave the best results in Siberia. It is concluded that ideal variety for Siberia has not less than 40 grains per ear, a 1000-grain weight of 45-50 g, an ear length of 7-8 cm and 20-25 spikelets per ear.

579. SAVITSKAYA,V.A. 1978
Breeding intensive varieties of durum wheat under irrigation in western Siberia and methods of accelerating it. (Ru)
Kuibysh.kniz.izadet'stvo (USSR), 68-73.

In order to develop a lodging-resistant variety suitable for intensive cultivation under irrigation, the best lines of the Siberian Agricultural Institute were crossed with short-strawed forms in single and 3-way crosses. The variety Intensivnaya was bred from Hordeiforme 5900 X K45402 and has been submitted for varietal trials. It has yielded 35.6 c/ha under irrigation.

580. SAVITSKAYA,V.A. 1979
Results and methods of breeding durum wheat in the eastern regions of the country. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 1:204.

Descriptions of several varieties grown in Siberia are given. Optimum parameters were determined for lengths of the stem, ear and uppermost internode, number of grains per ear and 1000-grain weight of durum wheat for intensive production.

581. SAVITSKAYA,V.A. and GABITOV,N.M. 1976
The problem of durum wheat in western Siberia. (Ru)
Selekts.Semenov. (USSR), 12-14.

582. SAVITSKAYA,V.A. and LETOVA,G.M. 1978
Features of breeding durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 7:259.

Complex interspecific hybridization proved particularly effective in Soviet breeding work with durum wheat. The breeding process was accelerated by raising hybrid grain during the winter in the greenhouse, sowing in the field and selecting in the hybrid population from F2 onwards.

583. SAVITSKAYA,V.A. and LETOVA,G.M. 1978
Model for optimum straw length in intensive durum wheat varieties in Siberia. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 4:207.

160 hybrid lines from five crosses were studied under irrigated and nonirrigated conditions. It is concluded that under Siberian conditions, optimum straw length is 80-90 cm without irrigation and 70-85 cm with irrigation. The highest yielding were plants with a straw length of 80-90 cm.

584. SAVITSKAYA,V.A. and LETOVA,G.M. 1980
Some results of work on breeding durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:224.

Different types of cross were used: single crosses within the species, more complex intraspecific hybridization and complex interspecific hybridization. Complex interspecific crosses between ecologically distant forms gave the best material for the selection of lines showing transgressive segregation. The varieties Almaz and Leucurum 54 were obtained. An ideotype of durum wheat is examined.

585. SAVITSKAYA,V.A., LETOVA,G.M. and SEMENOVA,M.V. 1979
Characteristics of hybridization in short-strawed forms of durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 3:167.

The main method of producing intensive varieties with strong, short, nonlodging straw is to cross local lines or varieties with short-strawed forms. Short-strawed forms from Chile, Mexico and Canada have longer flowering glumes and shorter anthers and stamen filaments than long-strawed forms. When short-strawed forms were used as

pollinators, grain set was considerably lower than when long-strawed forms were used, regardless of the method of pollination; trimming the glumes, lemma and palea of the short-strawed forms down to the level of the anthers and twirling the ear proved the most effective method of pollination.

586. SAVITSKAYA,V.A. and SINITSYN,S.S. 1977
Grain quality and yield in a collection of durum wheat in interspecific hybrids in western Siberia. (Ru)
Prob.Povysh.Kach.Zerna.(USSR), 115-125.

Forms with a high protein and gluten content and a fairly good yield were selected for the forest-steppe zone of western Siberia. Interspecific hybridization resulted in lines with good yield and grain quality.

587. SHARMA,T.R. and GANDHI,S.M. 1977
Variation and interrelationships among yield and various agronomical characters in common wheats.
Z.Pflanzenzuechtung (F.R.G), 39:40-46.

1236 lines of Triticum aestivum L. and 209 lines of T. durum Desf., originating from different agro-climatic regions, were evaluated for grain yield, yield components and other agronomical characters. A considerable amount of variability was noticed for all the characters in aestivum as well as durum wheats. Plant yield in aestivum was significantly and positively associated with number of tillers per plant, thousand kernel weight, number of grains per ear and the weight of grains per ear while thousand kernel weight, number of grains per ear and weight of grains per ear were found to be the major yield attributing characters in durum. Number of spikelets per spike was shown to be negatively correlated with grain yield in both species.

588. SHCHERBAKOVA,A.I. 1981
Selection of initial material for producing winter durum wheat varieties of the intensive type under irrigation. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 61-63.

980 Lines were studied under irrigation and 690 under rainfed conditions in the Povolzh'e (Volga Lands) area of USSR. The best varieties for a combination of characters included Stewart 63, 01275, Wells, Avetoro, Adrini, Gerardo 565, Anafil Claro 4314 and 458.

589. SHEVCHUK,N.S. and KORCHINSKII,A.A. 1980
Yield in winter durum wheat hybrids in relation to heterosis. (Ru)
Selekts.Semenov. (USSR), 45:17-20.

590. SHULYNDIN,A.F. and SHEVCHENKO,N.S. 1977
The breeding of winter durum wheat for short straw. (Ru)
Selekts.Semenov. (USSR), 16-19.

In crosses of dwarf wheats with tall forms, tallness was dominant in the F1. In F2, segregation was in the ratio 1 : 20. In the F4, stable dwarf forms were selected with a high yield, a height of 69-98 cm, and a 1000-grain weight of 44.5g.

591. SHULYNDIN,A.F., SHEVCHENKO,N.S. and KRASYUK,L.I. 1980
Variation in plants of winter durum wheat grown in typical conditions. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:95.

Wide plant variation was found over four generations when plants of varieties bred in Khar'kov in the Ukraine were sown in spring in the field and in controlled environment chambers to select typically spring forms. Some new botanical varieties were identified. Winter hardy forms did not head when sown in spring.

592. SHULYNDIN,A.F. and SHEVCHUK,N.S. 1979
Crossability of winter durum wheat and viability of the grain and plants after distant hybridization. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:40.

On average, the cross Triticum durum X T. aestivum set 67.3% grains and the reciprocal set 46.1%. The F0 grains were larger when the maternal form was durum wheat, but the viability and survival rate of the F1 hybrids was half as great as in the reciprocal crosses. Grain set in crosses of the dwarf form Lutescens 669 with durum wheat varieties was 15.2-18.6%. Pollination of this

variety with pollen from intraspecific F1 and F2 hybrids increased grain set by 2-3 times. Inviable grains were formed in triticale X durum wheat crosses.

593. SILVA,A.C.da., BRUNETTA,D. and NASSER,L.C.B. 1976
Work with international collections of wheat, triticale, and Triticum durum in Grossa UEPAE 1976.[Brazil]. (Pt)
Ponta Grossa,PR (Brazil), 13-16.

594. SINGH,S.P., ASAWA,B.M. and NEELAM SINGH. 1981
Genetic analysis in Triticum durum Desf.
JNKVV Res.J. (India), 13:18-20.

Sixteen varieties were studied for growth period, grain yield per plant and four yield components using path analysis. A selection index based on the number of tillers per plant, the number of grains per ear and 1000-grain weight would be more efficient than selection for yield alone.

595. SINGH,S.P., SHEOPURIA,R.R., RASTOGI,V.K. and HIRVE,C.D. 1980
Registration of Tawa 215 wheat.
JNKVV Res.J. (India), 14:112.

Tawa 215, a hard, spring variety of Triticum durum, is an F2 selection from CIMMYT material. It is semidwarf, of medium maturity and gives flour of good quality for chapatis and macaroni. It is resistant to 14 races of Puccinia graminis, seven of P. recondita and six of P. striiformis.

596. SINGH,S.P., TIWARI,V.N., MISHRA,Y. and TAWAR,J.N. 1982
Analysis of combining ability in durum wheat.
Indian J.Agric.Sci. (India), 52:359-364.

When six yield characters were studied in crosses of nine varieties, general combining ability effects were significant for all characters except 100-seed weight and specific combining ability effects were significant for all characters except grains/spike.

597. SINITSYN,S.S. and SEMENOVA,M.V. 1982
Combining ability of durum wheat varieties. (Ru)
Selekts.Semenov.(USSR), 6-8.

The combining ability of 13 varieties (ten of Triticum durum, two of T. dicoccum and one of T. turgidum) was determined by crossing them as maternal parents with three T. durum testerr. The durum wheats Zeramek, Rubis, K45402 and Hordeiforme 5900 showed high general combining ability (GCA) for yield, while Zeramek, K46509, K47117 and T. dicoccum cv. K13895 showed high GCA for protein content in the grain. Leeds, K46490, Lakota and Hordeiforme 4220 showed high GCA for grain weight/unit volume. An analysis of specific combining ability constants in conjunction with GCA values indicated that the most promising crosses were Leucurum 54 X Almaz, Zeramek X ALmaz and Zeramek X K47117.

598. SNOY,M.L. 1973
Seed grading and seed quality of T. durum growth in the south west of Germany.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 587-589.

Several grain characteristics were tested for 100 durum varieties, and the results are discussed. The influence of the climatic conditions in the south west of Germany with regard to the experimental results are discussed as well. The climatic diagrams for some (classical) areas, where T. durum is grown, are compared with those of Hohenheim.

599. SNOY,M.L. 1976
When may durum wheat become promising ? Evaluation of its suitability for production in south west Germany. (De)
DLG-Mitteilungen. (F.R.G), 91:684-686.

600. SPAGNOLETTI,Z.P.L., PORCEDDU,E. and VOLPE,N. 1977
Variability for agronomic characters in durum wheat from Sicily. In workshop on breeding methodologies in durum wheat and triticale, Viterbo, Italy.
FAO-European Network on Durum (Italy), 73-88.

601. SRIVASTAVA,J.P. 1975
Performance of durum varieties in the regional nurseries.
Proc.3rd Reg.Wheat Workshop,Tunisia, 117-127.

In the early 1960s' many varieties developed in Italy were tested in the region. Capeiti 8 showed good

performance in many countries. Castel Del Monto, GAB125 and Creso produced by nuclear radiation are also high yielding varieties in the region. Since the end of the 1960s', durum germplasm coming from CIMMYT has been spread in the region from CIMMYT and regional nurseries (ALAD-CIMMYT-FAO). The national programs have identified varieties/lines coming from CIMMYT and having high yield potential and good adaptation.

602. SRIVASTAVA,J.P. 1982
ICARDA's Cereal Improvement Program.
RACHIS (ICARDA,Aleppo,Syria), 8.

603. STEFANI,A., MELETTI,P. and ONNIS,A. 1983
New data on the experimental intergeneric hybrid Triticum durum Desf. X Haynaldia villosa Schur.
Z.Pflanzenzuchtung (F.R.G), 90:236-242.

Four hybrids between T. durum 'Cappelli' (n = 14) and H. villosa (n = 7) were obtained on different occasions. Three gave single F2 grains through spontaneous duplication of the chromosome number from 21 to 42, and one of these has reached the ninth generation. Morphological characteristics, meiotic behaviour and pollen and floret fertilities of the F1 and F2 hybrids are described.

604. SUKHANBERDINA,L.KH. 1981
Study of a collection of durum wheat in Turgai province. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 63-64.

In all, 640 lines were studied during 1978-79 in this province of Kazakhstan. The best for earlines, height and yield are listed. Hebda 2k, IVA8893, Candeal 18, 429, Leucurum 5383, Hordeiforme 1067, Pererod, Plastovaya 13, Plastovaya 2 and Liniya 27-62 were among the best for a combination of characters.

605. TAIRA,T. and LARTER,E.N. 1977
The effects of variation in ambient temperature alone and in combination with Sigma-amino-acid-n- Caproic acid on development of embryos from wheat-rye crosses.
Can.J.Bot. (Canada), 55:2335-2337.

A study was made on the effect of various temperature regimes on the in vivo development of hybrid embryos from crosses between tetraploid wheat (T. turgidum L.var durum cv. Jori) and an inbred rye (Secale cereale L.). A day-night temperature of 17 centigrade was found to be optimum for development of embryos as classified on the basis of their morphological features and their level of totipotency in vitro. The application of e-amino-n-caproic acid (EACA) to the female parent (tetraploid wheat) daily for a 10-day period during embryogenesis significantly improved, embryo development but not independently of temperature regime. Both temperature and EACA effects were manifested by increased growth and differentiation of the hybrid embryo; endosperm development was unaffected by treatment.

606. TERNOVSKAYA,T.K. 1982
Study of the combining ability of tetraploid AA BB components of durum wheat for some economically useful characters. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:220.

None of the tetraploids with genomes AABB derived from bread wheat exceeded durum wheat in general combining ability (GCA) for yield components. The most promising of the tetraploid components were tetra-Rescuse with respect to GCA for ear length, number of spikelets/ear and grain weight/plant and tetra-Thatcher in terms of GCA for number of grains/ear. The following crosses of the tetraploid components of bread wheat with durum wheats showed good specific combining ability: tetra-Saratovskava 29 X Chernokoloska [Black-eared] for number of spikelets/ear, number of grains/ear and grain weight/plant tetra-Thatcher X Melanopus 7 for number of grains/ear and grain weight/plant tetra-Thatcher X Chernokoloska for number of spikelets/ear; and tetra-Rescuse X M59H132 for ear length.

607. TIMARIU,A. 1982
Results of genetic and breeding studies on spring wheat. (Ro)
Red.Propag.Tehn.Agr.(Romania), 65-104.

Breeding work carried out at Turda during 1968-81 on bread wheat and durum wheat is described. The programme resulted in the release of Rubin in 1973

and of durum in 1976. Studies carried out in this period on the stability of quantitative characters in durum wheat are reported.

608. TIMARIU,A. and MOLDOVEANU,G. 1982
Phenotype of quantitative characters in spring durum wheat in the ecological conditions of Transylvania. (Ro)
Red.Propag.Tehn.Agr.(Romania), 105-117.

The contributions of genotype, environment and genotype environment interactions were estimated for grain yield and the main components of quality, using four genotypes at five sites. Environmental effects were strong for grain yield, vitreousness and milling yield, and less strong for net protein content and wet and dry gluten contents. Carotene pigments were little influenced by environment, with a genetic variance of 89.7%. Gluten deformation and elasticity had high phenotypic stability, with a strong genotype environment interaction.

609. TIMARIU,A. and MOLDOVEANU,G. 1983
The variability of agronomic and technical characters in wheat grown in Transylvania. (Ro)
Prod.Veg.Cereale.Plante Tehn. (Romania), 35:19-26.

Properties of the grain of four durum wheat varieties, grown at five sites in three successive years, were compared with regard to grain yield, the percentage of vitreous grains, semolina yield and protein and wet gluten contents. The influence of the environment was much greater than that of the genotype. The genotype was the most important influence on carotene content, while gluten deformation was determined mainly by interactions between genotype and environment. The three influences were about equal in their effects on inhibition and the rheological properties of the dough.

610. TSVETKOV,S. 1977
On the botanic diversity in hybridization between Triticum aestivum L. and T. durum Desf.
Plant Sci. (USA), 14:3-12.

Investigations were done on the botanic diversity which was obtained in F2 and F3 in crosses between T. aestivum L. and T. durum Desf. Following the segregation in F2, in the T. aestivum L. group 14 new and in T. durum Desf. group 21 new diversities were established. Largest number of diversities in the two wheat sp. were found in the reciprocal crossing of Bezostaya 1 with No 233-11 durum wheat. The segregation of T. aestivum L. and T. durum Desf. in F3 took place within the limits of each species. At that, the diversity of the individual forms was very close to that ascertained in F2. The studies on the botanic diversity in hybridization between T. aestivum L. and T. durum Desf. allowed the development of new winter soft wheat lines with a solid stem, resistant to Cephus pygmaeus L. These lines were also highly resistant to black rust and had excellent technological qualities of flour.

611. UHAN,L. 1981
Comparative descriptions of Austrian and other varieties of durum wheat. (T. durum Desf.) using polar diagrams. (De)
Bodenkultur (Austria), 32:326-335.

Five Algerian and two Austrian varieties studied over three years showed significant differences among the varieties for all 13 characters studied. The year X variety interaction was significant for ear length and 1000-grain weight. Graphical representation of the data facilitated selection of material for a hybridization programme.

612. V"LCHANOV,P. and ZHELEV,Zh.G. 1976
A study on the spring and winter habit of introduced and Bulgarian durum wheat varieties and lines.
Gent.Plant Breed.(Bulgaria), 9:143-145.

613. V'YUSHKOV,A.A. and ARTAMONOVA,V.D. 1980
Results of breeding spring durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:225.

The results are presented of Soviet work on breeding durum wheats under arid conditions since 1913 and under irrigated conditions since 1935. The varieties Hordeiforme 675, Leucurum 33, Bezenchuk 102 and Bezenchuk 105 have been approved for dry-farming conditions in various years. Particular attention is paid to the production of

drought-resistant varieties and also to the production of varieties of the intensive and semiintensive types with high resistance to lodging and good response to irrigation and fertilizers. In later years, the promising varieties Bezenchuk 141, Leucurum 163 and Hordeiforme 395 were produced. Several lines exceeded the standard in yield and other traits. The new durum wheat Bezenchuk 139 gives high yields and is suitable for cultivation on both irrigated and arid soils of the Volga region.

614. VALLEGA,J., BIANCOLATTE,E., MARIANI,M. and ZITELLI,G. 1983
Correlations and linkages observed in lines derived from crosses with the durum wheat variety "Trinakria".
Genetica Agraria (Italy), 37:220.

In lines from crosses of Trinakria with Valgerardo, Valfiora and Cappelli, earliness, protein content and 1000-grain weight were closely associated with morphological characters which could be readily assessed in the field. Particularly, protein content and 1000-grain weight were associated with waxiness.

615. VALLEGA,V. 1977
Triticum monococcum in wheat breeding (durum wheat).
Sementi Elette. (Italy), 23:3-8.

616. VALLEGA,V. 1979
Field performance of varieties of T. monococcum T. durum and Hordeum vulgare grown at two locations.
Genet.Agr. (Italy), 33:3[illegible] 70.

Nine randomly chosen accessions of T.monococcum, four durum wheats, and one barley variety were tested at two sites in Italy with regards to yield and other agronomic and qualitative characters. Yield and protein content of diploid wheats grown at Catania were equal and sometimes greater than those of commercial T.durum and H.vulgare varieties. The results obtained at Rome seem to confirm the relative failure of T.monococcum to profit from improved soil and climatic conditions.

617. VARUGHESE,G. 1974
Potential and prospects of dwarf durums. In wheat, triticale and barley seminar. 1973, El Batan, Mexico.
CIMMYT. (Mexico), 122-124.

Discusses the achievements made so far and the continuing needs in breeding for high yielding, stable, well adapted durum wheat varieties with good quality.

618. VERMA,P.K. 1982
Estimation of genetic parameters for certain quantitative trials including some quality characters in durum wheat.
Thesis Abstr,Haryana Agric.Univ.India., 8:63-64.

Analysis of an 8 X 8 half-diallel cross indicated great variation for the 12 characters studied. General and specific combining ability effects were highly significant for all characters. Nonadditive gene effects predominated over additive for all characters. Narrow-sense heritability estimates were high for spikelets/spike, 1000-grain weight, plant height, protein content and gluten content and moderate for harvest index, spikes/plant, grains/spike, lysine content and ash content. Best general combiners and crosses for different characters are given.

619. WAGNER,K. and MAIER,G. 1982
Identification of wheat varieties by polyacrylamid gel electrophoresis. The Australian collection of bread and durum wheat varieties. (De)
Bodenkultur (Austria), 33:322-332.

By electrophoresis of gliadin extracts 44 winter and spring bread wheat varieties and 9 durum varieties and lines were classified into variety groups. Varieties with an identical banding pattern could be distinguished by electrophoresis of reduced glutenin subunits.

620. WALTHER,F. 1978
Breeding problems in winter durum wheat (T. durum Desf.).
Z.Pflanzenzuchtung (F.R.G), 80:11-23.

One hundred lines from collections in the USA, the German Democratic Republic, Turkey, Mexico and Pakistan were studied for their suitability for cultivation in the German Federal Republic. Data are presented on the lines which were most promising for each of the following traits: winter hardiness, tested near

Helmsled in Bavaria and in Juelich; heading, flowering and maturity; lodging, diseases and sprouting resistance; yield components; and seed quality.

621. WALTL,K. and HAENSEL,H. 1980
Development of durum wheat (T . durum) breeding and quality in Austria. (De)
Getreide, Mehl Und Brot (F.R.G), 34:253-256.

622. YANCHENKO,V.I. 1981
Aspects of the formative process in T . durum Desf. X T . dicoccum (Schrank) Schuebl hybrids. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 48-50.

The durum wheats Altaika and leucurum 136 were crossed with five forms of T. dicoccum. The F2 and BC1 plants fell into four groups for ear shape: dicoccum type, durum type, intermediate and club shaped. A study of the F2 and backcross generation from crosses of the club-shaped types with their parents indicated that T. dicoccum carries an epistatic gene inhibiting the expression of club-shaped ear. The occurrence of some plants of the persicoid type among segregates of Altaika X K12134 and Leucurum 136 X K18774 is thought to indicate the possibility that T. persicum originated from a cross between T. dicoccum and T. durum.

623. YARINA,G.N. and UDACHIN,R.A. 1979
Initial material for breeding durum wheat under irrigation. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 25-32.

During 1970-71 167 varieties were evaluated in the Tashkent province of Uzbekistan. Lists are given of varieties with high 1000-grain weight and with good values for vitreousness. Brief descriptions are given of 24 varieties with macaroni-making qualities.

624. YASHAGASHVIL,Sh. and BEKOSHVILI,N. 1978
Inheritance of economically useful characters following hybridization of the Georgian local durum heat variety Coerulescens 19/28 with foreign varieties. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:118.

When the Georgian variety was crossed with short-strawed durum wheats from Italy, India, Albania and Chile, the F3 hybrids obtained were short (91.8-102 cm). Useful material was selected for breeding lodging-resistant varieties of the intensive type.

625. ZANGARA,L. and SONNINO,A. 1977
Development of bread and durum wheat varieties from 1972-1975. In Italy.
Sementi Elette (Italy), 23:3-15.

The development of bread and durum wheat varieties in Italy during the period from 1972 to 1975 was examined. Only about a third of the wheat sowings are carried out with certified seed. Varieties, if not clearly superior, cannot induce growers to abandon the old ones.

626. ZHELEV,Zh.G. 1980
Promising lines of durum wheat obtained by means of interspecific hybridization. (Bg)
Rasteniev"dni Nauki.(Bulgaria), 17:30-34.

Of 11 crosses between bread wheat and durum wheat, the most promising were Bezostaya 1 X 1131 and Mexipak X 233. One line derived from the latter cross and five lines derived from the former are described. All the lines are short (65-90 cm) and lodging resistant.

627. ZILLMAN,R.R. and BUSHUK,W. 1979
Wheat cultivar identification by gliadin electrophoregrams.2: Effects of environmental and experimental factors on the gliadin electrophoregram.
Can.J.Plant Sci. (Canada), 59:281-286.

Gliadin electrophoregrams of grain of 5 Canadian wheat cv. grown at 10 locations and of 5 Australian cv. grown in Canada and Australia showed that the electrophoregram was not affected by the area in which the crop was grown. In 3 hard red spring wheats, 1 soft white winter wheat and 1 durum wheat, inefficient extraction of the gliadin protein produced qualitative deviations in the electrophoregram, but variations in grain sample preparation and staining did not. It is concluded that the electrophoregram is a true genotypic character that can be used to identify the cv.

628. ZILLMAN,R.R. and BUSHUK,W. 1979
Wheat cultivar identification by gliadin electrophpregrams.3: Catalogue of electrophoregram formulas of Canadian wheat cultivars.
Can.J.Plant Sci. (Canada), 59:287-298.

The gliadin electrophoregram formulae were determined and catalogued for 88 common and durum wheat cv. The relative band mobilities, used to derive the formula, were calculated from actual band mobilities from a photographic negative of a stained gel using a microcomparator. Band mobility was essentially constant across any 1 gel and reproducible to within plus or minus 0.5 relative mobility unit from 1 gel to another. A subjective quantification of band intensities is described. The use of the electrophoretic test and the catalogue of cv. formulae for identifying unknown grain samples is discussed.

629. ZITELLI,G. 1979
Breeding hard wheat. (It)
Agric.Ricerca.(Italy), 2:12-22.

630. ZITELLI,G. 1980
Yield stability: A problem of durum wheat in Italy.
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 6.

Varietal characteristics needed for yield stability and broad adaptation are discussed. New durum semidwarf varieties like Creso, Valgerardo, Valnova etc. have demonstrated their good adaptability to ecological conditions of central Italy and even south Italy and of Isles. In 100 trials, carried out during six years in different locations, the above cited varieties have outyielded Capeiti and Appulo. In these areas Valnova was the best.

Adaptation

631. BHULLAR,G.S., RANVIR SINGH. and GILL,K.S. 1983
Stability analysis in durum.
Indian J.Genet.Plant Breed.(India), 43:246-251.

632. BRANDO,A., CIOCCA,L., NINNO,M.De., LI DESTRI,O. and WITTMER,G. 1980
Adaptability of new durum wheat (T . durum) varieties in interior areas of Campania region (Italy). (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 11:141.

633. BUYUKLI,P.I. 1981
Study of the adaptive characteristics of short-strawed forms of winter durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 11:168.

Over 200 dwarf durum lines obtained by crossing the Mexican spring variety Oviachik 65 with Soviet tall winter varieties, were studied during 1978-80. Those with dominant genes controlling red or black ear, black awns and red grain were better adapted to local conditions than those with the corresponding recessive alleles (white ear, white awns and yellow-white grain). Many of the short forms had high winter hardiness, profuse tillering and early stem extention (beginning of May).

634. CHANG,W.L., HUANG,H.Y., ABDUL REHMAN AL-H. and ABDUL-AZIZ ZAID. 1976
Adaptability of some bread and durum wheat varieties in eastern Saudi Arabia.
J.Agric.Res.China., 25:53-63.

The local varieties of both durum and bread wheat took longer to heading and to maturity than the improved varieties, and the bread wheats matured faster and were taller than the durum wheats. The durum wheats had heavier ears than of the bread wheats and had the highest grain yield of all varieties. Cocorit 71 had the highest yield of the durum wheats and a higher mean 100 grain weight.

635. CIDRAES,A.G., GUSMAO,L.B. and BAGULHO,F.C. 1976
Studies on adaptation of wheat varieties. (Pt)
Melhoramento (Portugal), 26:25-56.

Trials were carried out during 3 yr in different localities of the durum wheat zone of Portugal to test durum wheat cv. from Portugal, Mexico and Italy. An analysis of the yield of cv. Capeiti, Abegao, Cocorit 71 and Brant S is reported, and the characteristics of these cv. are described. Cocorit 71 (from Mexico) yielded more than Capeiti (from Italy).

636. GAUTAM,P.L. and JAIN,K.B.L. 1979
Analysis of adaptation in durum wheat.
In Proceedings of the fifth international wheat genetics symposium. Feb,23-28, 1978.
Indian Soc.Plant Breed.Genet.(India), 1014-1025.

Seventy populations representing four degrees of genetic diversity and consisting of 21 F2 bulks, 21 F3 bulks, 21 mixtures (M) and 7 homozygous parents (P) were evaluated across six diverse environments. In hybrid bulks, general combining ability (GCA) and specific combining ability (SCA) effects were equally important for grain and biological yields; for harvest index, GCA effects were predominant. In M, general mixing ability effects were of great importance and were associated with GCA effects for all three characters. Regression analyses indicated absence of significant genetic variation among the entries for response to environment; deviations from regression made a major contribution to genotype X environmental interaction for all three characters. Average deviations from regression, however, were smaller for P and M than for the bulks. For stability, as measured by deviations from regression, both GCA and SCA effects were important in hybrid bulks; in M, nonadditive mixing effects were highly pronounced.

637. GILL,K.S., BHULLAR,G.S., VIRK,D.S. and BHATIA,A. 1980
Stability of yield performance in durum wheat.
Crop Improvement (India), 7:109-112.

Of 23 Triticum durum and two T. aestivum varieties grown at five sites in northern India, the durum wheats DWL5002, DWL5001 and Raj 1522 proved the most stable for yield performance.

638. MARIANI,B.M., MANMANA,P.N. and STEFANINI,R. 1983
Efficiency of linear and multi-phase regression methods to evaluate genotype-environment interaction for grain and protein content in Italian durum wheat varieties.
Z.Pflanzenzuchtung (F.R.G), 90:56-67.

Thirteen varieties were evaluated in 85 environments for grain yield and in 69 environments for protein content. The best fit for grain yield was obtained by linear and three-line regression models, for protein content the most efficient was the two-line model. On the basis of these results, the adaptability of the varieties to different environments in central and southern Italy is assessed. Breeding implications are also considered.

639. WITTMER,G., IANNUCCI,A., De SANTIS,G., BALDELLI,G. and De STEFANIS,E. 1982
Adaptation and physiological factors limiting durum wheat yields. (It)
Riv.Agron.(Italy), 16:61-70.

The growth of 4 durum wheat cv. was analysed in field trials in 1978-80 at Foggia. Plant dry wt. was in the order cv. (a) Valgerardo > (b) Trinakria > (C) Capeiti 8 > (d) kid. Leaf area duration (b) > (a) > (c) > (d) before heading and (a) > (b) > (d) > (c) after heading, grain yields (a) > (b) > (d) > (c) and harvest index (a) > (d) > (c) > (b).

Genetics and Cytogenetics

640. AL'DEROV,A.A. and TAVRIN,E.V. 1980
Inheritance of straw length following hybridization of short-strawed forms of durum wheat with other tetraploid species .(Ru)
Genetike i Selektsii (USSR), 67:17-23.

It was established that the initial long-strawed and short-strawed forms crossed differ in 1-2 major genes controlling height and in many modifier genes. The Triticum dicoccum form used carries a gene for dwarfness different from that of durum wheat Quilafen.

641. ALI ZADE,A.V. 1981
The relationship between the mode of inheritance of quantitative characters in F1 and outcome of selectively valuable genotypes in F2 remote hybrid of Triticum durum Desf. (Ru)
Soviet Genet.(USA), 17:712-717.

In hybrids between tall, moderately tall, and short varieties the expression and inheritance of ear length, number of spikelets/ear, grain weight from the main ear, number of grains/plant, grain weight/plant and 1000-grain weight were studied. Dominance predominated in the

control of these characters followed by overdominance leading to heterosis and intermidiate inheritance. Positive transgressive segregation in the F2 generally occurred in which the F1 hybrids were better than the parent or intermediate between the parents in the character in question. High-yielding plants were selected and their F2 progenies were tested. High-yielding lodging-resistant material was selected in this way from progenies of Leeds X T.durum var. hordeiforme (local variety from Azerbaijan), resulting in the production of a new variety, Kyzyl [Red].

642. ALIEV,G.M. 1981
Inheritance of some qualitative characters in F1 hybrids of winter wheat in the Karabakh zone of the Azerbaijan SSR. (Ru)
Soc.Jnl.Source: Referat.Zh. (USSR), 12:152.

Intraspecific hybrids of the Triticum durum varieties with various bread wheats, and also interspecific hybrids, were evaluated for yield components. Overdominance effects and a high degree of heterosis were observed in hybrids involving Sevindz, Dzhafari, Kavkaz, Bol, and Arzu. Dominance of the female parent predominated for number of spikelets/ear, grain weight/ear and ear length.

643. AMAYA,A.A., BUCH,R.H. and LEBSOCK,K.L. 1973
Estimates of genetics of heading date, plant height, and grain yield in durum wheat.
Crop Sci.(USA), 12:478-481.

A weighted least-squares analysis of parental, F1, bulk F2 and F3, BC1 and BC2 means was applied to four Triticum durum crosses. F3 lines from randomly harvested F2 plants from each cross were included in replicated tests in three or four environments. The F1 hybrids exceeded their higher-yielding parents by an average of 25 percent in grain yield. Additive effects predominated in the expression of height and heading date. Epistatic effects were detected in some crosses in individual environments.

644. AYDEM,N. 1981
Heritability of number of days to flowering and of plant height in some durum wheats. (Tr)
Ege Uni.Zirat Fakultesi Dergisi(Turkey), 18:55-61.

A Jinks-Hayman analysis of gene action in the F1, F2 and F3 of a 5 X 5 diallel indicated that narrow-sense heritabilities for heading date were 0.76, 0.87 and 0.86 in the successive generation, but those for height were only 0.43, 0.07 and 0.31.

645. BANGRWA,K.S. 1981
Stability analysis of certain genetic parameters and populations in durum wheat.
Thesis Abstr.(India), 7:339-340.

The F1, F2 and backcross generation of four crosses were studied for 13 characters. There was a significant genotype x environment interaction for all the characters except harvest index and 1000-grain weight. Both additive and nonadditive effects were involved in the control of most of the characters in all the crosses. The F1 from Malvika x Mexicale 75 was stable and had high values for grain yield per plant, height and gluten content. The cross Malvaraj X Mexicale 75, had high heritability estimates together with a high expected genetic advance for grain yield per plant and biological yield per plant.

646. BARONCELLI,S., BUIATTI,M. and MAGNANI,G. 1980
Control of gibberellin action by "semidwarf" genes in durum wheat.
Z.Pflanzenzuchtung (F.R.G), 84:219-225.

GA treatment of the grain stimulated growth of the first seedling leaf in the light in all ten varieties studied except FE3066, Creso and FE3023. GA had no effect in the dark. Chlormequat had an inhibiting effect except in the three varieties mentioned when grown in the light. Chlormequat had no effect on coleoptile growth in the light, while GA stimulated growth only in sensitive material. In the dark, GA inhibited growth in all varieties except FE137 and FE2023, whereas chlormequat was generally ineffective. The effect of particular wavelenghts of light on leaf and coleoptile growth was also studied.

647. BEBYAKIN,V.M. and KUMAKOVA,A.V. 1981
Electrophoretic study of gliadin component in F2 hybrids of T. durum and their parent forms. (Ru)
Cytol.Genet. (USA), 15:39-42.

Eight varieties differing in grain quality were intercrossed and the F2 grain was analysed. Segregation for presence: absence of gliadin bands was generally in a 3:1 ratio, but some cases of 9:7 ratios were found, indicating interaction individually but in blocks.

648. BEBYAKIN,V.M., MARTYNOV,S.P. and PISKUNOVA,G.V. 1983
Analysis of the combining ability of durum wheat varieties with respect to grain quality on the basis of a topcross scheme [T. durum].
Cytol.Genet.(USA), 17:38-41.

In hybrids between four maternal varieties and two testers, vitreousness and protein content were controlled by additive genes. Carotenoid content was conditioned by additive genes and nonadditive interactions (dominance and epistasis). Grain hardiness was determined by genes with epistatic effects and 1000-grain weight by both additive and nonadditive effects. General combining ability effects were highest in Leucurum 1803 for 1000-grain weight and in Leeds for carotenoid content. Of the testers, Khar'kovskaya 46 had the most alleles conditioning additive effects for vitreousness and Cosorit 71 the most conditioning additive effects for grain hardness.

649. BEBYAKIN,V.M. and PISKUNOVA,G.V. 1982
Variability and heritability of quality character in Triticum durum during hybridization.
Soviet.Genet.(USA), 18:1277-1283.

650. BEDETTI,C., BOZZINI,A., POCCHIARI,F., SILANO,V. and VITTOZZI,L. 1973
Biochemical studies on the philogenesis of Alpha amylase protein inhibitors from wheat seed.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 71-76.

Protein inhibitors extracted with water from seeds of Triticum and genetically related species were characterized according to their apparent molecular weights and specificities in inhibiting alfa-amylases from human saliva and Tenebrio molitor L. larvae. No detectable amylase inhibition activity was found in extracts from diploid wheats, whereas in all tetraploid and hexaploid wheats as well as in the Aegilops species tested several amylase inhibitors groups of differnent molecular weights were found. Amylase protein inhibitors from hexaploid wheats were the summation of those from tetraploid wheats plus the ones from Aegilops squarrosa. Amylase inhibitors from Aegilops speltoides largely differred from those extracted from tetraploid wheats as well as from all the amylase inhibitors described in plant seeds up to now. These results confirm that Ae.squarrosa is the D genome to hexaploid wheats. They also suggest that Ae.speltoides is not the donor of the B genome to polyploid wheats, although a not yet identified Aegilops species might be such a donor.

651. BEDMAR,F. 1979
Effect of defoliation on partitioning of assimilates in Triticum durum Desf. (Es)
AR-EERA, Balcarce (Argentina).

652. BENNICCI,A., BARONCELLI,S. and D'AMATO,F. 1979
Cytogenetics of durum wheat plants regenerated in vitro.
(Monografie.Genet.Agr. (Italy), 177-183.

Mesocotyls of five cultivars and five lines were cultured on agar. Amitosis was observed in some nuclei of the calluses and was followed by mitosis. At least 15 out of 16 regenerated plantlets were mosaics with diploid (2n = 28), aneuploid and haploid cells.

653. BIANCHI,A.A. 1974
Genetic improvement of durum wheat for northern Italy: Conte morando bologinini, Lambro and Belfuggito, three recent varieties, bred from wide hybridization and selection. (It)
Ann.Ist.Sper.Cerealicoltura. (Italy), 4:113-122.

654. BIETZ,J.A., COBB,L.A. and WALL,J.S. 1982
Wheat varietal identification and genetic analysis by reverse phase HPLC protein extracted from single kernels.

Cereal Foods World (USA), 27:470.

Chromatograms of durum wheat varieties and aneuploids revealed quantitative and qualitative differences in polypeptide composition that readily differentiated most varieties and helped to locate chromosomal sites that code polypeptides.

655. BLANCO,A., GIARDINELLI,L., PERRINO,P. and PORCEDDU,E. 1980
Identification of dwarf genotypes in a wheat collection from Ethiopia and genetic control of the character.
Plant Breed.Inst.Univ.Bari,Italy., 35-40.

Reports the results of the attempt to identify alternative and additional sources of semi-dwarfing genes in wheat. 600 lines of wheat from Ethiopia were screened for response to gibberellic acid at seedling stage. In addition F2's and parental lines from a diallell cross among one and three for Ga3 response. Only three Ethiopian lines showed clear insensitivity to Ga3. That analysis of F2 families showed that insensitive lines carry the semidwarfism gene Rht.

656. BLANCO,A., GIRDINELLI,L., PERRINO,P. and PORCEDDU,E. 1983
Identification of dwarf genotypes in a wheat collection from Ethiopia and genetic control of the character.
Poc.6th Int.Wheat Genet.Symp.Japan., 35-38.

657. BLANCO,A. and SIMEONE,R. 1978
Producing lines of durum wheat trisomic for chromosomes 1A and 4B. (It)
Ann.Fac.Agr.Univ.Bari,(Italy), 3:547-552.

The trisomics were produced by crossing Triticum aestivum 'Chinese Spring' tetrasomic for 1A (2n = 44) and monosomic 4A tetrasomic 4B (2n = 43) with T. durum 'Cappelli' (2n = 28). F1 plants which had 2n = 28 were back crossed to Cappelli. BC1 plants were studied at metaphase to distinguish the trisomics from those which had an extra chromosome from genome D the former had 80% of PMCs with 1III+13II the latter had 14II+1I.

658. BLANCO,A. and SIMEONE,R. 1982
Genetic control of gibberellic acid insensitivity in semidwarf wheat (T . durum).
Z.Pflanzenzuchtung (F.R.G), 88:185-190.

The results of GA application to the parent varieties used in a 4 X4 diallel, and to their F1, F2 and F3 progenies, indicated that insensitivity was determined by a single partially dominant gene, Ga 11. By trisomic analysis in the F2, the gene was located on chromosome 4A.

659. BLANCO,A., SIMEONE,R. and GIORGI,B. 1982
The primary trisomics of durum wheat (T . durum Desf.)
Genetica Agraria (Italy), 36:161-163.

All 14 possible trisomic lines were developed in Cappelli. Some lines were obtained from plants with desynapsis or chromosome translocations. The method of identification of the extra chromosome is described. In repeated backcrosses of the trisomics to Cappelli the female transmission of the extra chromosome was about 30%, while the male transmission was < 1%. All the trisomic lines are vigorous, fertile and morphologically indistinguishable from the disomics.

660. BLANCO,A., SIMEONE,R. and ORECCHIA,C. 1983
Cytology, morphology and fertility of the amphiploid T . durum Desf. X Haynaldia villosa L. Schur.
Proc.6th Int.Wheat Genet.Symp.Japan., 205-211.

The hexaploid (2n = 42) amphiploid of Triticum durum Desf. (2n = 28, AABB) X Haynaldia villosa (L.) Schur. (2n = 14, VV) was obtained from F1 hybrids in which a low frequency of meiotic non reduction resulted in the production of male and female gametes with unreduced chromosome numbers. Phenotypically the amphiploid plants resemble the maternal parent, but some characters from H.villosa are also present. Cytological examinations of microsporogenesis revealed a high incidence of bivalent formation and the occurrence of univalents at metaphase I. The chromosome numbers in the progeny varied from 2n = 40 to 2n = 44. Data on fertility and agronomic attributes are presented in relation to its potential use in cereal breeding.

661. BLANCO,A., SIMEONE,R., TANZARELLA,O.A. and GRECO,B. 1983
Morphology and chromosome pairing of hybrid between T. durum Desf. and Haynaldia villosa L. Schur.
Theor.Appl.Genet (Italy), 64:333-337.

Hybrid seedlings were obtained from 2.8% of pollinated floret, following population of T.durum 'Cereso' with H. villosa. The F1 plants resembled T. durum more than H.villosa and were almost completely sterile. Some grains were obtained upon selfing or backcrossing to Creso. The hybrids had 2n = 3x =21, ABV, with a mean of 0.26III + 3.30II + 13.62I.

662. BLANCO,A., SIMEONE,R., TANZARELLA,O.A. and GRECO,B. 1983
Cytogenetics of the hybrid of T. durum Desf.X Haynaldia villosa L. Schur. (En,It)
Genetica Agraria (Italy), 37:149.

Intergeneric hybrid between T. durum Desf. (2n = 4n =28, AABB) and Haynaldia villosa (L.) Schur. (2n = 2x = 14, VV) was obtained at a frequency of about 3% of pollinated florets. The hybrid had a somatic complement of 2n = 3x = 21, ABV, with a mean chromosomal relationship of 13.62 univalents, 3.15 rod bivalents. The F1 plants phenotypically resembled the maternal parent more than H. villosa and were sterile; however, some seeds were obtained by backcrossing with durum wheat. The genome homology between T.durum and Haynaldia villosa is discussed.

663. BLANCO,A., TANZARELLA,O.A., CAIRO,F. and SCARASCIA,M.G.T. 1982
Inheritance of plant height in durum wheat, Triticum durum Desf.
Genetica Agraria (Italy), 36:393-406.

The parental, F1, F2 and F3 generations of a 4 X4 diallel involving a tall line (Cappelli) and three semidwarf lines (Creso, Valgerardo and Sansone) revealed the presence of significant additive and dominance variation. Most of the variation was accounted for by a single partially recessive gene for reduced height.

664. CARROZZA,M.L. 1981
Number of sites for ribosomal RNA genes in T. durum in situ hybridization on mitotic, meiotic and polytene nuclei.
Z.Pflanzenzuchtung (F.R.G), 87:300-308.

DNA in nuclei of root tips, PMCs and polytene antipodal cells of Cappelli and FE484, was hybridized in situ with homologous iodinated ribosomal RNA to determine the number of nucleolus organizer regions (NORs). In both varieties, two pairs of NOR chromosomes were identified, namely 1B and 6B. In all but one of the polytene nuclei examined, only one hybridization spot attached to the nucleolus was found.

665. CARROZZA,M.L., GIORGI,L. and CREMONINI,R. 1980
Nuclear DNA content and number of ribosomal RNA genes in cultivars and selected lines of durum wheat.
Z.Pflanzenzuchtung (F.R.G), 84:284-293.

The nuclear DNA content ranged from 16.82 to 31.16 pg per 2C nucleus in 8 durum var. The results of DNA/rRNA hybridization indicated that the number of rRNA genes ranged from 2.3 to 6.6 in the haploid genome.

666. CUBADDA,R. 1973
Chromosomal location of genes controlling the synthesis of some soluble protein in T. durum T. aestivum.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 653-658.

In the context of a research program developed to obtain wheat varieties with higher protein content and better amino-acid composition, a study was undertaken to identify the chromosomes that carry genetic information for the synthesis of the various protein fractions. It was possible to ascertain that of the seven protein fractions one is controlled by a chromosome of the A genome, two are controlled by a chromosome of the B genome and four by a chromosome of the D genome. Such identification was tested also analysing the protein fraction isolated from durum wheat, where the three bands codified by the D genome were absent.

667. DAMIDAUX,R., AUTRAN,J.C., GRIGNAC,P. and FEILLET,P. 1980
Genetic determination of the gliadin constituents of T. durum Desf. are associated with the intrinsic cooking quality of the varieties. (Fr)
C.R.Hebd.Acad.Sci.Ser.D.(France),

291:585-588.

A very consistent relationship was found between the presence of component 42 or 45 in polyacrylamide gel electrophoretic patterns of gliadins and viscoelastic properties of durum wheat gluten. Electrophoretic analysis of gliadins was carried out in F1, F2 seeds of intervarietal type 42 and type 45 durum wheat crosses and in aneuploid lines. 42 and 45 gliadin components segregate in accordance with two codominant alleles of single gene which is likely to be located on 1B chromosome. A better understanding of genetic aspects of gliadin composition should increase the interest of the electrophoretic tool in qualitative breeding of durum wheats.

668. DEPACE,C., OTTAVIANO,E. and PACUCCI,G. 1978
Genetic analysis of yield components in durum. (It)
Genetica Agraria (Italy), 32:125-138.

The main quantitative components of durum wheat yield were analyzed in order to determine the most significant ones. Besides, some characters of kernel quality were also considered, in order to study the possible relationships of them with the yield components. The utilized material consisted of 483 F4, durum wheat lines derived from a series of crosses between genotypes contrasting for most important agronomical characters.

669. DEPACE,C., SPAGNOLETTI,Z.P.L., PORCEDDU,E. and SCARASCIA,M.G.T. 1983
Variation in durum wheat population from different geographical origins. 5. Linkage studies.
Proc.6th Int.Wheat Genet.Symp.(Japan), 253-264.

Five crosses including two Ethiopian lines and three Italian cultivars of Triticum turgidum var. durum, were examined in order to detect the presence, and the type of linkage between loci of quantitative traits. Parental lines and BC1, BC2,F1,F2,F2 X F1, F2 X F2 and F generations were grown for each cross and 12 quantitative characters recorded. Linkage in coupling phase was evidenced for many traits in the Italian cultivars and Ethiopian lines. However repulsion phase linkage was evidenced for the flag leaf characters in the Ethiopian lines. Association analysis between quantitative and qualitative traits indicated as loci for waxiness and glume pubescence are associated to some loci for culm elongation characters. Although the prevalent coupling linkage phase for many traits prevent an increase of genetic variances after intercrossing, one generation of intercrossing is however useful to breakup linkage between characters.

670. DHONUKSHE,B.L. 1982
Gene action for yield and its component characters in durum wheat.
J. Maharashtra Agr, Univ. (India), 7:157-159.

Data are presented on the genetic components of variance of yield and eight yield-related traits in the parental and F1 generations of a 9 X 9 diallel.

671. DU CROS,D.L. and HARE,R.A. 1983
Genetics of proteins associated with quality in durum wheat.
Proc.6th Int.Wheat Genet.Symp.Japan., 857-861.

Electrophoretic studies have revealed a close relationship between viscoelastic properties and storage protein composition in durum wheat. Studies were undertaken to examine the genetics of a group of gliadin proteins (group 45) associated with dough strength and another group (group 42) associated with dough weakness. It appears that the Group 1 chromosomes carry the genes for these proteins. The majority of genes coding for the group 42 proteins, and the main member of group 45, are located on chromosome 1B. Examination of F1 and F2 individuals from reciprocal crosses of a 42-type and a 45-type durum supports the hypothesis that the synthesis of the main proteins, gliadin bands 42 and 45, is controlled by alleles. The results suggested that the allele coding for band 42 is incompletely dominant to the allele for band 45, with a gene dosage effect being observed.

672. DU CROS,D.L., JOPPA,L.R. and WRIGLEY,C.W. 1983
Two-dimensional analysis of gliadin protein associated with quality in durum

wheat: Chromosomal location of genes for their synthesis.
Theor.Appl.Genet (F.R.G), 66:297-302.

Two-dimensional electrophoresis was used to fractionate the gliadin proteins from the endosperm of durum wheat. This system, as compared with single-dimensional analysis, accentuated the heterogeneity of the proteins. This resolution coupled with the use of aneuploid lines of the cultivar 'Langdon', permitted identification of the chromosomes controlling synthesis of the major protein components. Homoeologous Group 1 chromosomes controlled omega- and gamma-gliadin synthesis and the Group 6 chromosomes 6A and 6B controlled alpha- and beta-gliadins.

673. FERNANDEZ,DE C.R., HERNANDEZ-LUCAS,C., CARBONNERO,P. and GARCIA-OLMEDO,F. 1976
Gene expression in alloploids: genetic control of lipopurothionins in wheat.
Genetics (USA), 83:687-699.

674. GILL,K.S., BHULLAR,G.S. and BHATIA,A. 1979
Analysis of generation means for metric traits in durum wheat.
Crop Improvement (India), 6:103-109.

Additive genetic effects proved more important than nonadditive. When five yield components, height and peduncle length were investigated in the parents, F1, F2, BC1 and BC2 of three crosses.

675. GILL,K.S., BHULLAR,G.S. and MAHAL,G.S. 1979
Gene action in seven parent diallel cross of macaroni wheat.
Indian J.Agric.Sci.(India), 49:827-831.

676. GILL,K.S., BHULLAR,G.S., MAHAL,G.S. and BHARDWAJ,H.L. 1983
Gene systems governing yield and other characters in durum wheat.
Genetica Agraria (Italy), 37:105-114.

Graphical data are presented on the genetic components of variance of yield and seven yield-related traits in the parental and F1 generations of an 8 X 8 half diallel. Dominance variance was more important than additive variance for grain yield, grain weight and spikes per plant, while additive variance was the more important for grains/spike, spikelets/spike, spike length and peduncle length. H itability estimates were high for grains/spike, spikelets/spike and spike length.

677. GIORGI,B. 1979
Chromosome location of "Kinky neck" character established by crossing durum wheat monosomics of Chinese spring.
Wheat Infor.Serv.(Japan), 6-7.

Triticum durum 'Capeiti' was crossed with 14 monosomic lines of T. aestivum 'Chinese spring' (CS). From the cross CS mono 7A X Capeiti it appears that a major recessive and homizygous effective gene on chromosome 7A controls the kinky neck character in Capeiti. Sometimes plants of the other monopentaploid hybrids have a slightly kinky neck, indicating that minor genes or modifiers are also present.

678. GOLIK,V.S. and ALADIN,V.S. 1976
The inheritance of characters affecting lodging resistance in hybrids of spring-bread and durum. (Ru)
Selekts.Semenov.(USSR), 17-21.

Plant height, length of the two lower internodes, number and diameter of vascular bundles, and thickness of the ring of mechanical tissue in most cases showed intermediate inheritance in the F1. In the F2, cases occurred of transgression for number and diameter of vascular bundles.

679. GOUD,J.V. and HANCHINAL,R.R. 1983
Development of monosomic lines in durum wheat.
Proc.6th Int.Wheat Genet.Symp.Japan., 335-340.

Monosomic lines of hexaploid wheat variety Pb C 591 (monosomic for A and B genomes) were crossed to durum wheat variety Bijaga Yellow to develop the monosomic lines in tetraploid wheat. On an average 59.44 per cent of the plants were monopentaploids (13"+8') in F1 generation. In first back cross generation (13"+8' plants X Bijaga Yellow) the frequency of occurrence of plants with various chromosome configurations varied from 13"+2' to 13"+8'. In the second back cross generation (13"+2' plants X Bijaga Yellow), the chromosome number varied from 27 to 31. In general, plants with 17 chromosomes occurred with least

frequency, whereas plants with 14 bivalents occurred in highest frequency. The present investigation indicated that, the occurrence of chromosomic plants in tetraploid wheat is quite low in contrast to that obtained with monosomics of hexaploid wheat. In third backcross generation (13"+1' plants X Bijaga Yellow), the frequency of transmission of monosomic condition varied from zero to 4.55 percent.

680. GRILLI,I., ANGUILLESI,M.C., FLORIS,C. and GALLESCHI,L. 1982
Influence of age and storage temperature on RNA metabolism in durum wheat seeds.
Z.Pflanz.Physiol.(F.R.G), 107:211-221.

681. HANCHINAL,R.R. and GOUD,J.V. 1982
Seed setting and germination in crosses of AB- genome monosomic lines of Pb C591 X Bijaga Yellow and their back cross generations in wheat.
Wheat Infor.Serv.(Japan), 15-21.

Grain set and germination in the F1, BC1, BC2 and BC3 of crosses of 14 monosomic lines of Triticum aestivum'PbC591' with T. durum 'Bijaga Yellow' (recurrent parent) were compared with that in disomic PbC591. Grain set was poor and varied, depending on the monosomic line used. Germination, which, overall, was poor in the F1 and BC1, improved in the BC2 and BC3, probably because most progenies were disomic.

682. HANCHINAL,R.R. and GOUD,J.V. 1982
Genetic analysis of tetraploid wheat Triticum durum Desf. cv. Bijaga Yellow by utilization of monopentaploid hybrids.
Wheat Infor.Serv.(Japan), 22-26.

In the F1 of crosses of 14 monosomic lines of T aestivum 'PbC591' with Bijaga Yellow, most plants had 2n = 35 or 34 and a few had 2n = 33. Compared with the disomic hybrids, monosomics 2A, 4A, 6A and 6B were shorter and monosomics 3B and 4B were taller; monosomic 1A, 6A, 7A, 2B, and 4B had longer and monosomics 5A, 5B and 6B shorter peduncles; monosomics 5A, 2B and 7B exhibited delayed heading; and monosomics 1A, 2A, 3A, 5A, 3B, 4B and 6B had fewer tillers. The data were used to assign genes controlling these quantitative characters to T. durum chromosomes.

683. HANZEL,J.J. 1982
Studies on the origin of B genome in T . turgidum by DNA hybridizartions.
Diss.Abstr.Int.(USA), 42:2693.

The source of the B-genome remains controversial (21,44). In this study, DNA:DNA hybridization techniques were employed to identify the B genome donor. Five diploid wheat species, considered as possible B genome donors, were examined. Triticum-labeled DNA of Triticum durum (AABB) was hybridized to an excess of unlabeled DNA from each of the five diploid species. Reassociation rate curves and thermal elution hydroxyapatite chromatography were employed to determine phylogenetic. The result indicated that of the diploid wheats, T.speltoides was the most closely related species to T.durum, and therefore, is the most likely B genome donor to the polyploid wheat.

684. HASSAN,R.K.A. 1981
A cytological study on the interspecific cross T . durum X T . aestivum .
Thesis (M.Sc.in Agronomy)Cairo(Egypt), 141.

685. HEGAZI,K.F., ABO EL-ENEIN,R.A. and KHALIL,O.H.S. 1979
Inheritance of morpho-physiological characters in durum wheat.
Agric.Res.Rev.(Egypt), 57:35-53.

Six varieties and the F1, F2, BC1 and BC2 generations of five crosses among them were studied. Analysis was performed of data on flag-leaf length, second-leaf length, flag-leaf width, second-leaf width, peduncle length and peduncle diameter. Additive, dominance and digenic epistatic effects were detected. Additive X additive and dominance X dominance effects were more important than additive X dominance. Heritability estimates were moderate to high.

686. HEGAZI,K.F. and KHALIL,O.H.S. 1979
Inheritance of kernel weight in durum wheat.
Agric.Res.Rev.(Egypt), 57:55-65.

Data from varieties and the F1 and F2 of four crosses among them were analysed. Transgressive segregation occurred for heavy and light grains. Epistatic effects were detected in all crosses. At least one to three genes controlled

grain weight, and eight genes with one or more modifying factors were apparent in one cross.

687. IVANOVA,S.V., PUKHAL'SKII,V.A. and ROMIS,N.B. 1980
Chromosome segregation in second generation populations of the interspecific wheat hybrid Triticum aestivum X T. durum .(Ru)
Izv.Timiryazev.Sel'sk-Khoz.Akad.(USSR), 49-55.

The durum wheat Narodanya was crossed as pollen parent with three bread wheats. Among F2 segregates, plants with an even number of chromosomes, especially 42, predominated irrespective of the seed parent. All three crosses gave more 28-chromosome plants than the theoretically expected frequency.

688. JOHNSON,B.L. 1973
Seed protein patterns and the gene resources of wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 153-162.

Species of Triticinae show a characteristic seed protein electrophoretic pattern, that of the amphiploids representing an addition of the parental patterns. All diploid species of Aegilops show a distinct albumin band between 10.2 and 10.5 cm on the standard scale, and this band recurs in all Aegilops polyploids. It also recurs in the aestivum hexaploid wheats which are known to carry a genome from Ae. squarrosa. The widely distributed diploid wheats (T. boeoticum) show a marked variation in the protein pattern, the fastest band, observed only in occasional individuals, occurring at 9.7 cm. The fastest band characterizing all of the tetraploid wheats occurs also at 9.7 cm. This suggests that a species of Aegilops did not contribute the second genome of Triticum, but that both the first and the second genome were derived from diploid wheats. The protein patterns of the emmer and timopheevii tetraploids indicate that they differ with respect to the first as well as the second genome. Other patterns occurring in the wild tetraploids suggest that they had a polyphyletic origin based on the wild Triticum diploids. However the protein pattern of the cultivated emmer tetraploids is remarkably uniform suggesting their derivation from the ancient cultivar T. dicoccum which in turn seems to have been derived essentially from one of the several types found among the wild tetraploids. Similarly the cultivated T. timopheevii seems to be a selection from the wild T.araracticum. The equally uniform pattern of the aestivum hexaploids can be simulated by a protein mixture (2:1) from rigidly selected types of T. dicoccum and Ae. squarrosa, suggesting a monophyletic origin for all of the subspecies, primitive as well as derived.

689. JONES,B.J., LOOKHART,G.L., MAK,A. and COOPER,D.B. 1982
Sequences of purothionins and their inheritance in diploid, tetraploid and hexaploid wheats.
J.Heredity (USA), 73:143-144.

Purothionins are small basic proteins found in the genus Triticum. Hexaploid wheat (T. aestivum), with genomes A, B, and D, produces three forms of purothionin that are similar in amino acid sequences. Tetraploid wheat (T. durum), with genomes A and B, produces two forms, whereas a diploid wheat (T. monococcum), with only the A genome, produces only one. The amino acid sequences of the purothionins examined have been completely conserved during the period in which hexaploid wheat originated from its progenitors.

690. JOPPA,L.R., JOSEPHIDES,C.M. and YOUNGS,V.L. 1983
Chromosomal location of genes affecting quality in durum wheat.
Proc.6th Int.Wheat Genet.Symp.Japan., 297-301.

A set of D-genome disomic substitutions in Langdon durum have been produced. The 1D(1B) disomic substitution line was crossed with the gluten cultivars Kharkof-5 and Edmore. The progeny was backcrossed five times to the Langdon 1D(1B) line and plants with a disomic substitution of chromosomes 1B from Kharkof-5 or Edmore were selected. A third line had a pair of 1D chromosomes from Chinese spring substituted for a pair of 1B chromosomes from Langdon. These disomic substitution lines had the quality characteristics of the 1B donor parents. The Chinese spring chromosome 1D substitution line also had good gluten quality. Therefore, chromosome

1B (and 1D) are extremely important in the determination of the quality of durum wheat.

691. JOPPA,L.R., KHALIL KHAN. and WILLIAMS,N.D. 1983
Chromosomal location of genes for gliadin polypeptides in durum wheat T. turgidum L.
Theor.Appl.Genet.(USA), 64:289-293.

Gel electrophoresis was used to determine the chromosomal location of genes for 19 of 30 gliadin bands from grains of the following T. durum varieties and lines: Langdon (weak gluten), Edmore, Vic (both strong gluten), Langdon D-genome disomic substitution and addition lines, Langdon (Edmore 1B) disomic substitution lines, and the double ditelosomic 1BS-1DS. The gene (s) for band 45, associated with strong gluten, was located on chromosome 1B, while a band with similar mobility (band 46) was controlled by Chinese spring chromosome 1D.

692. JOPPA,L.R. and WILLIAMS,N.D. 1977
D-Genome substitution-monosomics of durum wheat.
Crop Sci.(USA), 17:772-776.

Each of the D-genome chromosomes was substituted for its homoeologous A- and B-genome chromosomes in Triticum turgidum L. cv. durum Langdon. All 14 possible substitution-monosomics were obtained by crossing the appropriate Chinese spring nullisomic-tetrasomic (Triticum aestivum L.) with Langdon. Selfing these F's and selecting for 14 chromosome pairs in the F2 and F3 resulted in the disomic substitution of a D-genome chromosome pair for a homoeologous A- or B-genome chromosome pair. When these disomic substitutions were backcrossed to Langdon, the BC1 progenies were substitution monosomics with 13 pairs plus two univalents (13" + 2'). One of the univalents was an A- or B-genome chromosome and the other univalent, the homoeologous D-genome chromosome. In repeated backcrosses to Langdon durum, the D-genome chromosomes were transmitted through the female gametes 33% of the time on the average. The substitution-monosomics were more fertile, more vigorous, and the D-genome chromosomes were transmitted through the female gamete at a higher rate than the durum monosomics. They can be used for many of the same genetic studies as the monosomics in hexaploid wheat.

693. KADAM,V.C., KOLHE,A.K., SARODE,M.S. and LOKHANDE,S.B. 1983
Inheritance of leaf rust resistance of durum wheat.
Coll.Agric.Pune,Biovigyanam (India), 9:9-12.

It was observed that a cross of the variety Bijaga red with susceptible N59 carried two recessive genes for resistance to races 77 and 162A of Puccinia recondita. In a cross with susceptible N1264, resistance to races 77 and 162A in Bijaga Red was dominant. This was conferred by three complementary and one independent gene.

694. KALTSIKES,P.J. and LEE,J. 1973
The Genetic system controlling yield and related characters in durum wheat.
Proc.4th.Int.Wheat genet.Symp.Breed.USA, 533-540.

Diallel crosses were made between ten varieties of Triticum durum of diverse geographic origin. The resulting 45 F1 and F2 populations, together with the parents were grown for two years in two contrasting localities. Analysis of the genotype X environment interactions indicated that with the exception of a few characters, failure of the genotype to behave in a consistent manner was due to unstable additive and dominance gene effects. Epistatic effects other than additive X additive, were relatively stable over environments for few characters only.

695. KHALILOV,V.G. 1981
Cytogenetic study of the intergeneric hybrid Aegilops ventricosa Tausch X Triticum durum Desf. in the F1 and F2. (Ru)
Ma'ruzalar.Azsar Elmlar Akad.(USSR) 37:77-79.

In the F2 the cross Ae. ventricosa x T. durum 'Sevindz' many aneuploids of the hexaploid wheat type segregated, together with 56-chromosome amphidiploids. It is postulated that Ae. ventricoza rather than Ae. squarrosa subsp. strangulata was the donor of genome D in hexaploid wheat. It is suggested that, as a result of spontaneous hybridization of Ae. ventricosa (female) with tetraploid

wheat (male), amphidiploids with the genome formula AABBDDMM arose by chromosome doubling or incomplete amphidiploids with the formula AABBDDMM arose by fusion of aneuploid gametes, leading in the course of evaluation to the loss of genome M and the development of hexaploid wheat with the formula AADDBB.

696. KOBREHEL,K. and GAUTIER,M.F. 1973
Genetic variability in the peroxidasic composition of wheat.
Proc.Symp.Genet.Breed.D.W.Bari. (Italy), 527-534.

Polyacrylamide slab gel electrophoresis shows that the presence of peroxidase in wheat is a genetic character; the various genomes seem to control the synthesis of the specific peroxidases. The distribution of the peroxidases is not the same in the different parts of the seeds. The growing conditions have no influence on the electrophoretic patterns. However inside a single species the electrophoretic patterns of peroxidases may be different from one variety to another possessing the same genomes. With T. durum the dissimilarity of enzymograms is particularly important. Moreover some technological characteristics such as the brownness of macaronies are related to the composition of peroxidases. Thus a selection of the wheats corresponding to a given technological quality may be envisaged through the simple electrophoretic study of the new lines.

697. KONZAK,C.F., SADAM,M. and DONALDSON,E. 1973
Inheritance and linkage in durum wheats of semi-dwarfing genes with low response to gibberellin A3.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 29-38.

Preliminary evidence has been obtained indicating that two semidwarfing factors, presumably the same as the genes derived from the Japanese wheat Norin 10, are present in durum wheats. Because the independent effects of the two genes appear to be indistinguishable, or nearly so, their presence can be detected only by test crosses. Data suggest that each of the two recessive semidwarfing genes is closely linked to a semidominant gene for gibberellin (GA) insensitivity. The high frequency of GA insensitive seedlings in progeny of several tall F2 plants from crosses of tall GA sensitive strains with the semidwarf GA insensitive M6800127, and the occurrence of at least one homozygous tall GA-insensitive line of several homozygous semidwarf GA-insensitive lines indicates that both types of recombinants can be recovered from the F3 progeny.

698. LACADENA,J.R. 1973
Basic and applied cytogenetics in Triticum, with special reference to durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 3-28.

In this communication a general survey of wheat cytogenetics is presented pointing out the case specially concerned with durum wheat aneuploidy can be used as a tool in order to localize genes (by using nulli-, mono-, trisomics and intervarietal chromosome substitution lines) and for the construction of genetic maps. Haploid plants of durum wheat have been found and analyzed in different ways. The exploitation of the introduction of alien variation into wheat has been attempted in Triticum with many different approaches, such as interspecific hybridization, induced allopolyploidy genome manipulation and chromosome manipulation.

699. LAPOCHKINA,I.F. 1980
Chromosome segregation in the interspecific hybrid T. spelta L.X T. durum Desf.
Doklady Tskha.(USSR), 108-113.

Selfing of F1 hybrid (2n = 35) resulted in F2 plants with chromosome numbers ranging from 28 to 42. The low percentage of 42-chromosome plants (3.7%) compared with 35-chromosome plants (7.8%) is seen as resulting from a low rate of transmission of D genome chromosomes, indicating greater viability of gametes with few chromosomes of the genome. In the F3, all lines except the 42-chromosome segregates.

700. LEE,J., KALTSIKES,P.J. and BUSHUK,W. 1976
The inheritance of lipoxidase activity and pigment content in durum wheat.

Teor.Appl.Genet.(F.R.G), 47:234-250.

Analysis of a 10-parent diallel of durum wheat (Triticum turgidum L. var. durum) grown at low diverse locations revealed that for enzyme lipoxidase activity in wheat and predicted macaroni pigment contents, heterosis war environmentally dependent. Both additive and dominance genetic effects were significant for each of these quality traits studied, but in one location, the additive genetic effect was consistently more pronounced than the dominance genetic effect, while the reverse was the case in the other location. There was no evidence of epistatic gene effect for any of the the three characters in either location.

701. LEISLE,D., KOSMOLAK,F.G. and KOVACS,M. 1981
Association of glume color with gluten strength and gliadin proteins in durum wheat.
Can.J.Plant Sci.(Canada), 61:149-151.

Weak-gluten cultivars were studied for gluten color, gluten strength of gliadin proteins. The results indicated a linkage of factors controlling glume color and gliadin proteins, and also an association of these two characteristics with gluten strength.

702. LOGVINENKO,V.F. and MORGUN,V.V. 1978
Study of mutagenic effect of some pesticides on spring durum wheat. (Ru)
Tsitol.Genet.(USSR), 12:207-212.

Spraying growing plants of Khar'kov 46 with 2,4-D and its sodium and amine salts in various concentrations increased the frequency of chromosome aberrations in root-tip cells up to five times. Spraying with ethrel increased the aberration up to four times. In the M2, chlorophyll mutations of the albostriata type were induced by 0.2 per cent ethrel and also by the sodium salt of 2,4-D. Treatment of the grain with various concentrations of the pesticides trichlorphon and phthalophos increased the percentage of chromosome aberrations up to five times, phthalophos treatment gave chlorophyll mutants of the chlorina type with a frequency of 1 per cent.

703. LOGVINENKO,V.F., SHKVARNIKOV,P.K. and MORGUN,V.V. 1982
Genetic effects of treating spring durum wheat with pesticides. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 8:65-69.

Of the pesticides tested, Granosan and TOTD had an appreciable mutagenic effect, while no mutational changes were induced by 2,4-D and its amine and sodium salts.

704. MAAN,S.S. 1973
Cytoplasmic male-sterility and male-fertility restoration systems in wheat.
Proc.Symp.Genet.Breed.Bari (Italy), 117-133.

Nucleocytoplasmic interactions resulting in male-sterile wheat were investigated in greater detail than other phenotypic alterations in the expression of wheat genome because of possible economic use of cytoplasmic male sterility in commercial hybrid wheats. Wheats with alien cytoplasm have a series of other phenotypic and physiologic alterations and these influence the productivity of the newly established nucleocytoplasmic combinations. All cytogenetically distinct species of Triticum, Aegilops and Secale investigated had different cytoplasms. The prevalence of cytoplasmic variability among these related species indicated that the cytoplasmic and nuclear genes may control speciation. Therefore, cytoplasmic variability is an important component of genetic variability and may be useful in wheat improvement.

705. MAAN,S.S. and SASAKUMA,T. 1977
Fertility of amphihaploids in Triticum [Aegilops heldreichii , T . durum].
J.Hered.(USA), 68:87-94.

A detailed study of meiotic chromosome behavior in F1 hybrids of Aegilops heldreichii Holzm. (2n = 14, MM) and Triticum durum Desf. (2n = 28; AABB) is reported in which a high frequency of meiotic nonreduction results in functional male and famale gametes and amphidiploid progeny. Most PMC's of F1 plants had 21 unpaired chromosomes at metaphase I. Metaphase cells were of two types: one had randomly scattered univalents like those remaining unpaired and lying off the mataphase plate at the first meiotic division. These cells produced asymmetrical dyads and quartets

having nuclei of unequal size and different numbers of micronuclei. A second type had 21 univalents organized into a metaphase plate, these univalents had two clearly visible chromatids like those at meiotic metaphase and divided equationally and produced symmetrical dyads that matured to functional microspores without undergoing a second meiotic division. Symmetrical dyads were seen among a variety of second division quartets resulting from PMC's having irregular reductional-equational division of unpaired and randomly distributed univalents during first meiotic division.

706. MAKINO,T. 1976
Genetic studies on alien chromosome addition to a durum wheat. 1.Some characteristics of seven monosomic addition lines of Aegilops umbellulata chromosomes.
Can.J.Genet.Cytol.(Canada), 18:455-462.

Seven different monosomic addition lines of Triticum durum var. melanopus strain India for Aegilops umbellulata chromosomes were developed and identified by comparison of morphological and cytological characteristics of 29 chromosome plants. On the basis of cytological data obtained, probable causes of differential transmission rates of the univalent chromosomes are discussed.

707. MAKINO,T. 1981
Cytogenetical studies on the alien chromosome addition to durum wheat.
Bul.Tohoku.Nat.Agric.Exper.Station.Japan 1-58.

The production of three alien chromosome addition series was attempted using Triticum durum as recipient and T. spelta, Aegilops squarrosa and Ae. umbellulata as the donors of alien chromosomes. Seven kinds of monosomic addition lines of the D genome of T.spelta were established and the added chromosomes were identified in four of them. Six kinds of monosomic addition lines of the D genome of Ae.squarrosa were established and the added chromosomes were identified in four of them. Seven kinds of monosomic addition lines were produced for the Cu genome of Ae. umbellulata. A pentaploid hybrid between T. spelta and T. durum transmitted 2.64 D chromosomes per fertilized female gamete. However, a pentaploid hybrid between a synthetic common wheat and the same T. durum variety only transmitted 1.23 D chromosomes per fertilized female gamete. Both transmission rates were significantly lower than the theoretically expected rate. Segregation patterns of univalent transmission revealed that two or more major genes probably control univalent transmission.

708. MAKSIMENKO,T.V. 1975
Features of flowering in durum wheat under different climatic conditions. (Ru)
Resursy i Ikh Ispol'z. (USSR), 66-73.

A study of two varieties in western Siberia, Cuba and Iran showed that open flowering is genetically determined but greatly modified by environmental factors. The degree of chasmogamy was 60-87.5 per cent in Hordeiforme 10 and 70.2-92.8 per cent in Khar'kov 46.

709. MALIANI,C. 1974
Hard wheat. Twenty years of genetics. (It)
G.Agric. (Italy), 84:332-0.

710. MANZOOR AHMAD,BHUTTA and ABDUL KHALIQ,A.K. 1979
Inheritance of yield and its components in Triticum durum wheat crosses.
Pakistan Assoc.Adv.Sci. 4A, 4.

Analysis of data from 13 crosses revealed that most of the characters studies, including yield, plant height and five yield component traits, were quantitatively inherited. They showed transgressive segregation and high heritabilities. The crosses D4 X Jori 69, DI x D4 and DI X SI were particularly promising with respect to improving the characters studied.

711. MARIANI,B.M. and ZITELLI,G. 1973
Genotypic correlations and heritability of some characters in durum wheat. (It)
Genet.Agr.(Italy), 27:19-34.

F2 data from crosses of Selezioni Romane, Giorgio, Gerardo and Jenkins, all carrying dwarfing genes derived from Norin 10, with varieties of normal or intermediate height were analysed. The highest heritability found was for plant height (over 90 per cent average) and

peduncle length (83 per cent), which are each controlled by a small number of genes, possibly the same for both features. Ear length showed a mean heritability of 56 per cent. No significant correlation was found between plant height and either ear length or grains per ear but the latter feature, and spikelets per ear and grains per spikelet also showed high correlations with ear length. Heritability of grains per ear exceeded 90 per cent in some combinations.

712. MARTIN,A. and SANCHEZ,M. 1982
Cytology and morphology of amphiploid Hordeum chilenes X T. turgidum conv.durum.
Euphytica (Netherlandss), 31:261-267.

The morphology and meiotic behaviour of the amphiploid Hordeum chilenes X Triticum turgidum Conv. durum are presented. The fertility, agronomic performance, chromosome stability and grain quality of the new amphiploid give it special value for plant breeding.

713. MARTIN,L.M. 1979
Quantitative genetics of yield in durum wheat.(Es)
An.Inst.Na.Invest.Agr.Univ.Cordoba.Spain 91-104.

Data on yield and six of its components were recorded in a ten-variety diallel. Analysis of the data showed that additive effects played a large part in determining yield, number of grains/ear, spikelets/ear, grains/spikelet and ears/plant. Dominance was also significant in the control of yield, grains/ear, grains/spikelet and grain length.

714. MARTIN,W.W. 1976
Genetics to the rescue.
Agric.Res.(USA), 24:6-7.

The substitution of chromosomes 1D for 1A in the durum wheat cultivar Langdon in order to increase protein quantity and quality is described.

715. MELLO-SAMPAYO,T. 1982
The genetic regulation of chromosome association in polyploid wheat:a critical review of the research work done by the cytogenetics laboratory.
Melhoramento (Portugal), 27:91-121.

Work on inhibitors ph1, ph2 and ph3, on chromosome 5B, 5D, respectively, and some pairing promotors is described. It is suggested that ph1 represents a gene duplication. Evidence is adduced for the somatic association of homoeologous chromosomes. In Chinese spring ditelosomics or disomics, the presence of certain inhibitors, especially in high doses, or the absence of pairing promotors increased the frequency of bivalent interlocking in postmeiotic metaphase. A predominance of pairing promotors, however, was associated with a higher rate of asynapsis and with a high incidence of homoeologous pairing. It is pointed out that in intergeneric hybridization, e.g. when Triticum aestivum or T. durum is crossed with Agropyron sp., the capacity for homoeologous chromosome recombination will be higher in the absence of ph1.

716. MELLO-SAMPAYO,T. and WANDA,S.V. 1973
Chromosome engineering in hybrids involving durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 79-88.

Methods for the transfer of alien genetic variation to tetraploid wheat are discussed. These methods aim at taking advantage of the higher homoeologous chromosome pairing in hybrids that are defective for 5 B chromosome system. The transfer of D genome chromosome genes to the tetraploid wheat component of hexaploid Triticales is suggested as well making use of the induced elimination of a minor pairing suppressor from chromosome 3D.

717. MOCHIZUKI,A. and NAGAYOSHI,T. 1977
Genetical studies on a chromosomes substitution line of durum wheat, 2D (CH) for 2B.
Sci.Rep.Fac.Agric,Kobe Univ. (Japan), 12:217-221.

A semi-dwarf, non waxy, awned wheat (14") was obtained in the offspring of aneuploid derivative (13" + 2B +2D(Ch)) of the deficient hybrid between monosomic common wheat (Chinese spring) and Stewart durum in 1973. Chromosome analysis of the wheat revealed that 2D chromosome of Chinese was substituted for 2B of Stewart durum as expected from its breeding pedigree. No homoeologous

pairing of the 2D (Ch) with e4 of Agropyron elongatum (2x) was observed in F1 hybrid between the wheat and e4 of Agropyron chromosome addition line of Stewart durum, while the wax inhibitor genes were located on these two chromosomes by the senior author and others. From the comparative analysis of zymograms of beta-amylase isozymes performed with extracts of germinated seeds of the wheat and its relatives, it is decided that the band-8 in zymogram of the wheat should be given by the gene on Chinese 2D chromosome. Some other characteristics of the wheat as waxlessness, semidwarfness, are estimated to be due to the expression of the genes located on the Chinese 2D chromosome in the Stewart durum.

718. MOCHIZUKI,A., ONO,H. and NAGAYOSHI,T. 1979
Effect of the ph gene on chromosome pairing in durum wheat. (Ja)
Japannese J.Genet. (Japan), 54:541.

Chromosome pairing in the F1 of crosses between substitution lines of Triticum durum (4x) and, respectively, Aegilops longissima, Ae. sharonensis and T. aegilopoides was similar to that of n5B m5D haploid T. durum (2n = 14). Ph. situated on the long arm of 5B controlled the pairing of homoeologous chromosomes in T. durum as in T. aestivum.

719. MOSAAD,M.Y. 1981
Genetical and technological studies on durum wheat (T . durum Desf.)
Thesis(PH.D.in agronomy).Menia(Egypt), 201.

720. McINTOSH,R.A., LUIG,N.H., JOHNSON,R. and HARE,R.A. 1981
Cytogenetical studies in wheat X 1.Sr9g for relation to Puccinia graminis tritici .
Z.Pflnazenzuchtung (F.R.G), 87:274-289.

The Sr9g allel of the Sr9 loucs on chromosome 2B is present in Triticum durum 'Iumillo', T.aestivum 'Marquillo', 'Double Cross' and 'Thatcher' and several derived varieties. Sr9g conferred resistance to a number of cultures of P. graminis subsp. tritici. Its responses to different races of the pathogen permitted Sr9g to be distinguished from other Sr9 alleles. In Iumillo and many derived hexaploid varieties, Sr9g and Yr7 (conferring resistance to P.striiformis) were closely linked.

721. NODA,K. 1983
Comparison of chromosome banding patterns of Aegilops speltoides and emmer wheat.
Seiken Ziho (Japan), 27-37.

The banding patterns of only two Ae. speltoides chromosomes, e and f, were similar to those of the B genome chromosomes, 5B and 6B, of the emmer-group wheat Triticum durum var. reichenbachii. It is concluded that Ae. speltoides could be the unique donor of the B genome.

722. ONO,H. 1981
The alien chromosome substitution line of durum wheat. 1. substitution of the chromosome el of Agropyron elongatum for the chromosome 1B of T . durum cv. Stewart.
Wheat Infor.Serv.(Japan), 42-43.

Monosomic 1B lines of T. durum 'Stewart' and disomic el addition lines of A. elongatum were crossed to obtain 10 monosomic el (1B) substitution lines having 13II + 21 and indistinguishable from T.durum except for fertility. No pairing between el and any wheat chromosome occurred. Root-tip chromosome counts and configurations were obtained for 114 selfed monosomic substitution lines. Thirty-eight plants having 14II at meiosis were similar in morphology. Seed set in eight of these was 0.47/spikelet compared to 2.1 in the rest, suggesting that the former carried the substituted el chromosomes. When crossed with T. durum the F1 of the low-fertility plants all had 13II + 21.

723. ONO,H. 1983
Genetic variations in the AABB genome extracted from T . durum - Elytrigia elongata (Agropyron elongatum 2n=14) chromosome addition lines.
Wheat Infor.Serv.(Japan), 56:61-63.

Analysis of variance of data on ear length for normal T. durum wheat and AABB plants obtained from self-pollinated progenies of seven different monosomic addition lines produced by crosses between monosomic T. durum and an A. elongatum disomic addition line, revealed significant

differences among AABB plants. These results indicate recombination between the added Agropyron chromosome and the corresponding wheat chromosome.

724. ONO,H., KIDO,A. and SAKAI,Y. 1983
Preferential transmisson of the alien chromosome in a durum wheat-Agropyron chromosome addition line. (Ja)
Sci.Rep.Fac.Agric,kobe Univ. (Japan), 15:261-264.

In a substitution line of A.elongatum in Triticum durum, one plant with 2n = 29 bore ears in which 80% of the grains shrivelled and died. Progeny from selfing this plant also had 2n = 29 and many shrivelled grains. From results of reciprocal crosses between the plant bearing shrivelled grains and durum wheat, it is concluded that a spontaneous lethal mutation had occurred in the wheat genome and that the lethal gene action may be suppressed in addition lines monosomic for chromosome el.

725. ONO,H., MOCHIZUKI,A. and NAGAYOSHI,T. 1979
Characteristics of 5B-5D chromosome substitution lines in durum wheat. (Ja)
Japanese J.Genet.(Japan), 54:461.

Substitution lines obtained by back crossing monosomic 5B Chinese spring to Triticum durum 'Stewart' were similar to Stewart in such characters as height, habit and number of tillers but were about seven days earlier in heading. They had compact ears and thick stems. Meiotic configurations were 67% 14II, 23% 13II + 21 and 3% 12II + 41, with polyvalents in the remaining cases. Fertility after selfing was 80% and 97% of progeny had 2n = 28.

726. ORTIZ,F.G., RODRIGUEZ,V.A. and QUINONES,M.A. 1976
Inheritrance of resistance to Puccinia graminis f. sp. tritici Erikss, and Puccinia recondita f. sp. tritici Erikss, and Henn. In durum wheat (triticum durum Desf.) (Es)
Agrociencia (Mexico), 87-99.

In crosses of susceptible variety Niphad 31 to two varieties and three experimentable lines with resistance or moderate resistance to race 113 of P. graminis and race 77 of P. recondita, it was shown that Cocorit 71 had a gene with incomplete dominance for resistance to race 113 and another for resistance to race 77. Jori C69 had a recessive gene for resistance to race 113 and two recessive genes for resistance to race 77. Stork s and D.Dwarf S15Cr s each had a gene with incomplete dominance for resistance to race 113 and a recessive gene for resistance to race 77.

727. PACE,C.de., OTTAVIANO,E. and PACUCCI,G. 1977
Genetic analysis of yield components in durum wheat.
Genetica Agraria. (Italy), 31:249-250.

In 483 F4 lines from crosses between contrasting lines considerable phenotypic variability was observed for various yield components and quality characters. Genetic variability accounted for 63 per cent of the total variability of yield. Heritability estimates for height and heading date were more than 90 per cent. Using path coefficient analysis, it was calculated that most important yield components were number of spikes/m2 and number of grains/spike.

728. PANDEY,H.N. and RAO,M.V. 1980
Hybrid necrosis in Indian durum wheat.
Indian J.Genet.Plant Breed.(India), 39:444-445.

The durum varieties 'NP 404', 'Bijaga Yellow', 'A 206' and 'HD 4519' were found to be carriers of Ne1 gene and the rust resistant aestivum varieties 'II-62-3 (E 8667)' and 'CC-Tob2 (CPAN 1533), carriers of Ne2 gene.

729. PERERA,E., LACADENA,J.R. and SENDINO,A.M. 1983
Cytogenetic structure of durum wheat cultivars from or introduced into, Spain.
Z.Pflanzenzuchtung.(F.R.G), 91:36-45.

Chromosomal arrangements of 48 Triticum durum (4x = 28, AABB) varieties were examined at metaphase I of PMCs in crosses to male T. aestivum, Chinese spring' (6x = 42, AABBDD) and/or Italian tetraploid T. durum 'Senatore Cappelli' both showing the same chromosome arrangement for genomes A and B. Of the 48 varieties studied, 21 showed reciprocal translocations. All those differed by one interchange, except

Hercules which had two different interchanges involving three chromosomes.

730. PEREZ DE LA VEGA,M. 1982
Meiotic pairing in alloplasmic rye with T. durum cytoplasm.
Z.Pflanzenzuchtung.(F.R.G), 88:331-334.

PMCs of alloplasmic variants of the variety Elbon exhibited normal meiotic pairing except at metaphase I when the number of chiasmata per PMC was slightly lower than in Elbon and other euplasmic lines. This adverse effect was attributed to desynapsis.

731. PLATFORD,R.G. 1977
Chromosome location of genes conditioning resistance to Claviceps purpurea in spring and durum wheat.
Can.J.Genet.Cytol. (Canada), 19:679-682.

The chromosome location of genes conferring resistance to Claviceps purpurea (Fr.) Tul. in Triticum aestivum L. cv. Kenya farmer and T. durum Desf. cv. Carleton was determined. A substitution series of individual chromosomes of Kenya farmer into the susceptible T. aestivum cv. Chinese spring and the F1 plants of Carleton crossed with Chinese spring monosomics for the A and B genomes were used. Chromosomes 6B of Kenya farmer and 1B of Carleton appeared to carry a gene or genes conditioning resistance to all three components of the resistant reaction, i.e. frequency and size of sclerotia and size of sclerotia and honeydew production. In addition, chromosome 3B of Carleton appeared to reduce the sclerotia frequency and honeydew production while several chromosomes of both Kenya farmer and Carleton influenced sclerotia size and honeydew production.

732. PUKHAL'SKII,V.A. 1977
Material on the location of genes for hybrid necrosis in the genotypes of bread and durum wheat varieties in the USSR. (Ru)
3-iS"end Vses.Ob-Va Genet.i.Selekt.USSR. 428-429.

The genotypes of 562 varieties of Triticum aestivum and 99 varieties of T. durum were studied. The genotype Ne1 ne2 ne2 predominated among the spring varieties and ne1 ne1 Ne2 Ne2 among the winter ones. These differences were less marked among local varieties than among bred forms. The latter tended more towards the genotype ne1 ne1 Ne2 Ne2, especially the bread wheats. The durum wheats generally carried Ne1 and few of them had the genotype ne1 ne1 ne2 ne2.

733. PUKHAL'SKII,V.A. and LAPOCHKINA,I.F. 1980
Interspecific hybridization in the genus Triticum L. involving natural and artificial spelt. (Ru)
Izv.Timiryazev.Sel'SK-Khoz.Akad.(USSR), 36-45.

The natural spelt T. spelta 'K45365' and the artificial spelt K47748 obtained by crossing T. carthlicum with Aegilops squarrosa were each crossed as maternal parent with T. durum. When the F1 hybrids (2n = 35) were selfed, segregates with a wide range of chromosome numbers were obtained in the F2. Plants with 2n = 28-32 predominated in k45365 X Narodnaya and those with 2n = 39-42 predominated in K47748 X Narodnaya. In the F3 of the former cross, almost all chromosome groups gave 28 chromosome segregates, which predominated. Segregates falling outside the range of variation of their parents were found only in K47748 X Narodnaya. Stable 28 chromosome forms with resistance to rust and lodging and with many fertile tillers were selected.

734. RAJORA,A., SAREEN,P.K. and CHOWDHURY,J.B. 1979
Cytological studies in Triticale hexaploid Lart... Triticum durum L. and Secale cereale L.
Z.Pflanzenzuchtung (F.R.G), 83:127-132.

The variation in chromosome number ranging from 38 to 42 observed in hex.ploid triticale, may be due to the formation of anaphase laggards, which were observed in PMCs, and may subsequently give rise to micronuclei. During diplotene and metaphase I, chiasma terminalization was found to be slower in tetraploid wheat than in Secale chromosomes. Discrepant terminalization rates in Triticum and Secale indicated instability.

735. RASI-ZADE,G.M. 1982
Cytogenic analysis of the 56-chromosome Aegilop wheat amphidiploids

[Aegilops ovata X T. durum var. hordeiforme] (En,Ru)
Soviet Genetics (USA), 18:1494-1499.

736. RICE,R.H. 1976
Wheat germ agglutinin. Evidence for a genetic basis of multiple forms.
Biochem.Biophys.Acta (USA), 444:175-180.

737. ROMERO,C. and SENDINO,A.M. 1982
Meiotic behaviour in haploids of T. durum.
Cereal Res.Commu. (Spain), 10:191-196.

Analysis of data on meiotic configurations in metaphase I PMCs of two haploids of Senatore Cappelli and some of Bidi 17 revealed significant varietal differences. These are attributed to greater chromosomal differentiation in Bidi 17 and/or a difference in degree of pairing control.

738. SALAZAR GOMEZ,M. and JOPPA,L.R. 1981
The use of substitution monosomics for the localization of genes which condition resistance to stem rust in durum wheats (T. turgidum L.). (Es)
Agrociencia (Mexico), 55-62.

All available D-genome substitution monosomics of Langdon, which is resistant to Puccinia graminis f. sp. tritici, race 121, were crossed with the susceptible variety Marruecos 9623 [Morocco 9623]. One gene for resistance was located on chromosome 4A and another probably on 6A. The Langdon substitution monosomics were more fertile and vigorous than monosomics of other varieties which lack a compensating homoeologous chromosome from the D genome.

739. SALAZAR GOMEZ,M., RODRIGUEZ,V.A. and QUINONES,M.A. 1975
Inheritance of plant height in durum wheat (T. durum Desf.)
Agrociencia (Mexico), 133-143.

The parental generation, F1, F2, F3, BC1 and BC2 of ten diallel crosses between four Mexican durum lines and the tall variety Leeds were examined. The majority of F1 progenies were taller than the taller parent on the average, except in crosses with Leeds, when F1s were equal to the parental mean. The degree of dominance observed depended on the parents involved and crosses with highly contrasting parents showed a lower degree of dominance than crosses of less contrasting parents. Additive variance was greater when the degree of dominance was low. Heritability in the broad sense varied from 76 per cent to 93 per cent and in the narrow sense from 0.22 per cent to 0.89 per cent. The existence of three dominant genes acting additively was inferred genotypes aabbcc in Meauca, AABBCC in Leeds and AAbbcc, aaBBcc or aabbCC in other three lines.

740. SASAKUMA,T. 1978
Evaluation of cytoplasmic variability introduced into durum wheat.
Diss.Abstr.Int.B.(USA), 38:5185.

Plants of Triticum durum with Aegilops squarrosa or Ae. cylindrica cytoplasm were partially male sterile and those with T. aristata cytoplasm were completely male sterile; all had extra telocentric chromosome remaining unpaired at mataphase I. Zygotes with 28 chromosome were eliminated. Transmission of the telocentric chromosome in the plants with aegilops cytoplasm through male and female gametes was 97 and 22% respectively. Male fertility and plant vigour in plants with rye or Ae. umbellulata cytoplasm were affected by temperature and photoperiod. Plants with T. boeoticum cytoplasm remained vegetative under 8-h days.

741. SASAKUMA,T. and KIHARA,H. 1981
A synthesized common wheat obtained from a triploid hybrid, Aegilops squarrosa var. stangulata (female) X Triticum durum (male).
Wheat Infor.Serv. (Japan), 14-18.

In crosses of Ae. squarrosa var. strangulata with T. boeoticum, T. monococcum, Ae. speltoides and T. timopheevii, no plump grains were obtained. However, with Emmer (AABB) or Dinkel (AABBDD) some plump grains were produced and reciprocal crosses, Emmer or Dinkel X Ae. squarrosa, set mostly plump grain. It is suggested that grain plumpness requires a balance of D genome dosage between embryo and endosperm. Five mature wheat-like plants (2n = 21) were obtained through embryo culture of Ae. squarrosa X T. durum '56-1' F1 hybrid seed. The F2 progeny PmCs had 2.58I + 19.70II + 0.02III, indicating that amphiploidization had occurred,

apparently through formation of unreduced gametes. Plants from crosses of the F1 with T. aestivum 'Chinese spring' and T. durum '56-1' had 3.80I + 19.10II and 7.8II + 12.59II, respectively, indicating that pairing stability was not significantly reduced. Induced autotetraploid lines of Ae. squarrosa subspp. typica, strangulata, meyeri and anathera showed reduced fertility possibly because of multivalent formation and irregular segregation of duplicated chromosomes. F1 hybrids of these autotetraploids with T. durum '56-1' and T. aestivum 'Chinese spring' had 16.26I + 5.87II in ABDD and 20.75I + 6.56II + 0.35III in ABDDD, respectively. They were highly sterile but crosses of each F1 with T. durum produced a few grains.

742. SAVITSKAYA,V.A., KALSHNIK.N.A. and LETOVA,G.M. 1979
Inheritance of quantitative characters in durum wheat in western Siberia. (Ru)
Genetika (USSR), 15:306-313.

In a study of yield components and height in F1-F2 hybrids obtained by crossing foreign short-strawed forms with local tall varieties, the characters of the tall parent predominated in most cases except height. The coefficient in heritability was greatest for height. The most useful breeding material was obtained by crossing the Hordeiforme 45402 with the tall forms Hordeiforme 5327 and Hordeiforme 5900.

743. SCARASCIA,M.G.T. and PORCEDDU,E. 1974
Genetic studies of coleoptile length in T. durum.
Proc.4th Int.Wheat Genetic Symp.Columbia 301-308.

Coleoptile length of 1600 lines from 18 Mediterranean countries were analyzed. As a result of these analyses the following conclusions are drawn: 1) An appreciable variability exists in T. durum for examined traits; 2) Worthy of particular mention is the independence of culm and coleoptile lengths; 3) Lines carrying dwarfing factors from Norin and Brevor fall into the group of lines with low stability at different temperatures; 4) The analysis of F1 generation data seems to suggest a polygenic type of inheritance for coleoptile length.

744. SENDINO,A.M. and PERERA,E. 1984
Identification of an induced interchange in T. turgidum durum cv."Senatore Capelli".
Caryologia.(Italy), 37:241-248.

On the basis of (1) meiotic analysis of hybrids between T. durum cv. Senatore Cappelli and 12 double-ditelocentric and 2 ditelocentric lines (A and B genomes) of T. aestivum cv. Chinese spring and (2) karyotype analysis, it is concluded that the chromosomes involved in the interchange in Senatore Cappelli are 7A and 5B.

745. SHEVCHUK,N.S. 1981
Inheritance of quantitative characters of lodging resistance in winter durum wheat hybrids. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:117.

In crosses involving (1) the tall thin-strawed variety Khar'kov 1, (2) the fairly lodging resistant varieties Khar'kov 2, Khar'kov 909 and Novomichurinka, and (3) the medium-statured, lodging resistant, thick-strawed varieties Mutant 5 and Mutant 9, heterosis for tallness observed in the F1 was maintained in the F2. Height was correlated with length of the uppermost internode (r = 0.48). Selection for shortness was ineffective. Internode diameter was correlated with stem strength (r = 0.8). Some 20-25% forms showing transgressive segregation for internode diameter were obtained; this and the high heritability for internode diameter (h2 = 0.74) enabled a number of lodging-resistant plants to be selected in the F3. Stem strength was correlated with thickness of the ring of mechanical tissue (r = 0.81) and number of vascular bundles (r = 0.6).

746. SIMEONE,R. and BLANCO,A. 1980
Fertility and chromosomal pairing of Triticum boeticum - Triticum urartu synthetic amphiploids and their F1 hybrids involving Triticum durum .(It)
Genet.Agr. (Italy), 34:188-189.

747. SIMEONE,R. and BLANCO,A. 1983
Chromosome pairing and transmissiom rates of telocentric chromosome in telotrisomics of durum wheat (T.durum Desf.)
Genet.Agr. (Italy), 37:215-216.

Two telotrisomics were isolated in progenies of the primary trisomics for chromosomes 2A and 5B; the two arose as a result of misdivision of the extra chromosome during the first meiotic division. The pairing and transmission of the telocentries are described.

748. SINGH,S.P., TIWARI,V.N., MISHRA,Y. and TAWAR,M.L. 1981
Heterosis in wheat (Triticum durum Desf.)
JNKVV Res.J. (India), 15:104-108.

Heterosis was studied for yield and five related characters in a diallel of nine varieties.

749. SUSEELAN,K.N., RAO,M.V.P., PRABHAKARA,M.V. and NARAYANA RAO,I. 1982
Mapping of an alcohol dehydrogenase (Adh-A1) structural gene on chromosome 4A of durum wheat.
Heredity (U.K), 49:353-357.

The tall variety Bijaga Yellow was crossed reciprocally to the semidwarf variety Malavika. The F1s were intermediate in height and their alcohol dehydrogenase (ADH) zymogram showed a five-banded pattern. Individual F2 families were grown separately and scored for GA3 sensitivity, height and grain ADH phenotypes. Results indicated that Gail is located 15 crossover units from the centromere on the "P" arm of chromosome 4A, and Adhal lies 23.1 units to the right of Gail.

750. TABUSHI,J. 1979
Chromosome pairing and fertility in the F2, F3 and F4 of Triticum durum cv. Gulas X Aegilops squarrosa meyeri. (Ja)
Japanese J.Genet.(Idengaku Zasshi)Japan, 54:466.

In one F2 plant (2n = 41), pairing in PMCs was 0.15IV + 0.12III + 18.27II + 3.50I, pollen fertility was 60.9%, self fertility was 0% and cross fertility 36.7%. In five F3 plants produced by open pollination, 2n = 39-42 and chromosome pairing differed in each individual; pollen fertility was around 50% and, in four plants, self fertility was 0-21.4%. Pairing in the F4 was similar to that in the F3 parents. No close correlation between fertility and pairing. In the F1 of F3 X the similar hybrid ABD16, there were many plants with satisfactory pairing and fertility compared with the F4. In the F1 of F3 X Gulab, there were 9-14 biavalents, 6-12 univalents and an unspecified number of trivalents and quadrivalents.

751. TAGLIASACCHI,A. and FORINO,L.M.C. 1979
A cytophotometric study of protein during the 1st mitotic interphase in the radicale meristem of germinating seeds of T. durum cv.Cappelli harvested in 1968 and 1976. (It)
G.Bot.Italiano. (Italy), 13:482.

752. TANZARELLA,O.A. and BLANCO,A. 1982
Inheritance of the stomatal frequency and size in durum wheat.
Genetica Agraria (Italy), 36:192-193.

The parental lines and F1 hybrids from a 5 X 5 half diallel differed significantly for stomatal frequency per mm2, stomatal length, trichome frequency per mm2 and stomatal number leaf. Removal of Creso and its hybrids from the analysis showed that stomatal frequency was mainly controlled by additive gene effects and stomatal length by additive and dominance gene effects. Heritability was high for both characters.

753. TRIPATHI,R.S., AGRAWAL,K.B. and KHAN,A.W. 1973
Estimates of variation and heritabilty of some quantitative characters in durum wheat. (Triticum durum Desf.)
Indian J.Agric.Sci.(India), 43:842-845.

In 16 varieties 9 quantitative characters were studied. The highest values for the genetic coefficient of variation were obtained for the number of days to 75 per cent flowering and number of grains per plant. The highest estimates of heritability in the broad sense and of expected genetic advance were obtained for panicle length, numbers of spikelets per panicle and number of grains per plant.

754. TSUJIMOTO,H. 1981
The aline chromosome substitution line of durum wheat. 2: Substitution of the chromosome e7 of Agropyron elongatum for the chromosome 4A of Triticum durum cv.Stewart.
Japanese J. Genet. (Japan), 59:141-151.

T. durum 'Stewart' lines (female) monosomic for 4A and disomic e7 additions from A. elongatum were crossed to produce the monosomic substitution (2n = 28, (AABB -4A + e7). The plants obtained were similar in height but could be distinguished by number of tillers, thickness of culm and length of awn when compared with euploid T. durum. They grew vigorously but had reduced fertility. The e7 transmission rates in the male and female, determined from the reciprocal cross T. durum X monosomic substitution, were 38.8 and 32.1%, respectively. Homoeologous pairing between 4A and e7 was observed in monosomic substitution PMCs.

755. TSUJIMOTO,H., SHINOTANI,K. and ONO,H. 1984
Alien chromosome substitution of durum wheat: Substitution of the chromosome e7 of Elyrigia elongata for chromosome 4A of Stewart durum.
Japanese J.Genet.(Japan), 59:141-153.

Four Triticum durum lines with monosomic substitution of E.elongata (Agropyron elongatum) chromosomes e2,e3,e6 and e7 for chromosome 4A were produced by crossing T.durum cv. Stewart monosomic for 4A with the corresponding disomic addition lines of Stewart. Among them, the monosomic substitution line e7(4A) was the most vigorous and fertile. The fertilization rate of the four types of egg cells produced by this monosomic substitution suggested a 50% elimination of both e7 and 4A univalents during meiosis in T.durum. Male transmission behaviour indicated that chromosome e7 compensates for the function of chromosome 4A during certation. A disomic substitution line was selected from the progeny of the monosomic substitution line e7(4A). Plants of this line were vigorous and completely fertile. It was thus concluded that chromosome e7 of E.elongata belongs to homoeologous group 4. A comparison of the morphology of the substitution, addition and monosomic lines with those of normal Stewart showed that chromosome e7 carried genes for awn suppression, culm thickness and ear laxness.

756. TSUNEWAKI,K. 1983
Gene transfer between three groups of wheat. 2: Differential transmission rates of deletrious genes in 6X and 4X wheats.
Japanese J.Genet. (Japan), 58:219-229.

The genes B1 (awn suppression) Hp (hairy peduncle from rye) and the lethal V1 (virescence), were transferred from 6x Triticum aestivum sources to 6x T. aestivum 'S615' and 4x T. durum var. reichenbachii by repeated backcrossing using the latter as recurrent pollen parents. In each backcross generation, heterozygotes of each gene were backcrossed and selfed. B1 showed normal transmission in 6x and 4x wheats. Hp was transmitted normally in 6x wheat, while transmission was slightly reduced through female and male gametes in 4x wheat. Gene V1 was transmitted at slightly lower frequency than its normal allele in 6x wheat, while transmission was greatly reduced through female and male gamates in 4x wheat. Results indicated that polyploidy increased tolerance of deleterious genes.

757. VERMA,P.K., LUTHRA,O.P., PARODA,R.S. and SHARMA,G.D. 1984
Genetics of yield and its component characters in durum wheat.
Cereal Res.Commu.(AUB), 12:179-185.

Information is presented on genetic parameters for grain yield/plant and 7 yield-related characters from an 8 X 8 diallel, excluding reciprocals, in Triticum durum. Dominance components of genetic variance were more important than additive components for all characters, though additive effects were significant for spikelets/spike, grain weight and plant height. Narrow-sense heritability was high for 1000-grain weight, plant height and spikelets/spike.

758. WADA,K. 1982
Localization of purothionins and genome expression in wheat plants.
Plant Cell Physiol. (Japan), 28:1357-1361.

The leaves, stems and ears of tetraploid Triticum durum harvested two weeks after heading were analysed for purothionins. There were considerable amounts of isopurothionins Pu-1 and Pu-2 in the young grains, but not in the leaves and stems. The amino acid compositions of Pu-1 and Pu-2 were in good agreement with those of Pu I and Pu II from hexaploid wheat. As diploid T. monococcum is known to produce only Pu

I, it is concluded that the isopurothionins Pu I, Pu II and Pu III in hexaploid T. aestivum are encoded by the genes of genomes A, B and D, respectively.

Mutation Breeding

759. ANON. 1982
List of varieties.
Mutation Breeding Newsletters (USA), 16-19.

Varieties obtained by induced mutation in eight crop species are listed. Triticum durum 'Lozen 79', from Bulgaria, was derived from 788 X Castelporziano pollinated with irradiated Castelporziano pollen. It gives good yields of good quality grain and is resistant to lodging.

760. AVASTHI,A.K., SHARMA,G.S. and LUTHRA,J.P. 1982
Modifying effect cysteine and ethrel on EMS induced morphological damage in durum wheat. [T.durum L.]
Indian J.Agric.Res.(India), 16:239-243.

The effects of seed treatment with ethyl methane sulphonate (EMS) and cysteine or Ethrel [ethephon] alone or following EMS on the characteristics of durum wheat cv. Raj 911, were studied in boxes or in the field. In boxes, 0.4 and 0.6% EMS generally adversely affected all characteristics studied. Germination rate and seedling survival were reduced by all Ethrel and some cysteine conc. Ems effects on germination rate and seedling survival were generally reversed by post-treatment with cysteine or Ethrel. Seedling ht. was only increased by cysteine following 0.4% EMS. Increases in days to ear emergence and to maturity and reductions in grain yield by 0.4 and 0.6% EMS in the field were frequently reversed by post-treatment with Ethrel or cysteine. Numbers of effective tillers/plant were increased by 100 or 1000 p.p.m. cysteine but were not affected by EMS, Ethrel or post-treatments. Days to ear emergence were significantly increased by 100 or 1000 p.p.m. Ethrel and grain yield was significantly reduced by all rates of Ethrel.

761. BAGNARA,D., ROSSI,L. and PORRENCA,G. 1973
Mutagenesis in T. durum mutants for protein content obtained from CV.Capeiti.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 679-684.

Seeds of the durum wheat cv. Capeiti were treated with fast and thermal neutrons and ethylmethane sulfonate. In M2 generation, mutants were isolated for culm length, heading time and other characters of both theoretical and practical interest. In M4 generation, mutant lines were identified with as much as 16% grain protein, compared with 10% for Capeiti. Coefficients of correlation calculated on the whole series of considered lines indicate that a higher protein content tends to be found more likely in lower yielding lines, with shorter culms, later heading times, lower test weights and lower percentages of yellow berry. In spite of the above mentioned unfavourable association between protein content and yield, it was possible to isolate a small group of seven lines in which sufficiently high values of both characters seem to match.

762. BOZZINI,A. 1974
Breeding possibilities offered by induced mutation in durum wheat.
Theor.Appl.Genet.(Italy), 44:304-310.

Results of a breeding program performed under controlled conditions from December, 1965, to June, 1970, using the line Castelporziano (Cp 8132) (a short-strawed Capelli mutant) crossed with PsAl (an early Fusselio mutant). 87/35, 'Yuma, LD357 and Fyperrounda, are given.

763. BOZZINI,A., BAGNARA,D., MOSCONI,C., ROSSI,L. and SCARASCIA,M.G.T. 1974
Trends and results of durum wheat mutation breeding at Casaccia.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 339-345.

In 14 years of activity 15 durum wheat lines were treated with mutagenic agents, in order to isolate mutants of theoretical and agronomic value. In all varieties at least one and often several mutant lines were isolated that demonstrated a better performance than the mother variety. Four of them have

been released as new varieties. Interesting characters such as straw length and stiffness, earliness, kernel size and quality, disease resistance level, culm and leaf structure, root development, male fertility, cold resistance, spring or winter habit, yield performance, etc., have been largely affected.

764. BUTNARU,G. and DRAGANESCU,I. 1979
Investigations on the stimulating effect of ionizing radiation on some T. aestivum, T. durum and triticale cultivars and lines. (Ro)
Lucr.S.Inst.Agron.Tims.Ser.Agron.Romania 16:19-24.

In field trials in 1976-78, seeds of T. durum were treated with gamma -rays at 0, 500, 1000, 1500, 3000 or 5000 rad. Subsequent grain yield of cv. DF 14-71, was not significantly affected and of durum wheat cv. DF 19-71 decreased with increase in irradiation rate.

765. DEKOV,D. 1976
Influence of some mutagenic factors on the durum wheat variability. (Bg)
Rasteniev'd Nauki,(Bulgaria), 13:3-10.

The durum wheat varieties No. 1522, No. 788, No. 233, Odeskaya Yubileynaya, Montanazi, Carlo Fino and Italian 139 were studied in 1971-1973 at the laboratory of Nuclear Energy Application in agriculture on the Kasacia farm (Rome). 1000 grain seeds of each variety were treated with gamma-rays (10,15 and 20Kr), fast neutrons (1000, 1500 and 2000 r) and ethylene imine (0.2%, 0.3% and 0.4% solution). Induced morphological changes were followed up. Results pointed to a various sensitivity of the individual varieties to the experimented mutagenic factors. Varieties devoloped by individual selection proved more resistant and the hybrids more sensitive. Increasing doses reduced field germination, stem height and plant productivity. Besides that, morphologically and physiologically valuable mutant progenies, though in a very small number, could be produced through experimental mutagenesis, which might be used in combination breeding or directly in the farm practice. 156 progenies with valuable commercial and physiological features were segregated which are an object of future investigations.

766. DESAI,R.M. 1979
Improvement of protein quantity and quality in durum wheat using induced mutation approach.
IDAE (India)1979:13 pp.

M1-M5 material were treated with gamma rays, thermal neutrons, ethyl methanesulphonate, N - nitroso - N - methylurea or N - nitroso - N - ethylurea. Grain protein percentage increased in the treated populations, but the mutants which exhibited an increased protein concentration also exhibited a reduction in yield.

767. DJELEPOV.K. 1976
Chlorophyll mutations induced by irradiation and chemical mutagenes IR T. aestivum L. and durum Desf. (Wheat)
C.R.Acad Bulgar.Sci. (Bulgaria), 29:895-897.

768. DONINI,B., DEVREUX,M. and SCARASCIA,M.G.T. 1974
Genetic effect of gamethophyte irradiation in durum wheat frequency and types of mutation induced.
Euc./FAO-IAEA Conf.Mut.Polyplo. (Italy), 127-138.

Spikes of durum wheat were acutely irradiated in the Casaccia gamma field (60Co source) at different developmental stages of their gametophytes. The male and female gametophytes were saparately irradiated. For each M1 plant unthreshed spikes, sown in sand in the greenhouse, were scored for chlorophyll and morphological mutations at seedling stage; moreover 44 seeds collected from one or two spikes in each plant were sown in the field for M2 analyses to be carried out through the life-cycle of the plant. The analyses of the 68 segregating progenies, of the 2749 M1 plants scored in the greenhouse, showed the presence of mutations in all the 444 spikes. Therefore, the treatment of haplophyte stages of the tetraploid species durum wheat leads to overcoming plant chimerism. The total mutation frequency, expressed as number of segregating progenies per 100 M1 plants analysed throughout the life-cycle was 9.05 and 4.56 after irradiation of male and female gametophyte, respectively. The mutation frequency shows insignificant difference regardless of the developmental stages irradiated at

lower exposure while at higher exposures the mutation frequency increases with the stages of gametophyte development.

769. DONINI,B. and ROSSI,L. 1979
Italian durum wheat varieties obtained by induced mutations and their economic importance.
Mut.Breed.Newsl.(Italy), 6-7.

Among the varieties briefly described are Castelpoziano and Castelfusano, both derived from Cappelli using thermal neutrons, and Castelnuovo, derived from Garigliano using X rays. These varieties have given higher yields than their respective parents and have shown better resistance to lodging, but are not widely grown.

770. FILEV,K.A. 1981
Utilization of induced mutations and gamma radiation in cross-breeding of durum wheat.
Proc.Int.Symp.IAEA.Vienna (Austria), 504.

The local Bulgarian variety 788, which is resistant to cold and lodging, was hybridized with the Italian mutant variety Castelporziano, which is resistant to lodging and late-maturing. Both have high-quality grains. Male and female gametophytes were exposed to gamma rays prior to hybridization and the M1F1 plants were backcrossed using irradiated pollen of Castelporziano. Irradiated hybrid material showed greater genetic variation than controls. After several cycles of selection, the promising lines were obtained which exceeded the standard in yield by 18.3 to 28.9%. They showed early maturity and resistance to lodging and cold.

771. FILEV,K.A. and DONINI,B. 1981
Useful mutations induced in durum wheat by gametophyte and seed treatments.
Proc.Int.Symp.IAEA.Vienna (Austria), 65-72.

Gametophytes and grain of cultivar 233 separately and in combination were exposed to radiation or ethyl methanesulphonate. Among 2264 M1 plants obtained, a higher frequency segregating for morphological mutations was observed after gametophyte and combined gametophyte and grain irradiation, compared with only grain treatment. Of the total number of morphological mutations induced, only four were semidwarf and they were obtained only after gametophyte irradiation. Data are presented on height, yield, yield components and protein content of the four semidwarf mutants in the M3.

772. FLORIS,C., MELETTI,P. and ANGUILLESI,M.C. 1975
Response to X-rays of dormant and non-dormant seed of T. durum Desf.
Mut.Res.(Italy), 28:63-67.

Dry grains at different dormancy levels were exposed to X-ray doses of 1000 and 5000 R. Deeply dormant grains were generally less damaged than lightly dormant or nondormant grains. Damage of the chromatid type resulted from the 1000 R dose irrespective of the physiological condition of the seeds. Lightly dormant or nondormant grains irradiated at 5000 R showed both chromosome and chromatid damage.

773. GEORGIEV,G.A. and BUYUKLI,P.I. 1976
Production of new forms of winter durum wheat by means of radiation mutagenesis. (Ru) Teor.i Park.aspekty ispol'z ioniziruyushchikh izluchenii kh. (USSR) Tezisy docl.Simpoz,Po S-Kh.Radiobiol.SSR.

The durum wheats Kishinev 2, Kishinevskaya rannyaya (Kishinev Early) and Kishinevskaya Krupnozernaya (Kishinev Large-grained) were gamma irradiated. In the M2 the widest range of genetic diversity was obtained in Kishinevakaya Krupnozernaya. The mutations included awned squareheads, awnless squareheads, obverse squareheads (the lower part of the ear being more compact), erectoids, long-awned forms, smooth-awned forms and semiawned forms. The most useful forms were the erectoids (50-70 cm tall) which were highly resistant to lodging.

774. GEORGIEV,N.A. 1981
Gamma rays a method of increasing induced variability in varieties of winter durum wheat. (Ru)
Sec.Jal.Source: Referat.Zh. (USSR), 7:65-68.

Following treatment with different doses, the frequency of induced mutants was established in relation to the mutagen dose and the variety treated.

775. GEORGIEV,S. 1980
Cytological analysis of some structural spherococcoid mutants obtained from T. durum following treatment with ethyl-methanesuphonate. (Bg)
Genet.Selekt (Bulgaria), 14:280-286.

Analysis of the mutants 24/3, 24/4 and 24/4A, obtained by treating T. durum var. hordeiforme '788' with 0.1% ethyl methanesulphonate, indicated that they arose by structural chromosome rearrangements of the translocation type. The mutants studied have a high content of protein and lysine.

776. GIORGI,B. and BARBERA,F. 1981
Use of mutants that affect homoeologous pairing for introducing alien variation in both durum and common wheat.
Proc.Int.Symp.IAEA.Vienna (Austria), 37-47.

The types of mutants available, and the ways in which these can be used, are surveyed.

777. IANEV,S. and YANEV,Sh. 1978
Research on the effect of radiation and chemical mutagens on durum wheat variability.
Bulgarian Acad.Sci.(Bulgaria), 200-207.

Grains of interspecific Triticum hybrids and durum varieties were treated with gamma rays, fast neutrons and ethyleneimine. Mutation rate was affected by genotype and was greater in interspecific hybrids than in true-breeding varieties. Several mutants had higher yields than the corresponding wild types.

778. KADAGIDZE,M.G. 1977
Experimental mutagenesis in breeding the Georgian durum wheat Shavpkha. (Ru)
Genet.Selekt.N.I.vavilova (USSR), 218.

Combined and separate treatment with chemical mutagens and gamma rays resulted in chlorophyll mutations and also in mutants with a higher content of protein, gluten and aminoacids. An increase in chlorophyll content was associated with an increase in protein and gluten content and vice versa.

779. KONZAK,C.F. 1981
Induced mutations for genetic analysis and improvement of wheat.
Proc.Int.Symp.IAEA.Vienna (Austria), 469-488.

Details are presented of studies at Washington State University on induced mutants of Triticum aestivum and T. durum with alterations in various plant, spike and seedling characters and resistance to Puccinia striiformis.

780. KONZAK,C.F. 1982
Evaluation and genetic analysis of semi-dwarf mutation of wheat.
Proc.Int.Symp.IAEA.Vienna (Austria), 25-37.

Data are presented on the genetic testers used in reduced height studies and the induced mutants and other stocks under investigation at Washington State University. Burt M937 was observed to carry the recessive gene rht4. It is suggested that the "tallness" loci may be loosely linked to the (Rht) Gai loci, resulting in some restriction to recombination and the apparent dominance of "tallness" observed by some investigators. A promising gamma radiation induced mutant of Karcag 522 is unusual because it has behaved as a complete dominant in all crosses made to date. Studies of several useful semidwarf durum wheat mutants are also outlined.

781. KRAVCHENKO,M.L. 1978
Improvement of winter durum wheat by means of chemical mutagenesis. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 1:290.

Treatment of the red-grained variety Rovenskaya 970 (Rovno 970) with N-nitroso-N-ethylurea produced a mutant with white grain and a yield equalling that of the initial variety and approaching that of the standard spring bread wheat Mironovka 808.

782. KULIK,M.I. 1977
Induced mutation in yield components in spring durum wheat. (Ru)
Prob.povysh.kach.Zerna (USSR), 281-282.

A study of 50 mutant lines and 12 control lines of the variety Khar'kov 46 revealed a significant increase in the variability and a change in the mean values of the following characters : ear length, spikelet number, number of grains per ear, grain weight per ear.

783. KULIK,M.I. and KHAVARNIKOV,P.K. 1977
Durum wheat mutations induced by chemical mutagens and radiation. (Ru)
Molekul. i Prikl.biofiz.s-kh.rastenii i Primenenie noveish. fiz-tekhn.metodov vs.kh.
Published in Kishinev,Moldavian SSR,1977 43-44.

Mutation was induced in spring durum wheat by gamma irradiation and with chemical mutagens. Several mutants with improved yield, 1000-grain weight and growth period were subjected to a second treatment using fast neutrones. This treatment resulted in mutants with a stronger stem derived from high-yielding forms susceptible to lodging, mutants with a shortened growth period derived from late midseason forms and mutants with higher yield from fairly low-yielding early forms.

784. KULIK,M.I. and KHAVARNIKOV,P.K. 1981
Useful induced mutants of spring durum wheat and their hybrids. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 9:176.

Mutants with high yield, shorter growth period, stronger straw, larger grain, reduced height and winter habit were induced in the spring durum wheat Khar'kov 46. When the mutants were intercrossed, new useful forms were obtained. Of 40 dwarfs and semidawrfs tested under different conditions, some appeared promising for direct cultivation without further improvement.

785. MAMALYGA,V.S. 1979
The effect of chemical and physical mutagens on spring durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 2:236.

Of 10 mutagens used on the variety Khar'kov 46, N-nitroso-N-methylurea was the most effective in the frequency and spectrum of mutations induced. A narrower range and a lower frequency of mutations occurred in the M2 than in the M3. Mutants were selected as breeding material.

786. MAMALYGA,V.S. and SHKVARNIKOV,P.K. 1976
Hereditary variation of spring durum wheat induced by chemical and physical mutagens. (Ru)
Genetika (USSR), 12:36-43.

787. MAMALYGA,V.S. and SHKVARNIKOV,P.K. 1977
Relative efficiency of different mutagenes in inducing useful mutations in spring durum wheat. (Ru)
Tsitol. Genet.(USSR), 11:227-230.

Grains of Khar'kov 46 were treated with eight chemical mutagens and gamma rays and high temperatures. No correlation was found between the frequency of mutations and the frequency of useful mutations. Treatment 1% hydroxylamine proved the most effective of all those tested. The most useful mutants were large-eared forms.

788. PACUCCI,G. and SCARASCIA,M.G.T. 1974
Agronomic evaluation of the durum wheat mutant line "Casteldelmonte".
Euc./FAO-IAEA Conf.Mut.Polyplo. (Italy), 247-258.

A mutant line, isolated from the cultivar Grifoni-235 after treatment with fast neutrons and registered under the name of Casteldelmonte, has been tested in agronomic trials at several locations in key areas of southern Italy from 1965-1966 to 1970-1971. The same mutant line has also been tested in multilocation trials on durum wheat mutants, carried out in Mediterranean and Near East countries, in comparison with other commercial varieties and selected new lines; the reactions to irrigation have been troroughly investigated. The yielding ability of this mutant line is greater than that of the mother variety, and is not significantly different from the Capeiti variety, the more widely spread durum wheat variety in southern Italy. With increasing N-doses, the yield of Casteldelmonte increases more than that of Grifoni-235. In irrigated conditions, its yielding ability is significantly greater than that of both Grifoni and Capeiti. In the semi-arid conditions, typical of many places of southern Italy, the main features of the new mutant variety Casteldemonte appear to be, besides yielding ability, a new pronounced adaptiveness, an appreciable earliness, a short straw and a suitable lodging resistance.

789. ROSSI,L. 1981
National Committee for Atomic Energy Researches: Programs of mutagenesis and genetic improvement (of T. durum) (It)
Agric.Ric. (Italy), 4:8-9.

790. SANZ de CORTAZAR,C. and HACKE,E. 1979
Relationship between length of coleoptile and height of adult plant in wheat (T.durum Desf) (Es)
Simiente (Chile), 49:33-34.

791. SANZ de CORTAZAR,C., HACKE,E. and RAMIREZ,A.I. 1980
Coleoptile length and mature plant height association in durum wheat, T. durum Desf.
Agric.Tecnica (Chile), 40:18-21.

Coleoptile length and mature plant height association was studied in 154 mutant durum wheat lines, selected in the M3 and M7 generations of the cultivar Candealfen 5 treated with chemical mutagen, and 23 non-treated durum varieties and experimental lines. No positive correlation and no significant chi square for independence were found between coleoptile length and mature plant height in the mutant lines. On the contrary a highly significant correlation (P = 0.01) and a statistically significant chi square value (P = 0.05) were obtained between the two studied characters in the non treated material.

792. SENDINO,A.M. and LACADENA,J.R. 1973
Cytogenetics studies of aneuploidy in the varieties Senatore Cappeli and Bidi 17 of T. durum Desf.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 91-99.

Seeds of the varieties (Senatore Capelli) and (Bidi 17) were irradiated with gamma-radiation. In the variety Senatore Capelli the M0 was cytologically analyzed. A dose-effect correlation was found when the effect was measured as the numbers of chromosome fusions per cell. Fertility percentages were also recorded. The origin of a M1 plant with 2n = 26 + 1 dicentric showing somatic mosaicism (26 + 1 dicentric/26 + 2 telocentrics) is discussed. Its meiotic behaviour was also analyzed. An M2 trisomic plant from a 28-chromosome M1 plant produced M3 trisomic and tetrasomic offspring. In the Bidi 17 variety, the meiotic behaviour of an M1 plant with 2n = 27 + telo was studied. This plant produced hypoaneuploid offspring. M2 trisomics have been found among the offspring of M1 structural heterozygous for reciprocal translocations. Haploid plants were found in polyembrionic seeds of the two varieties. Haploid crosses produced disomic offspring but two trisomic plants.

793. SHARMA,N.C. and GUPTA,P.K. 1978
Cytogenetic effect of gamma rays,EMS and hydrazine in Triticum durum.
J.Indian Bot.Soc. (India), 71.

When grains of the variety NP404 were subjected to the three treatments, structural aberrations such as translocations resulted from the 10 and 30 KR doses of gamma rays alone. LD50 data given for the three treatments.

794. SHKVARNIKOV,P.K. and KULIK,M.I. 1979
Some types of induced mutations in spring durum wheat as material for use in practical breeding. (Ru,En)
Cytol.Genet. (USA), 13:35-38.

Grains of Khar'kov 46 were treated with N - nitroso - N - ethylurea, N - nitroso - methylurea, diethyl sulphate, dimethyl sulphate, ethyl methanesulphonate, ethleneimine, hydroxylamine and fast neutrons. Some of the useful mutants obtained in the M2, including forms with short straw, early ripening and high yield are described. A chlorophyll mutant of the virescens type with good resistance to Puccinia recondita may be useful as breeding material.

795. VILLENA,L.M. 1976
Spanish dwarf wheat, 2: New variety of durum wheat Abadia. (Es)
Ann Est.Exp.Aula Dei.(Spain), 13:[illegible]18 195.

796. YANEV,Sh. 1976
Effect of gamma-rays and fast neutrons on the sensitivity and mutability of some durum wheat cultivars.
Genet.Plant Breed.(Bulgaria), 9:458-466.

797. YANEV,Sh. 1977
Agrobi[illegible]ical characterization of some durum wheat mutant forms.

Plant Sci. (Bulgaria), 14:43-49.

Gamma-rays, fast neutrons, ethylenimine (EI) and diethyl sulphate (DES) were used to induce the new mutant forms as M-H/192, M-5782/176, M-4575/187, 6322/225, etc. which may play an important role in the wheat breeding and in the farm production as direct varieties. Some of them are particularly valuable because of very good values of the most important biochemical characteristics.

798. YANEV,Sh. 1979
Mutation induced in durum wheat by treatment with gamma rays and ethyleneimine. (Bg)
Genet.Selekt.(Bulgaria), 12:409-415.

Grain of four varieties was treated with gamma-ray doses and ethyleneimine (EI). Judging by frequency of morphological and chlorophyll mutations induced, gamma rays were more effective than EI. The mutations induced affected mainly height, ear colour and leaf colour, and included fairly rare mutations of the compactoid and spherococcoid types, as well as short-strawed and early forms.

799. YANEV,Sh. 1979
Valuable durum wheat mutants.
Mut.Breed.Newsl.(Austria), 2-3.

Fast neutrons, gamma rays, ethyleneimine and diethyl sulphate were used for producing a series of mutants with good biological and commercial traits of which M-H/192, M5753/220, M5782/176, M4575/187 and 6322/225 may be used in breeding or directly as varieties.

800. YANEV,Sh. 1980
Short-strawed forms of durum wheat obtained by treatment with gamma rays and ethyleneimine. (Bg)
Rastinev"di Nauki. (Bulgaria), 17:29-35.

Grains of four varieties treated with gamma rays or ethyleneimine in order to produce lodging-resistant dwarf mutants. Mutant lines were obtained which were 42.4-73.4% shorter and 18-81% higher yielding than the initial variety and also contained 0.4-4.1% more protein and 4.4-8% more gluten.

801. YANEV,Sh. 1980
Effect of gamma rays and ethyleneimine on the growth, development and variability of durum wheat.
Genet.Selekt.(Bulgaria), 13:389-394.

Treatment of four varieties with gamma rays and ethyleneimine gave a mean M2 mutation frequency of 0.05-0.76%. The new mutant lines obtained, exceeded 233 in yield and grain quality. The varieties of hybrid origin (233 and 1812) were more mutable than the rest.

802. YANEV,Sh. 1980
Chemical and technological characteristics of durum wheat lines obtained by means of induced mutagenesis. (Bg)
Rastinev"di Nauki. (Bulgaria), 17:3-8.

Four Bulgarian varieties and the Soviet variety Odesskaya Yubileinaya were treated with gamma rays, ethyleneimine and N-nitroso-N-methylurethane. The promising mutant lines obtained included several with improved gluten and protein content and better macaroni-making quality than the standard variety 233.

803. YANEV,Sh. 1981
Sensitivity and variability of durum wheat following treatment with N-notroso-N-methylurethan (Bg)
Genet.Selekt.(Bulgaria), 14:89-95.

Of six varieties treated with N-nitroso-N- methylurethane, the most resistant was 2042. Judging by seedling mutations in the M2 was on average 0-0.75%. Brief descriptions are given of four dwarf lodging-resistant mutants obtained

804. YANEV,Sh. and SAVOV,P. 1978
Use of ethyleneimine to produce mutational changes in durum wheat.(Bg)
Rasteniev"di Nauki (Bulgaria), 15:18-25.

Grain of six varieties were treated with four concentrations of ethyleneimine. The percentage of morphological mutations obtained was 0.05-0.66 per cent, the most effective being concentrations between 0.02 and 0.04 per cent. Useful mutations affecting height, grain quality and grain size were obtained. These included line 1193/258, derived from 223 after treatment with a 0.01 per cent concentration, which was 8.2 per cent shorter than the initial variety and exceeded the standard in yield, 100-grain weight and gluten content.

Breeding Methods

805. AYDEM,N. 1982
Selection of parents for hybridization using discriminant analysis. (Tr)
Ege Uni.Zirat Fakultesi Dergisi(Turkey), 19:23-29.

Discriminant function analysis was applied to nine yield-related characters in five varieties of Triticum durum. Plant height, spikelets/spike, spike length, grains/spikelet and grain yield/plant contributed most to total genetic variation.

806. BAGNARA,D., ROSSI,L. and PORRENCA,G. 1973
Criteria of evaluation of new lines in durum wheat.
Genetica Agraria (Italy), 26:233-246.

The suitability for a particular range of environments of 15 advanced breeding lines and the variety Capeiti was assessed by the method of Eberhart and Russell. The parameters evaluated were b, the regression coefficient of individual yield on an environmental index, and s2d, the variance of deviations from this regression. High b values (i.e. high capacities for yield under favourable conditions) were associated with low minimum recorded yields and high values of s2d (i.e. the variance of deviations from regression coefficient of individual yield) it was concluded that s2d is a good indicator of the adaptability of a variety, while a high b value is a virtue only when the crop is unlikely to be subjected to unfavourable conditions.

807. BLANCO,A. and PORCEDDU,E. 1983
New approaches to durum wheat breeding.
Germ.Inst.CNR.Bari (ITaly), 5-14.

Most of the present durum wheat breeding programmes involve intervarietal hybridization of two homozygous or near-homozygous parents followed by several generations of self-pollination. Selection is carried out in the successive generations in a variety of ways, which represent variations of classical breeding methods. Distinctly different methodologies have recently been developed in order to shorten the time needed to reach homozygosity, to increase selection efficiency and to better exp[illegible] the genetic variability. The single seed descent method has been recommended for a rapid advance in generations and for maintaining more genetic variability. The techniques of production of a large number of haploids and of chromosome doubling can contribute to the durum wheat breeding. Haploidization and subsequent chromosome doubling to produce double haploid allow the development of completely homozygous lines from heterozygous parents in a single generation. When the breeder wishes to transfer only a single or a small number of characteristics from one parent to another, the use of pollen irradiation appears to be an alternative to the time-consuming series of three to six back-crosses and selection. Cytogenetic techniques which manipulate the genotype by chromosome engineering have been developed. These allow the directed transfer of whole or parts of chromosomes from related species. The major development in this area is the isolation of ph mutants which allow more precise transfer of alien segments to wheat. This increase in precision will be valuable since most transfers have been too gross to be easily incorporated into commercial varieties.

808. GRIGNAC,P., POUY,J. and TOMAS,A. 1978
Comparison of pedigree, bulk and single seed descent methods in wheat breeding for productivity (Fr)
Ann.Amelior.Plantes,France., 28:341-350.

Progeny of two crosses between durum wheat varieties: "Durtal" X "Agathe", were selected by three breeding procedures: pedigree method, bulk method and single seed method. At the end of breeding, the mean yield of the best lines obtained by the three methods did not differ significantly. Disease resistance is identical in conditions of strong selection pressure. But, the bulk method gives lines lower in protein than other methods.

809. MITCHELL,J.W., BAKER,R.J., KNOTT,D.R. and FASOULAS,A. 1982
Evaluation of honycomb selection for single plant yield in durum wheat.
Crop Sci. (USA), 22:840-843.

Fasoulas' honeycomb design was used to select for high and low yield among

single F2 plants from three crosses, each planted at interplant spacings of 30 and 60 cm. Response to selection, measured as the difference between the means of F4 progenies from high and low selections, was significant for all crosses with 60 cm spacing and for two of the crosses with 30 cm spacings. Correlations between single-plant yields in 1979 and plot yields in 1980 in one cross where progeny of all plants were tested indicated that (1) selection was slightly more effective with the wider spacing, (2) Fasoulas' method was slightly better than mass selection based on unadjusted single-plant yields, and (3) heritability of single-plant yield was 13 - 17%.

810. NIEHAUS,W.S. 1981
Effectiveness of harvest index and the honeycomb design in early generation yield evaluation in durum wheat.
Diss.Abstr.Int.B (USA), 42:868.

F2 plants from three crosses were selected for high and low harvest index (HI) and the progeny were grown in F4 yield trials. High HI selections produced higher yielding F4 lines than low HI selections. Selection for HI was not effective in material which was segregating for height. F2 plants from one cross were grown in a systematic arrangement with uniform competition referred to as a honycomb design. High-yielding plants selected from this design produced higher yielding F4 lines than random selections from the same cross.

811. PALVOLGYI,L. 1982
Methods to investigate the use value, of durum wheat.
Novenytermeles (Hungary), 31:263-268.

812. SALTYKOVA,N.N. and SUKHANOV,V.M. 1981
Methods of breeding winter durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 10:239.

The results are presented of Soviet work on the successful production of winter-hardy durum wheats by means of distant hybridization and tissue culture.

813. TANZARELLA,O.A., DE PACE,C., BLANCO,A., CAIRO,F. and SCARASCIA,M.G.T. 1982
Utilization of the genetic information from a diallel analysis for selection in durum wheat.
Genetica Agraria (Italy), 36:193-194.

A 5 X 5 diallel among high-yielding cultivars produced F1 progenies differing for yield, several yield components, height and flowering time. Factor analysis showed consistent results for four variance/covariance matrices (general combining ability, specific combining ability, error and total), indicating that the technique is useful in providing information on selection criteria either based on phenotypic values or on genotypic effects.

Breeding for Grain Yield

814. BAGNARA,D. and SCARASCIA,M.G.T. 1973
Outlook in breeding for yield in durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 249-269.

Examination is carried out of the main factors affecting yield in wheats, with particular reference to durum wheat. Physiological processes and environmental influences are considered, which, interacting, lead to the differentiation of plant structures mainly involved in yield determination: number of spikelets, number and size of caryopses, photosynthesizing areas particularly above the flag leaf internode, etc. Consideration is also made on morphological traits regulating interplant competition in the wheat field community: number, shape and size of leaves, tillering, etc. Finally, attention has been devoted to the physiological factors conditioning some aspects of photosynthesis, transport of assimilates, etc.

815. BHULLAR,G.S., BRAR,S.P.S. and GILL,K.S. 1981
Breeding value and combining ability studies in durum wheat.
Indian J.Genet.plant Breed.(India), 41:359-400.

Eight characters, including yield and five yield components, were investigated in the F2 from a diallel cross involving

ten genetically diverse lines or varieties. Yield alone was examined in the F1 and F4. Both general and specific combining ability (SCA) variances were significant for every character evaluated. Five good general combiners and six cross combinations showing consistently high SCA effects were identified.

816. BHULLAR,G.S., BRAR,S.P.S. and GILL,K.S. 1981
Combining ability for yield and its component characters in durum wheat.
Indian J.Agric.Sci.(India), 51:842-846.

General and specific combining ability (GCA, SCA) effects were significant for all eight yield components studied. Six varieties showed good GCA for grain yield per plant and most yield components. Six cross combinations showed high SCA for grain yield per plant.

817. DHONUKSHE,B.L. and RAO,M.V. 1979
Combining ability for yield and its component characters in durum wheat.
Indian J.Genet. Plant Breed. (India), 39:501-505.

Combining ability for yield and eight other component characters was studied in a 9x9 diallel cross in durum wheat. Three parents, viz.,'Anhinga S', 'Cocorit S' and 'CPAN 1469', were found to be the best general combiners for grain yield. Seven crosses exhibited significantly superior specific combining ability effects for grain yield. Both the parents of crosses, 'HD 4500 X Anhinga S', 'HD 4500 X Bijaga yellow' and 'Cocorit S X Bijaga yellow', were positive general combiners. It is suggested that the varieties showing good general combining ability may be used in a multiple crossing programme for isolating high yielding varieties in durum wheats.

818. DHONUKSHE,B.L. and RAO,M.V. 1979
Gene system governing yield and its component characters in durum wheat. (India)
Indian J.Genet. Plant Breed. (India), 39:396-401.

The nature and magnitudes of genetic variances controlling grain yield and its eight component characters were investigated in a diallel cross among nine parents of durum wheat. Both additive and non-additive genetic effects were important in the expression of the different characters studied. However, the magnitude of additive component was higher than the nonadditive component for all the characters excepting number of tillers per plant, 1000-grain weight and grain yield per plant. It is suggested that a breeding methodology that can exploit both additive and nonadditive genetic effects would be the most effective in attaining maximum improvement in yield and its component characters in durum wheat.

819. DOROFEEV,V.F., KHORIKOV,C.S., KRAVCHENKO,N.A., DAVIDOV,S.E. and RUDENKO,M.I. 1980
New approach to the methodology of studying and producing durum wheat breeding material in northern Kazakhstan. (Ru)
Tr.Prikl.Bot.Genet.Selek.(USSR), 68:3-7.

General breeding value (GBV) for yield reflects the ability of a variety or line, when crossed with different varieties, irrespective of the direction of the cross, to give stable lines outyielding the best standard variety. It differs from (GCA) in being determined in stable material of late generations in order to reflect capacity to transmit stable high yields. Unlike (GCA) it cannot be determined in early generations because it is distorted by the heterotic effect.

820. DOROFEEV,V.F. and RUDENKO,M.I. 1978
Prospects for breeding and increasing grain production in durum wheat. (Ru)
Kuibysk.Kinz.Izadet'stvo. (USSR), 16-28.

821. GRIGNAC,P. 1973
Relations between yield, components of yields of durum wheat and certain morphological characters.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 275-283.

The relationship between yield, components of yield and certain morphological characteristics, in normal cropping conditions and on every lodging resistant lines of durum wheat have been studied. The component of yield most narrowly linked with yield is the number of grains per spike which rapidly

increases with the improvement of cultural practices. But, it is preferable to increase the number of spikelets per spike in the case of intensive cultivation. It has been possible to compute the optimum values of the morphological characteristics which influence the yield determination: length of the last internode, length of the spike, ratio between lengths of the last internode and the stem, ratio between diameters of the last internode and the last node.

822. KHORIKOV,C.S., DAVYDOV,S.E., KRAVCHENKO,N.A., LOGUNOVA,N.A. and TRISHNEV,V.F. 1980
Effectiveness of selection for yield in elite plant from hybrids of spring durum wheat art different sowing dates in northern Kazakhstan. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 2:254.

The best sowing dates for hybrid material, to ensure effective selection of high-yielding forms and maximum suitability for the local climate were established. An early sowing date is recommended.

823. RAUT,R.S., DESHMUKH,N.Y. and PHALKE,A.M. 1977
Inter-relationship among yield and its components in T. aestivum L.and T. durum L.
Coll.Agric.Nagpur Magazine (India), 49:39-44.

A study of the correlations between grain yield, five yield components, number of days to maturity and plant height in 30 varieties of T. aestivum and T. durum revealed that grain yield was positively and significantly correlated with grain and spikelet number per ear, tiller number per plant, ear length. Among the yield components, the highest association occurred between spikelet number per ear and grain number per ear, plant height and 1000-grain weight, and tiller number per plant and spikelet number per ear.

824. SALEEMI,A.R. 1982
Development of high yielding durum wheat (Triticum ssp.) in Pakistan.
Pakistan J.Agric.Res.(Pakistan) 3:125-128.

825. SHECHUK,N.S. and KORCHINSKII,A.A. 1980
Yield in winter durum wheat hybrids in relation to heterosis. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 9:110.

826. SRIVASTAVA,J.P., JANA,S. and NIKS,R.E. 1984
Parallel selection: An approach to increase grain yield and stability.
Proc. 6th Inter.Wheat Genet.Symp.(Japan) 725-733.

ICARDA's durum wheat breeding program in Syria has carried out selection under relatively unfavorable low rainfall conditions as well as under irrigated, high fertility conditions. Results indicated that for low rainfall area maximum benefits are realized by selecting in both environments and from selecting only in the favorable environment.

827. SYED SADAQAT MEHDI and SIRAJ-UD-DIN SHAH 1979
Variability and correlation studies in durum wheat.
Pakistan J.Sci Res (Pakistan), 31:26-28.

Information is presented on variation in yield and five yield components in 35 varieties, together with correlation coefficients. Plant height and 100-grain weight appeared to be the best criteria in selecting for yield.

828. VENEZIAN,M.E.S. 1982
Triticum durum : How to increase the yields. (It)
G.Agric. (Italy), 92:23-25.

829. VERMA,P.K. and LUTHRA,O.P. 1983
Heterosis and combining ability analysis for yield and its attributes in macaroni wheat.
Indian J.Agric.Sci. (India), 53:385-389.

Additive genetic effects predominated for grain yield and its components but not for biological yield. In an eight-parent diallel, without reciprocals, MASC 147 and Meghdoot showed good general combining ability for grain yield and some of its components. Of the 28 crosses, MACS 147 X Meghdoot and MACS 147 X Raj911 were promising for grain yield/plant and biological yield/plant. The former was

also promising for spike/plant and the latter for grains/spike while MACS 147 X Malvaraj was good for harvest index. These three crosses showed heterosis over both the better and best parent for grain yield/plant.

Breeding for Stress Tolerance

830. ARORA,N. 1979
Anatomical characteristics of triticum, triticale and secale in relation to resistance to lodging and productivity.
Crop Improvement (India), 6:135-140.

831. BLUM,A., GOZLAN,G. and MAYER,J. 1981
The manifestation of dehydration avoidance in wheat breeding germplasm.
Crop Sci. (USA), 21:495-499.

The purpose of this investigation was to document the existence of and variability in dehydration avoidance within a random sample of advanced and well-adapted wheat (Triticum sp.) genotypes. Midday leaf water potentials (Nl), as a measure of dehydration avoidance, were monitored with a pressure chamble in the various wheat genotypes, simultaneously subjected to soil moisture stress in three different field tests . Leaf diffusive resistance (Rl) was monitored with a diffusion porometer in two of the tests. Genotypes varied significantly in their midday leaf water potentials. About 2 bars of (Nl) were sufficient to differentiate significantly between genotypes. Variations in (Nl) were greater than variations in Rl among genotypes. The largest difference in (Nl) between extreme genotypes, as observed in these tests, reached 12.9 bars. In one test, where drought stress developed during the spike development stage, leaf water potential (but not leaf diffusive resistance) was correlated with the final number of grains per spike across genotypes of similar phonology. Linear regressions developed for each genotype between (Nl) and Rl revealed large variations among genotypes in stomatal response to (Nl). These relationships lead to the conclusion that dehydration avoidance in only a few of the genotypes may have resulted from stomatal sensitivity and closure at low stress levels. Most of the avoidant genotypes, however, maintained relatively open stomata.

832. BOZZINI,A. 1973
Breeding durum wheat for the Near East and North Africa. In Proceedings of the Fourth FAO/Rockefeller Foundation Wheat Seminar, Tehran, Iran, 21 May- 2 June,1973.
FAO Publ.Rome (Italy), 179-173.

Several lines with promising winter survival have been identified among material originating from the Balkan area and from crosses between winter-hardy bread and durum wheats. Cold resistance has also been identified in material from Turkey, Iran and the USSR. A series of promising lines for arid areas around the Mediterranean basin and the Near East has been developed.

833. DUWAYRI,M. 1980
Studies on drought tolerance in wheat. (Abstract) Paper presented in the meeting of cereal production in Arab World, held in Mosul University Sept.1-3, 1931.
Amman Univ.Fac.Agric.(Jordan), 1.

The objectives of the present study were to identify wheat varieties that are capable of resisting or enduring drought environments in its different growing stages. Various wheat varieties ware tested for their ability to germinate and be established under simulated drought conditions. It was found that the durum varieties Hourani, Wascana and the bread wheat variety Pavon 76 were among the best germinators as compared to Mexicali 75 which was the poorest germinator. The use of 10 ppm of GA enhanced the germination of the tested varieties under severe stress conditions. Furthermore the cell membrane stability technique was used as a measure for drought in the heading stages of wheat. There were differences among the varieties. However there was no positive correlation between germination under stress and percent injury of the cell membrance.

834. DUWAYRI,M. 1983
Comparison of wheat cultivars grown in the field under different levels of moisture.
Cereal Res.Commn.(Hungary), 12:27-34.

The objective of the experiment was to evaluate the performance of four wheat

cultivars under different levels of moisture and to identify certain mechanisms which can be used to screen for drought resistance. The durum cultivars Hourani, Stork and Wascana and the spring wheat Pavon 76 were grown in the field under three levels of moisture stress: Rainfed conditions (R): supplementary irrigation (SI) and stress (S) imposed at 3 leaf stage. Moisture levels affected the traits studied with stress treatment significantly reducing biological, grain and straw yield, plant height and area of flag leaf. The cultivars differed in the traits studied. Though no interaction was observed between variety X moisture level, the local cultivar Hourani was more stable under the moisture levels tested. The semidwarf cultivar Stork produced the highest grain yield (3284 kg/ha) under supplementary irrigation and the yield was reduced by 35% when exposed to the stress treatment. Under supplementary irrigation Hourani produced the lowest grain yield which was reduced only by 18% when grown under stress. Significant effects were not observed for moisture levels tested on flag leaf area after heading and on relative water content (RWC). However, data showed that the reductions in the leaf area of Hourani and Wascana upon growing them under stress compared to (SI) treatment were smaller than in the case of Stork and Pavon 76.

835. GEBEYEHOU,G. and KNOTT,D.R. 1983
Response of durum wheat cultivars to water stress in field and greenhouse.
Canadian J.Plant Sci.(Canada), 63:801-814.

In the field the varieties did not differ significantly in drought resistance in terms of yield but did differ in the effect of water stress on yield components, such as number of grains per spike, number of spikes per plot and 1000-grain weight. Varietal performance was not consistent for yield components or between years. In greenhouse tests, the varieties which grew most under normal conditions showed the largest reduction in growth under stress. Overall, there was little evidence of significant differences in drought resistance but Pelissier and Wakooma appeared to be the most resistant.

836. GERMANTSEV,L.A. 1978
Breeding drought resistant varieties of durum wheat in the Volga area. (Ru)
Kuibysh.Kinz.Izadet'stovo.(USSR), 50-56.

A description is given of the recently bred variety Krasnokutka 6 (wheat from Krasnyi Kut 6), bred from Leucurum 2677 X Melanopus by open pollination. It has a white awned ear, highly vitreous white grain, an erect habit and a height of 70-90 cm. Its growth period is 82 - 87 days. It is resistant to lodging and shedding. Gluten content is 39% and protein content is 18.7%. It yields 35-40 c/ha.

837. JANA,S., SRIVASTAVA,J.P. and GAUTAM,P.L. 1983
Evaluation of genetic resources of durum wheat for salt stress tolerance.
Proc.6th Int.Wheat Genet.Symp.Japan., 137-141.

About 3000 durum wheat accessions from diverse sources were evaluated for response to salt stress in the field and controlled environment. Ten accessions were found to withstand moderate to high levels of salt concentrations. Some of these lines were adapted to both short-day Mediterranean and long-day temperature climates. These lines are expected to possess multiple stress tolerance and wide adaptation.

838. KIRICHENKO,F.G. 1973
Methods and results of breeding durum wheat in the steppe regions of Ukranian SSR.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 305-309.

Main objective of the durum wheat breeding in Ukraine is the development of winter forms of durum wheat suitable for the severe environmental conditions of the steppe region. This problem was solved by interspecific hybridization of winter hard varieties of T. aestivum with spring varieties of T. durum.

839. KIRKHAM,M.B. 1981
Temperature coefficients as a screening test for drought resistance in wheat.
Indian J.Genet. Plant Breed.(India), 41:110-113.

This paper has suggested that it might be possible to predict whether or not a cultivar is drought resistant by

calculating Q10 values using climatological information and heading dates. These data are readily available and the Q10 values could be determined quickly. Cultivars with higher Q10 values might be more drought resistant than those with lower values.

840. NATH,S.B. and GHOSAL,K.K. 1978
Proline accumulation as a selection index for water-stress resistance in Triticum genotypes.
Indian Agriculturist (India), 22:35-39.

Accumulation of proline moisture-stress was employed as a selection index for screening triticum genotypes to identify their resistance against moisture-stress condition. Out of ten aestivum varieties, only three (HD4519, K7340 and Janak) were found to accumulate significant amount of proline in rainfed condition, whereas none of two durum varieties (N59, Raj 911) was promising in this respect. The only one variety of T.dicoccum (Ex33) showed itself to be resistant to stress on the basis of this selection index.

841. RAZUMOVA,I.I. 1980
Drought resistance in forms of spring wheat useful for breeding in the povolzh'e. (Ru)
Genetike i Selektsii. (USSR), 68:83-86.

Of about 300 varieties of bread and durum wheat evaluated during 1975-77 in the Povolzh'e (Volga Lands) area of the USSR, the most drought resistant durum wheat were Lakota, Wells, Leeds, Candeal 15, Candeal 17, Candeal 19, Melanopus 69, Melanopus 26 and Khar'kovskaya 46. The most useful varieties, combining high drought resistance with high yield and good grain quality, were Lakota, Amber N3 and Melanopus 69. Drought resistance based on the permeability of the leaf cytoplasm measured by electrolyte diffusion, was also measured.

842. RICHARDS,R.A. 1983
Should selection for yield in saline regions be made on saline or non-saline soils?
Euphytica (Netherlands), 32:431-438.

Saline soils are typically very patchy in their salinity and the yield of crops growing on them is similarly patchy. The authors present arguments that because most of the yield from saline soils comes from the least saline areas, the best breeding strategy for improving the overall yield of crops growing on them may be to select for high yield on nonsaline soils.

843. RUDENKO,M.I., BARASHKOVA,E.A. and SHAIDUKO,N.T. 1981
Frost resistance of a collection of T. durum forms. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 70-74.

The resistance of 160 lines was tested by direct exposure to - 13 deg C and by a rapid laboratory method using seedlings. High resistance under the direct exposure method was shown by D1001/76, K51862, and Hordeiforme 25.

844. SHULYNDIN,A.F. 1980
New genetic resources in breeding winter wheat. (Ru)
Selekts.Semenov. (USSR), 14-15.

In a trial of interspecific hybrid lines obtained by crossing the bread wheats Avrora and Kavkaz with the durum wheats Khar'kov 1 and Khar'kov 909 (1978-79), one line from Avrora X Khar'kov 1 (r7) exceeded the bread wheat Mironovskaya 808 in yield by up to 78% (with a yield of 34.6 c/ha) and in cold resistance, and also proved resistant to Fusarium.

845. WELTZIEN,E. and WINSLOW,M.D. 1984
Resistance of durum wheat genotypes to saline drought field conditions.
RACHIS (ICARDA,Aleppo,Syria), 3:34-36.

This article reports one-year data on differences among durum wheat genotypes in resistance to saline-drought field conditions and the performance of durum relative to the more resistant barley crop. Promising selection criteria for future improvement of stress resistance in durum are discussed.

Breeding for Disease Resistance

846. ANGELOV,I., MICKOVSKA,V. and GEORGIEVA,O. 1980
The inheritance of susceptibility to natural infection by Erysiphe graminis D.C.f.sp. tritici marchal in single crosses, Their reciprocals and backcrosses in T. durum. (Ru)
God.Z.Zenjod.Fac.Univ.Skopje (Poland),

29:189-194.

When the resistant ZT1 was crossed as seed parent with the completely susceptible Crvenka (Red wheat), F1 plants were all resistant, but the F2 segregated in the ratio 1 resistant: 2 intermediate: 1 susceptible. The F1 from the reciprocal cross and backcrosses of these F1s to Crvenka all displayed an intermediate reaction, whereas 82% of the other backcross progeny was resistant. In the F2, 5% resistant, 60% intermediate and 35% susceptible plants segregated.

847. BABAYANTS,L.T. 1982
Donors of disease resistance in the south of the Ukraine. (Ru)
Nauch.Tekhn.Byul.Vses.Sel.Gen.Inst(USSR) 4:61-66.

Donors of resistance to Puccinia graminis, P. striiformis, Tilletia caries and Erysiphe graminis are listed. Rust resistance has been transferred from some bread wheats to durum wheat by interspecific hybridization. Hybrids obtained are being used as donors of resistance in breeding durum wheat.

848. BACCHI-LAZZARI,L. 1981
Emila-Romagna: Good production (of T. durum) in spite of Fusarium and low temperature. (Italy) (It)
Infor.Agr (Italy)., 37:17448-17450.

849. BAHADUR,P., SINHA,V.C., RUIKER,S.K. and UPADHYAYA,Y.M. 1978
Horizontal and vertical resistance in exotic durum wheats.
Indian J.Genet.Plant Breed.(India), 37:328-334.

One thousand entries of germ plasm of exotic durum maintained at Indore Centre, India were screened under natural conditions for rusts, smut, powdery mildew and leaf blight; and in the glasshouse for individual races of leaf and stem rusts and foot-rot. For field screening, entries were sown in "hot spots"-Indore, Dholakuan, Ludhiana, Ropar, Mahabaleswar and Wellington from 1973 to 1975 under medium fertility conditions. Out of the one thousand entries, 17 were found promising for rusts and smut. ED nos.76, 82, 155, 375, 784 A and 1096 appeared resistant to both leaf and stem rusts in the field and also in the glasshouse to many races, thus showing horizontal resistance. ED 404 possesses excellent field resistance to all the 3 wheat rusts, but shows susceptibility to many individual races of leaf and stem rusts at the seedling stage. Other entries show resistance to one or the other rusts indicating vertical resistance in them at the adult stage. All these entries are late maturing and escape smut infection. ED nos. 76,375 and 404 also exhibit excellent resistance to powdery mildew. ED 76 is resistant to leaf blight and ED 89 moderately susceptible to it. For root-rot, ED 368 manifests resistance and ED nos. 76,80,91, 103 and 155 moderate resistance.

850. BAIGULOVA,G.K. and KISLYUK,A.Z. 1976
Determining degree of rust resistance in some varieties of durum wheat .(Ru)
Zemledeliya.UZ.(USSR), 11:29-33.

Under conditions of artificial infection Leucurum 3, Leucurum 6, Leucurum 21, Melanopus 1, Melanopus 2, Melanopus 110, Apulicum 232 and Altyn were moderately resistant to Puccinia recondita and P.striiformis.

851. BASILE, R., BIANCOLATTE,E., CECCHI,V., CEOLONI,C. and CORAZZA,L. 1979
Field observation on the behaviour of wheats towards rusts and powdery mildew carried out in 1978-1979.
Ist.Sper.Cerealicoltura,Rome (Italy), 66.

In 1978-1979, 760 wheats were tested including: 1) differential and additional lines and varieties with specific genes for resistance to rusts and powdery mildew, 2) commercial and old varieties, 3) material under selection, not yet released, of bread and durum wheats. Generally, this year climatic conditions did not favor severe rusts and powdery mildew epiphytotics especially in northern and central Italy. Most of the cultivars more widely grown in Italy turned out to be susceptable to rusts and powdery mildew, whereas some of new varieties showed excellent resistance, including durum cv. Belfuggito, Creso, Valgerardo, Valnova, Valitalico and Valsacco. Several new selections, besides, resulted highly resistant to more than one disease.

857. BURDUN,A. and GUIDA,A. 1983
New durum spring wheat line resistant to cereal leaf beetle.
Cereal Res.Commu.(USSR), 11:147-148.

Solnyshko was selected for its early maturity, high productivity, Puccinia and Erysiphe graminis resistance and for its high resistance to Oulema melanopus. The pedigree of Solnyshko is: Krasnodarskaya 362// Multico-Italicum 59h 132// F1 R D55-1/ Cocorit 71. Solnyshko has significantly more trichomes/mm2 leaf than other commercial cultivars.

853. CARIELLO,G., CASULLI,F. and VALLEGA,J. 1977
Races, efficacy of some resistance genes and responses of some varieties of durum wheat (T. durum Desf.) and bread wheat (T. aestivum L.) to P. recondita f.sp. tritici in Italy. (It)
Phytop.Mediterranea (Italy), 16:51-64.

The varieties most resistant to races of P. recondita f.sp. tritici collected in Italy were T.aestivum 'Elia', T.durum 'Valgerardo' and those carrying Lr9, Lr1, Lr2a, Lr10 and Lr3. Of 42 durum wheats grown in Italy, ten were resistant to all eight races and a further twelve to some of them.

854. CORAZZA,L. 1980
Field and greenhouse reaction of some Italian wheat (T. durum and T. aestivum) varieties to the race 11, 34, 344 of P. graminis pers.f.sp. tritici Erikss.et Henn (It)
Ann.Ist.Spor.Patol.Veg.,Rome (Italy), 6:45-48.

During two consecutive years, 1978 and 1979, the reactions to three races of P. graminis f.sp. tritici: 11,34 and 344 of some Italian varieties of durum and bread wheat have been tested in the greenhouse and in the field. Only the more recent varieties of durum wheat were found to be resistant.

855. DOBREV,D., ZHELEV,Zh.G. and LALEV,T.S. 1981
Research on the resistance of some imported and indigenous durum wheat cultivars to powdery mildew.
Rastenniev'd Nauki (Bulgaria), 18:122-129.

In glasshouse trials cvs. were inoculated with 5 races of Erysiphe graminis. Observations were also made in the field under natural infection. Gerardo, Valgerardo, Bacum and No. 2833 were completely resistant.

856. EL AHMED,A, MAAMOURI,A.R. and DEGHAIES,M. 1984
Wheat breeding for Septoria resistance in Tunisia: Identification of resistant genotypes.
FACHIS (ICARDA,Aleppo,Syria), 3:20-22.

A study was made in the 1981/82 season to evaluate a large number of wheat cultivars for their resistance to Septoria. 17 out of 262 durum wheat lines tested were resistant to Septoria leaf blotch.

857. FORNI,C. and ZITELLI,G. 1979
Preliminary results of studies on resistance sources to Septoria tritici in wheat.
Genetica Agraria (Italy), 33:383-392.

Some varieties of durum and bread wheat have been tested in the field and under controlled conditions. Bread wheat Atlas 66 and durum wheat Jaopar seemed to be most resistant varieties to the leaf blotch. In addition F4 progenies, derived from cross Atlas 66 X Super X, have been tested in the field under natural infection. The analysis of data indicated the probable independence of resistance to S. tritici from plant height and earliness. It was possible to select early and short plants resistant to the leaf blotch. The F5 progenies from these selected plants were examined through artificial infections under controlled conditions. 57 out of the 108 selected plants appeared resistant.

858. GOEL,R.K. and JHOOTY,J.S. 1984
Screening of wheat germplasm for resistance to flag smut.
Indian J.Agric.Sci.(India), 54:739-741.

Of 85 Indian and foreign varieties and lines of Triticum aestivum and 14 of T. durum screened for resistance to Urocystis agropyri both under natural (soil-borne) conditions and following grain inoculation, all 14 varieties and lines of T. durum remained immune.

859. GRAS,M.A. 1980
Disease resistance in wheat: 1. T. dicoccum as a source of genetic factors against rust and mildew.
Genetica Agraria (Italy), 34:123-132.

In this work we have examined the behaviour of 309 strains of T.dicoccum with respect to three biotypes of Puccinia graminis; and to a population of Erysiphe graminis. From the results obtained, it appears evident the general tendency of T. dicoccum to susceptibility to stem and leaf rust. For P. recondita, a good percentage of resistant and moderately resistant strains has been observed. For Erysiphe graminis, a predominant percentage of resistant strains has been obtained. 17 strains of T. dicoccum have shown, in controlled conditions, a combined resistance to all the three pathogens, but only 8 out of these strains have maintained such resistance to stem and leaf rust also in the field.

860. KIRICHENKO,F.G. and KOSTENKO,A.I. 1983
Results and prospects in breeding spring wheat for arid steppe regions of the Ukrainian SSR. (Ru)
Nauch-Tekhn.Byul.Vses.Se.Gen.Inst.(USSR) 7-12.

The main trends in selecting parents for crossing, in particular the production of parent material with resistance to diseases and pests, are examined. Methods of obtaining several hybrid generations in one year are indicated. The production of the spring durum wheat Nakat and the spring bread wheat Zhuravka is described in detail.

861. KIRICHENKO,F.G., PYL'NEV,V.M. and SLYSARENKO,A.G. 1980
Breeding winter durum wheat for resistance to stem rust. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 5:191.

Forms of the steppe ecotype with resistance to Puccinia graminis were produced using the donor Leucurum R1 which carries a single dominant gene for resistance to race 21. Data are given on yield, grain quality and frost resistance in the forms produced.

862. KOSTENKO,A.I. and SAMBUU,A. 1982
Breeding value of disease-resistant spring wheat varieties of different geographical origin in the steppe zone of the southern Ukraine. (Ru)
Nauch-Tekhn.Byul.Vses.Se.Gen.Inst.(USSR) 11-13.

An evaluation of 540 varieties for resistance to Erysiphe graminis and Puccinia recondita, was carried out and recommendations made. Some of the material was used in breeding hybrids resistant to P.recondita. Among durum wheats the following were highly resistant to P. recondita: Izumrud, Krasnodar 302 and Melanopus 7.

863. KRAKAR,P.J. 1980
Nature and inheritance of ergot (Claviceps purpurea Tul.)susceptibility in T. timopheevii (Zhuk) X Secale cereal L. and Triticum timopheevii (Zhuk) X T. durum L. hybrids. (Fr)
Diss.Abstr.Int.(USA),B., 40:2924.

Specific combining ability (SCA) effects for susceptibility were significant in the F1 of T. timopheevii X S. cereale inoculated with the R3A isolate. Both general combining ability (GCA) and SCA effects were significant for sclerotial frequency and total sclerotial weight when the F1 of T. timopheevii X T. durum was inoculated with M15A, while only GCA effects were significant for both susceptibility traits when inoculated with R3A. The most promising resistance results were obtained from crosses of T. timopheevii accession 4B288 with rye line 127 or T. durum cultivar Carleton.

864. KRIVCHENKO,V.I., MEDVEDEV,A.M. and GRIGOR'EVA,O.G. 1978
Resistance of durum wheat to P. recondita. (Ru)
Kuibysh.Kniz.Izadet'stvo (USSR), 36-39.

Among 500 varieties screened, 15 were selected as highly resistant, including 4B260 from Canada, 319403 from the USA, Geardo 512 from Argentina and H12450 from Portugal.

865. LALEV,T.S. 1978
Resistance of some varieties and breeding lines of durum wheat to brown and black rusts and to fusarium. (Bg)
Rastenievd dni Nauki.(Bulgaria), 15:141-148.

During 1973-76 some 600 varieties were screened for resistance to nine races of

Puccinia recondita and eight races of P. graminis under field conditions, and 128 varieties for resistance to four races of each rust under greenhouse conditions. In addition, 50 varieties were screened for resistance to F. graminearum (Gibberella zeae) under artificial conditions of infection during 1975-76. The most resistant to G. zeae were the forms 788 and 2460. The varieties fell into five groups with respect to rust resistance.

866. MEYER,H. 1982
Investigations into hereditary transmission of mildew resistance in Tetraploid wheat [T . durum Desf.and T . dicoccum Schrank].
Arch.Zuechtungschung (Germany D.R.), 12:109-115.

In 16 tetraploid wheat varieties (Triticum durum Desf. and T. dicoccom Schrank) mildew resistance was found to be controlled by one or two genes which were recessive or dominant. Results obtained in the context of F2 segregations suggested that the wheat families tested included resistance genes of test varieties 'Hope', 'Ulka' or 'Axminster', and perhaps, 'Weihenstephan M1', in addition to other factors which were not identified in detail. Several lines in which resistance genes could be present in isolation or in combination were recorded.

867. MITOV,N., SAVOV,S.G. and ZHELEV,Zh.G. 1978
Resistance of durum wheat varieties to races of Ustilago tritici f.Sp.tritici duri. (Bg)
Rasteniev'd Nauki. (Bulgaria), 15:128-134.

During 1976-78, in tests of 56 varieties for resistance to five races, the following were selected as useful breeding material resistant to all the races tested : Candeal 5, Candeal 17, Candeal 19, Italicum 1883 and Maliani 78. Varieties showing combining resistance to two or more of the common diseases (loose smut, brown and stem rusts and powdery mildew) included Maliani 1, Lacota 038, Apulicum 23311 and Garigliano.

868. MUSTAFAEV,I.D., IBRAGIMOVA,A.I., ALI-ZADE.A.V. and FIGAROVA,V.V. 1979
Sources of resistance to fungal diseases of durum and soft wheat and their use in wheat breeding [Azerbaidzhan]. (Ru)
Vestn.Sel'sk-Khoz Nauki. (USSR), 1:19-25.

53 variety specimens with the group immunity to yellow brown rusts, powdery mildew have been selected against the natural background. Donors of resistance to two or three diseases have been obtained as a result of the field and glasshouse evaluation against the background of the artificially-induced infection. A group of variety samples has been isolated with genes which control the resistance to yellow and brown rusts. The resistance did not change with age in most variety samples which allow estimation of susceptibility of intermediate links of the breeding material to fungal diseases under glasshouse conditions. The analysis of the resistance of parental forms and hybrids of the first and second generations showed certain regularities in the resistance.

869. NEGULESCU,F. and TAPU,Z. 1978
Resistance of varieties and lines of winter durum wheat, bred at the Research Institute for Cereals Industrial Crops, Fundulea, to yellow rust. (Ro)
Prob.Genet.Teor.Aplic.(Romania), 10:493-498.

All the 14 lines bred at Fundulea were susceptible at seedling stage to one or more races of Puccinia striiformis, although most had some field resistance. The two varieties bred were susceptible to all common races at the seedling stage but Topaz had better field resistance than the Bulgarian variety Apulicum 233. The similarity of performance reflects the similarity of parentage of the material.

870. PANDEY,H.N. 1984
Development of multilines in durum wheat cultivars.
RACHIS (ICARDA,Aleppo,Syria), 3:9.

Multilines were developed for durum wheat to increase the stability for resistance to stem rust. The multilines showed a significantly lower rate of rust spread than the individual susceptible and maintained a high degree of population resistance.

871. PANDEY,H.N. and RAO,M.V. 1984
Differential behaviour of aestivum and durum wheat to races 77 and 106 of leaf rust (Puccinia recondita Rob.ex Desm.).
Wheat Infor.Serv.(Japan), 34-35.

Seedling tests showed that 7 of the 10 Triticum durum varieties were resistant to race 77 and 3 were resistant to race 106. Comparison with known responses of T.aestivum lines showed that only 2 of the T.durum varieties resistant to race 77 carried Lr10. The other resistant T.durum varieties did not carry Lr10, Lr24, Lr25, Lr26, Lr27, Lr28, or Lr29 indicating, that other resistance factors are involved in T.durum.

872. PASQUINI,M. and ZITELLI,G. 1979
Inheritance of resistance gene to stem rust in Gaza [T . durum] and their relationship with those present in durum wheat varieties.
Genetica Agraria (Italy), 33:371-382.

The resistance of F2 populations and F3 families from crosses between Gaza and the susceptible Cappelli, and between Gaza and Valgerardo and Valsacco, to Puccinia graminis was studied. The resistance factors in Gaza are different from those in Valgerardo and Valsacco. F3 families from the latter 2 crosses, which combined the genes carried by the different parents, proved resistant to both races.

873. PIGLIONICA,V. 1977
Resistance of durum wheat cultivars to Fusarium culmorum and the difficulty of bringing greenhouse data into agreement with field results.
Proc.Int.Symp.IAEA.Vienna (Austria), 409-427.

When 192 cultivars were grown in the field and in the greenhouse, the range of host responses to artifical infection in the greenhouse was much wider than in the field. Also cultivars did not behave similarly in the field and in the greenhouse. Factors that could cause this disagreement are discussed, including environmental effects and the possibility of infection with other pathogens.

874. PLAKHOTNIK,V.V. and TROITSKAYA,L.A. 1980
Results of a search for rust resistant durum wheat lines. (Ru)
Selekts.Semenov.(USSR), 23-24.

In field trials 2275 samples of spring durum wheat from 37 countries of 15 geographical regions were inoculated with races 17, 24, 34 and 40 of stem rust (Puccinia graminis) and races 20, 77, 122 and 192 of brown rust (P. recondita), which are most widespread in N. Kazakhstan complex. Immunity, high yield and grain quality were found in Towner from USA; DF 139 RL 3207, Stewart 63, RL 208 and 137 RL 3207 from Canada; and CBPP 66 Nos. 405, 429, 411 and 446 from Chile.

875. PRABHAKARA,M.V. 1977
Transfer of genes for stem rust resistance from Agropyron elongatum and Imperial rye to durum wheat.
Proc.Int.Symp.IAEA.Vienna (Austria), 527-531.

The Agropyron elongatum gene for resistance to Puccinia graminis f. sp. tritici on chromosome 6A of a translocation line of the hexaploid wheat variety Thatcher was transferred to the susceptible durum wheat Jaya through a series of back crosses. Homozygotes were not obtained because of the absence of male transmission in a T. durum background. The gene for resistance to P. graminis f.sp. tritici from rye was transferred to Jaya through a series of back crosses using a ditelocentric addition line of Chinese spring wheat which had a pair of rye telocentrics for the short arm of chromosome 3P. Transmission of the rye telocentric was only 11-13 per cent when selfed. After irradiation, a resistant plant with 28 chromosomes that formed 14 normal bivalents was obtained. Transmission of resistance in this line was normal through female gametes but was nonexistant through the male gametes.

876. RAO,M.V.P. 1979
The transfer of alien genes for stem rust resistance to durum wheat. In Proceedings of the Fifth International Wheat Genetics Symposium Vol.1. New Delhi.
Indian Soc.Genet.Plant Breed.(India), 338-341.

Attempts were made to transfer genes for stem rust resistance from Agropyron elongatum and Imperial rye to a local

durum wheat var. Two durum-rye translocations and 1 A.-durum translocations show normal female transmission but no male transmission. Homozygotes have not therefore been obtained for any alien translocation in durum background, although there was no such difficulty when the genes were transferred to hexaploid wheat. The transfer of alien genetic variation to durum wheat may be more difficult to obtain because of the reduced buffering effect of the tetraploid genome.

877. REINHOLD,M., SHARP,E.L. and GERCHTER-AMITAI,Z.K. 1983
Transfer of additive "minor-effect" genes for resistance to P. striiformis from T. durum and Triticum aestivum.
Can.J.Botany (Canada), 61:2702-2708.

Transgressive segregation for higher resistance than either parent was observed in segregating populations (F2-F5) of the crosses T. dicoccoides X T. aestivum, T. dicoccoides X T. durum. This indicates that minor additive resistance genes can be transferred directly from wild T. dicoccoides (AABB) to cultivated tetraploid and hexaploid wheats.

878. ROYO,C. 1982
Determination of the inheritance of resistance to leaf rust (P. recondita Rob.ex Desm.f.sp. tritici Erikss.and Henn)in two lines of durum wheat (T. turgidum L.var. durum) (Es)
Ann.Inst.Na.Inv.Agr.Univ.Cordoba(Spain), 109-125.

The resistant varieties Yavaros 79 and Guillemot "s" were crossed with Camadi Arsitt 175 and PI 195055, which are both susceptible. Their reactions to inoculation in field conditions were compared with those of their F1, F2 and F3 progenies. It was found that a single recessive gene conditions resistance in each of the resistant varieties. The frequencies of virulence genes in the investigated population of the pathogen, indicated that the host resistance gene could be Lr16, LrEG or LrT.

879. SALAZAR,J., BRANAS,M., ZITELLI,G. and VALLEGA,J. 1973
Old Iberian durum wheats as an important source of resistance to stem and leaf rust.
Proc.Symp.Genet.Breed.D.W.Bari. (Italy), 497-508.

A search for resistance factors in a group of Iberian durum wheats was made. Resistance factors to races of stem and leaf rust were found in material from Spain and Italy.

880. SHESTAKOVA,A.P. 1978
Breeding spring durum wheat for resistance to Ustilago nuda . (Ru)
Kuibysh.Kniz.Izadet'stvo. (USSR), 106-110.

Raketa proved to be a good parent for resistance. The most promising hybrid obtained was Leucurum 8B33 X Raketa. Leucurum 168, selected from this cross, combines good resistance with high yield.

881. SINSCALCO,A., PARADIES,M., FANELLI,C., ZITELLI,G. and BIANCOLATTE,E. 1978
Field observations on the behaviour of wheats towards rusts,powdery mildew and Septoria tritici carried out in 1977-78. (It)
Ann.Ist.Sper.Cerealicoltura,Romo (Italy) 58.

Epidemiological observations were carried out on the behaviour of wheats towards rusts, powdery mildew, Septoria tritici, in 13 Italian localities. Climatic conditions favoured Puccinia recondita var. tritici and, in some places, S. tritici, whereas other rusts and Erysiphe f.sp. tritici were less widespread. The 657 wheats tested in 1977-1978 included: 1) differentials and additional lines or varieties with specific genes for resistance to rusts and/or powdery mildew, 2) commercial varieties, old varieties and 3) material under selection, not yet released, of bread and durum wheats. In general, the varieties of bread and durum wheats more widely grown in Italy confirmed their susceptibility to rusts and powdery mildew; whereas, some of the new varieties showed good resistance to one or more of the diseases

882. SOUTHWELL,R.J., WONG,P.T.W. and BROWN,J.F. 1980
Resistance of durum cultivars to black point caused by Alternaria

alternata .
Australian J.Agric.Res.(Australia), 31:1097-1101.

The cvs. tested in field trials in northern NSW showed a wide range of infection levels. The most susceptible were Duramba and Gaza, and the most resistant were Wandell, Wascana and UAS 15350.

883. STACK,R.W. 1982
Transgressive segregation for resistance to common root rot in durum wheat.
Phytopathology. (USA), 72:933.

F4 lines with gains in resistance of 10-28% over either parent in field experiments were obtained from a cross of Wakooma and Edmore.

884. STATLER,G.D., KIESLING,R.L. and BUSCH,R.H. 1975
Inheritance of black point resistance in durum wheat.
Phytopathology. (USA), 65:627-629.

A methods of testing resistance to Cochliobolus is described. This involves the excision of green kernels in the early soft-dough stage of development. Lactic acid is added to the excised kernels which are then incubated for 3-5 days at room temperature to permit any reaction to develop. This test was applied to segregating populations of reciprocal Leeds x controlled by recessive genes. The genetic variances of F2 plants, F3 families, back-cross F1 plants and back-cross F2 families were significantly greater than those of the parents.

885. TIKHOMIROV,V.T. 1981
Embryonic resistance to Ustilago nuda in spring wheat. (Ru)
Sel'sk-Khoz.Biol.(USSR), 26:870-872.

Grain of 167 varieties and 168 breeding lines was inoculated with races widespread in the Krasnodar region of the USSR. The embryos of the lines proved more susceptible than those of the varieties, with 96.4% susceptible among the lines as against up to 50% susceptible among the varieties. Field resistance was correlated with resistance of the embryo and with that of the scutellum. Embryonic susceptibility combined with field resistance was found among some of the lines.

886. VALLEGA,J. and ZITELLI,G. 1978
Resistance genes in the Mediterranean durum wheat against some virulence genes present in the stem rust population of Mediterranean area. (Abstract)
Proc.5th Int.Wheat Genet.Symp.New Delhi.

Diallel crosses among 10 durum wheats were made. F2 and some F3 progenies were infected with two races (14 It.2 and 116) of P. gramini The following results were obtained: 1) The nine resistant varieties carry few genes (one or two apparently no more than three in each variety). Several of these genes are different but few look to be common to more than one variety. 2) Valgerardo and Valsacco carry genetic factors different from those of all the other seven resistant wheats.

887. VALLEGA,V. and ZITELLI,G. 1979
Epidemics of yellow rust on wheat in Italy.
Cereal Rust Bull.(Italy), 6:17-22.

The disease nurseries grown during the last 5 years (1974-8) in different parts of Italy, include both durum and bread varieties, cultivars carrying known genes for resistance and new lines derived from various Italian breeding programmes. The data collected so far indicate that yellow rust, which is traditionally considered a minor disease in Italy where it is therefore not taken into consideration during the selection of new wheat varieties, may constitute a greater menace than was previously thought. In fact, epidemics have been observed in our trials in 1974, 1975 and especially during 1977 and 1978. Possible breeding strategies to deal with yellow rust are discussed.

888. WILLIAMS,N.D. and MILLER,J.D. 1982
Allelic and linkage relation among genes for stem rust resistance from T . turgidum ,'Mindum', 'Acme'selection,'Palestine',and 'Khapli'.
Crop Sci. (USA), 22:1203-1207.

Thirteen lines each with a single resistance gene from crosses of susceptible T. turgidum [T. durum] Marrueccos 9623 with resistant Mindum, Acme, Khapli and Palestine were used. A

partial diallel cross was made among the lines and F2 seedlings were tested for reaction to Puccinia graminis. Absence of segregation indicated that line Srda2 (resistance gene from Acme) and Sdrm1 (resistance gene from Mindum) had allelic or closely linked resistance genes, as did Sdrm3, Srdm2 and PltC (resistance genes from Acme, Mindum and Palestine, respectively). Segregation data for 19 crosses indicated two independent genes controlling different levels of resistance. Genes conditioning high resistance usually masked those conditioning low. Segregates with greater resistance than either parent occurred in 1 crosses, indicating that resistance genes from the two parent had cumulative effects. Genes for resistance in parental lines in each of five crosses conditioned similar levels of resistance, and most F2s segregated in ratios of about 15 resistant: 1 susceptible. Significant deviations from tested ratios occurred in the F2s from 16 crosses, but the direction of the deviations did not imply linkage.

889. WILLIAMS,R.D., MILLER,J.D. and JOPPA,L.R. 1979
Inheritance of stem rust resistance in the durum wheat cultivar, Ward. In Proceedings of the Fifth International Wheat Genetics Symposium Vol.1.New Delhi.
Indian Soc.Plant Breed.Genet.(India), 1057-1060.

F3 seedlings within different F2 families derived from reciprocal crosses between Ward and Marruecos 9623 were inoculated with pairs of Puccinia graminis cultures belonging to seven races and having contrasting spore colours. It is concluded that Ward has (1) two genes for resistance to two cultures of race 15 and one culture of 15B, (2) possibly two genes conditioning resistance to a culture of race 121, (3) three genes for resistance to cultures of races 9, 11 and 29 (4) four genes for resistance to a culture of race 111.

890. ZITELLI,G. 1973
Genetic improvement of durum wheat for diseases resistance.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 473-484.

891. ZITELLI,G. 1974
Methods and results of breeding durum wheat for general and specific resistance to rusts and other diseases. In Proceedings of the Fourth FAO/Rockefeller Foundation of Wheat Seminar, Tehran, Iran, 21 May, 1973.
FAO.Publ.Rome (Italy)1974, 248-257.

A review is given of progress in breeding for resistance to Puccinia graminis f. sp. tritici, P. recondita and Erysiphe graminis in Triticum durum in Italy, mainly with reference to studies carried out since 1960. Tabulated data are presented showing the sources of resistance which have been utilized.

892. ZITELLI,G. 1982
Limiting factors of durum wheat productions in Italy: Strategies for disease resistance.
Genetica Agraria (Italy), 201-216.

To keep varieties resistant for a long period of time breeders must operate in conditions similar to those encountered in natural ecosystems. Therefore, it is essential to study the various types of resistance present in the host and in closely related species. An interesting strategy could be based on the growing of a mosaic of varieties carrying different specific and non-specific resistance genes, incorporated with traditional methods (back-cross, simple and multiple crosses) or by cytogenetical means (chromosomic substitution, translocations, addition lines etc.).

893. ZITELLI,G., MARIANI,M., BIANCOLATTE,E. and VALLEGA,J. 1977
A durum wheat of high protein content useful for breeding purposes. In Proceedings of the Fifth International Wheat Genetics Symposium Vol.1.New Delhi.
Indian Soc.Genet.Plant Breed. (India), 177-187.

Trials conducted over three years revealed that Trinakria has a high protein content compared with other Italian Triticum durum varieties. Analysis of data from an 8 X 8 diallel, revealed that (1) Trinakria transmitted the high protein trait to its F1 hybrids, and (2) broad-sense heritability estimates for protein

percentage, protein content per grain and 1000-grain weight were 83, 95 and 90 per cent respectively, the traits being conditioned by additive-gene action.

894. ZITELLI,G., PASQUINI,M., VALLEGA,V., CECCHI,V. and BIANCOLATTE,E. 1982
The field reaction of bread wheats and durum wheat to fungal diseases in 1981-82. (It)
Infor.Agr.(Italy), 38:22645-22650.

The reactions of 72 bread wheat varieties and 50 durum wheat varieties commonly cultivated in Italy to Puccinia graminis, P. recondita and Erysiphe graminis are tabulated. Similar information is presented on a number of other lines and new selections.

895. ZITELLI,G., VALLEGA,V. and PASQUINI,M. 1983
Field behaviour of wheats with regard to rusts in Italy during 1982.
Cereal Rusts Bulletin (Italy), 11:33-35.

The ninth national wheat (Triticum aestivum and T. durum) disease nursery was grown in 1982 at 12 localities. Disease readings for Puccinia graminis, P. recondita and P. striiformis on three susceptible control varieties at each locality are given. On the basis of these and previous results, some resistant lines are identified.

Breeding for Grain Quality

896. ABOUSSOUAN,S.C. and PLANCHON,C. 1982
Response to water stress of different wheat genotypes. (Fr)
INRA. France, 169-174.

897. ANON. 1978
The quality of 1977 wheat harvest hard wheat, common wheat (T.France). (Fr)
Perspectives Agricoles (France), 12:1-63.

898. AUTRAN,J.C. 1981
Selection and quality of durum wheat. (Fr)
Cultivar (France), 145:23-25.

A very important part of bread wheat production is consumed by animals; on the contrary durum wheat destination is only for human consumption. Except for some secondary products such as couscous or soup paste, the only finished products for durum wheat are pasts. In France and Italy these have to be obtained from durum wheat semolina, so it is essential that the quality of the latter satisfies the industry requirements. That's why the creation of new durum wheat varieties attractive to the farmers and whose quality matches the requirements of wheat and pasta industry constitutes a priority objective, which in order to be obtained requires close collaboration between breeders and food technologists.

899. AVIVI,L., ALEVY,A.A. and FELDMAN,M. 1983
Studies on high protein durum wheat derived from crosses with the wild tetraploid wheat, (T. turgidum var. dicoccoides)
Proc.6th Int.Wheat Genet.Symp.Japan., 199-204.

Four F2 populations from crosses between T. turgidum var. durum cv. Inbar and four high protein (23-27%) lines of wild wheat, T. turgidum var. dicoccoides, were analyzed for their grain protein percentage. In each of the four F2 populations the distribution of the protein percentage is continuous, exhibiting weak dominance of the low protein genes of the cultivated parent. The estimated heritability for protein percentage is relatively high (64-74%), indicating a significant potential for rapid progress in selection. The protein percentage of var. dicoccoides seems to be controlled by several genes. Nine selected F6 lines derived from the above crosses were grown in trial plots under regular agricultural conditions. All the lines contained higher protein percentage (18-23%) as compared with that of the cultivated parent, Inbar (15.6%). Two out of the nine F6 lines showed a higher grain yield per plant and five lines showed a higher protein yield per plant than Inbar. The possibility of utilizing this material for protein improvement in cultivated wheats, is discussed.

900. BEBYAKIN,V.M. and DUSHAEVA,N.A. 1982
The polymorphism of gliadin and quality of durum wheat grain in relation to breeding. (Ru)

Fiziol Biokhim.Kul't Rast.(USSR), 14:561-567.

Three varieties widely used in breeding programmes and differing in gliadin components were intercrossed. On the basis of a study of the F2-F4, allelic blocks of gliadin components were identified and statistically significant associations were established between some of the these blocks and grain quality characters. However, the association between some of these characters and gliadin bands depended on genetic background and differed in different hybrid populations, sometimes being absent entirely.

901. BEBYAKIN,V.M. and ISHINA,G.F. 1979
Breeding durum wheat for macaroni quality. (Ru)
Selekts.Semenov.(USSR), 6:17-18.

Relationships between a number of characters affecting processing quality were analysed in 19 varieties during 1975-1977. Grain hardness was not correlated with vitreousness, nor was dry macaroni colour correlated with carotenoid and lipoxygenase contents. Breaking strength of the macaroni was correlated negatively with gluten content (r = -0.3 to -0.6) and positively with flour strength (r = 0.2-0.5).

902. BEBYAKIN,V.M., PISKUNOVA,G.V. and GURKINA,M.N. 1981
Genotypic control of grain quality characteristics in bread and durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:65-172.

The genotypic control of protein and carotenoid content in the grain of durum wheat was studied.

903. C.N.R.BARI 1976
Evaluation of the durum wheat collection for protein content. (It)
Ric.Sci.C.N.R (Italy), 45:53.

More than 1500 lines were evaluated in 3 different locations. At Santeramo 300 lines had a protein content higher than 15%. At Bari only 36 lines had a protein content higher than 15%. Values from the third location were intermediate.

904. CONTTENET,M., AUTRAN,J.C. and JOUDRIER,P. 1983
Isolation and characterization of gamma gliadin 45 and 42 compound associated to viscoelastic characteristics of the gluten durum wheat.
C.R.Hebd.Acad.Sci.Ser.3 (France), 297:149-154.

905. DAMIDAUX,R. 1979
New selection criteria for the evaluation of the durum wheat culinary quality. Gluten viscoelastic properties and gliadin electrophoregram. (Fr)
These.Dr.Ing.Univ.Sci.Techn.(France), 72.

The viscoelasticity test applied to cooked gluten allows to establish a relationship between viscoelastic properties and culinary quality. The small sample size required and the quantitative character of the test makes it a precise and last method to use as early as the first selection generation. Gliadin electrophoregrams of durum wheat varieties which is independent of environmental factors show a close relation between the presence of bands 42 and 45 viscoelastic properties of durum wheat gluten.

906. DAMIDAUX,R., AUTRAN,J.C. and FEILLET,P. 1980
Gliadin electrophoregrams and measurements of gluten viscoelasticity in durum wheat.
Cereal Foods World (USA), 25:754-756.

907. DAVYDOV,S.E., DEMIDOVA,E.G. and LAKS,G.A. 1980
Improvement of grain quality in spring durum wheat in the course of breeding. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 3:261.

Good results were achieved in breeding for grain quality by using varieties of local Kazakh which are better suited to the severe climate conditions of northern Kazakhstan, in addition to high-quality varieties from Transcaucasia, the Ukraine, the central Chernozem zone and North America (K43103). The use of Triticum dicoccum in crosses gave hybrids with several undesirable grain characteristics.

908. DELLA GATTA,C. 1983
Selection of lines for chemical and

technological characteristics in durum wheat.
Genetica Agraria (Italy), 37:159.

Material of promising protein content and gluten and pasta quality was selected from F4-F10 lines in different years and localities in southern Italy.

909. DEXTER,J.E. 1984
Development of quality durum wheat varieties in Canada.
RACHIS (ICARDA,Aleppo,Syria), 3:23-28.

The major emphasis in durum wheat development in Canada in recent years has been improvement of protein content and gluten strength. This paper reviews the breeding process from the initial cross until the time a line is licensed.

910. DEXTER,J.E., MATSUO,R.R., KOSMOLAK,F.G., LEISLE,D. and MARCHYLO,B.A. 1980
The suitability of SDS-sedimentation test for assessing gluten strength in durum wheat.
Can.J.Plant Sci.(Canada), 60:25-29.

For thirty lines differing in gluten strength and quality of cooked spaghetti, the SDS test was able to differentiate over a narrower range for variations in gluten strength than the mixograph. Protein content and the SDS test accounted for more than 40% of the variability in cooking quality at optimum time and after overcooking for 10 min.

911. DONNELLY,B.J. 1977
Quality of U.S.south-western grown durum wheat.
Macaroni J.(USA), 58:11-15.

912. DONNELLY,B.J. 1978
Quality evaluation in the durum wheat breeding program of the USA.
Getreide, Mehl Und Brot.(F.R.G), 32:169-173.

At the North Dakota State University, USA, quality evaluation between the F8 and F10 generations has been extended from observations of grain shape and vitreousness to include determinations of milling, dough and cooking characteristics.

913. DU CROS,D.L. and WRIGLEY,C.W. 1982
Prediction of durum wheat quality from gliadin protein composition.
Australian J.Agric.Res.(Australia), 33:429-442.

The possible use of gel electrophoresis of grain proteins to select for pasta-making quality in breeding durum wheats was studied in Australian durum cultivars and in 103 crossbred lines. Computer-based pattern analysis was used to compare gliadin electrophoregrams and dough strength. Close relationships were found between dough strength and a group of gliadin proteins and between dough weakness and a different groups of gliadins. All 27 breeding lines with weak dough had band 42 and its associated bands, while 90% of strong-dough lines had gliadin 45. These relationships were shown not to be due to similarities in pedigree. The results indicate gel electrophoresis to be a valuable means of screening for grain quality at early generation in durum wheat breeding.

914. ERDMAN,J.A. and MOUL,R.C. 1982
Mineral composition of small-grain cultivars from a uniform test plot in South Dakota.
J.Agric.Food Chem.(USA), 30:169-174.

915. HADJICHRISTODUOLOU,A and DELLA,A. 1976
Frequency of control plots in breeding nurseries for protein content.
Euphytica (Netherlands), 25:387-391.

Correlation coefficients between protein content of control plots of Kyperounda durum wheat and Athenais barley sown at distances of 0.6 m to 68.4 m from each other were calculated in two seasons. Simple correlation coefficients were high and significant at the 1% level of probability for plots 0.6 m apart, but decreased rapidly with increasing distances between plots. It was concluded that a control plot provides a fairly good measure of the protein content of adjacent plots.

916. HADJICHRISTODUOLOU,A and DELLA,A. 1978
Factors affecting genotypic and environmental variance for crude protein content in cereals.
Euphytica (Netherlands), 27:117-126.

917. HEGAZI,K.F., MORSI,L.R. and GOMAA,A.S. 1978

Inheritance of plant height and date of heading in tetraploid wheat (Durum wheat in Egypt).
Albohouth Azziraiya (Egypt), 56:93-104.

918. JOHNSTON,R.A. 1980
Semolina color and other quality and agronomic traits in durum:genetics and methods.
Diss.Abstr.Int. B (USA), 41:2013.

The objectives of this study were to determine the genetic parameters associated with inheritance of semolina color (heritabilities and genetic effects) and other quality and agronomic traits (genetic effects only) in durum wheat, and to evaluate several methods of measuring semolina color. These results indicate that early generation selection should be successful for semolina color, plant height (large differences among parents), days to head, and grain protein. Results from the Hunter reflectance colorimeter and the butanol pigment extraction were highly correlated (r=0.85 for lutein). The reflectance colorimeter is recommended for use in screening breeding material because of its overall efficency in time and space.

919. JOHNSTON,R.A. and QUICK,J.S. 1980
Heritability of semolina color in durum crosses.
Agronomy Abstracts (USA), 58-59.

The crosses, from ten parents representing a range of expression for the characters, were grown in 1978. Data from F4 lines and their F5 families were used to calculate heritabilities. Relatively high realized heritabilities were obtained as well as highly transgressive segregates. Predicted gains were very close to actual gains, indicating the importance of additive genetic variance.

920. JOHNSTON,R.A., QUICK,J.S. and DONNELLY,B.J. 1981
Methods for evaluating semolina color in early generations.
Crop Sci.(USA), 21:472-473.

The feasibility of evaluating seed samples from single plants of durum wheat (Triticum turgidum L.) for semolina color was examined by comparing the relative precision of different combinations of sample sizes and milling methods. Four sample size and mill combinations were used with 10 durum cultivars. The 200-g sample size milled on the Brabender Quadramat Micromill was the most sensitive test. Data were highly correlated with those from 2- and 1-g sample sizes milled on the Udy Cyclotec mill (r= 0.85 and 0.90, respectively). Consequently, screening for semolina color using 2- or 1-g samples should be effective.

921. JOHNSTON,R.A., QUICK,J.S. and HAMMOND,J.J. 1983
Inheritance of semolina color in six durum wheat crosses.
Crop Sci.(USA), 23:607-610.

Ten durum wheat (Triticum turgidum L. var durum) cultivars and experimental lines were crossed, and lines were generated for two genetic studies pertaining to the inheritance of semolina color. Experiment 1 included six crosses grown in a split plot arrangement of a randomized complete block design over three environments. Data on semolina color for P1, P2, F1, F2, F3, BCP1 and BCP2 generations were analyzed by using an unweighted least squares procedure to determine the relative importance of gene effects. An average of 82% of the genetic variability for semolina color was attributed to additive effects. In experiment 2, F3 lines and their corresponding F4 families were derived from five of the original crosses and grown in an augmented design with replicated checks at one location. Heritabilities were calculated for the five crosses and compared to realized heritabilities, revealing only slight differences. The realized heritabilities obtained for the five crosses were 69, 66, 31, 52, and 66%. There were only slight differences between the predicted and actual gains for each cross. Transgressive segregation for high color was found in four of the five crosses. Semolina color was a highly heritable trait controlled primarily by additive gene effects. The intensity of expression was influenced by environment, but improvement of color should be possible through early generation selection.

922. KETATA,H. and SELLAMI,A. 1984
Genetic study of quality characteristics in durum wheat (T. durum Desf.).

RACHIS (ICARDA,Aleppo,Syria), 3.50-52.

The inheritance of kernel weight and protein and ash contents in 6 durum wheat crosses (Karim/Badri, Karim/Amal, Badri, Ben Bechir and the reciprocals) was studied. Genetic variances, heritabilities, and heterosis are described.

923. KOBREHEL,K. and JEANJEAN,M.F. 1977
Selection of durum wheat varieties as to weak brown index based on their isoperoxydasic composition. (Fr)
Symp.Bioch.Techn.Qual.Bles Durs (France).

Pasta color characterized by a yellow and a brown index. If the latter is high it may reduce pasta quality. It is highly correlated with semolina peroxidase activity. Durum wheat varieties may be classed in two groups according to their peroxidasic diagram: high activity (Mediterreanian type), low activity (north American type). Methodology for durum wheat selection for color using the low peroxidasic activity criteria is discussed.

924. KONOV,V. 1976
Investigations on some technological properieties of local forms of durum wheat. Assortment grown under the conditions of village of Gorni Lozen, Sofia district.(Bg)
Rasteniev'd Nauki (Bulgaria), 13:18-26.

Development of new varieties with good agrobiological and technological properties required a rich and valuable assortment. Considering this necessity, 662 durum wheat samples of 1964 and 1965 crops were technologically characterized in order to find out the valuable ones as initial selection material. The accomplished technological investigations showed that some local lines of durum wheat had a quite high 1000-grain weight in both crop years, a good crude protein content, gluten with an extensibility, elasticity and sedimentation value, all distinctive in regard to durum wheat.

925. KONZAK,C.F., HU,R., RUBENTHALER,G.L., SADAM,M. and SHUEY,W.C. 1973
A rapid micro-screening method for semolina color applicable to early generation materials.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 716-731.

A rapid, simple, and efficient method for screening small samples (2 to 5 grams) of durums for semolina color was developed. The method used a special small multiple-unit micromill. The samples of cured semolina could easily be classified visually or by a color-difference meter. As many as 1000 or more samples a day could be processed through the micromill. Results obtained with the micromill were comparable with those obtained with the Brabender Quadrumat, which required larger grain samples and longer milling time.

926. KOVACS,M. 1982
Improved SDS-sedimentation test for early generation screening of durum wheat quality.
Docum.Bult.D.W.Prod.INRA.(France)No.4, 11.

A study has been carried to simplify and optimize the application conditions of the sedimentation test with sodium dodecyl sulfate (SDS) in durum wheat. With this method, about 200 samples may be analyzed daily by one person.

927. LEISLE,D. and BAKER,R.J. 1973
An evaluation of quality testing in durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 549-556.

Testing procedures used by Canadian durum wheat breeding programs to screen for protein and pigment content and gluten strength are reviewed.

928. MOLDOVEANU,G. and IONESCU,N. 1978
Technological quality of durum wheat (T . durum) varieties recommended for growing for pasta production. (Ro)
Lucr.Cerct.Inst.C.Pentru Ind. (Romania), 13:105-114.

The grain, milling and pasta characteristics of six winter and eight spring varieties are tabulated. The spring varieties were more suitable for pasta production than the winter varieties but their overall yields were lower.

929. MONNEVEUX,Ph. 1983
Improvement of the pasta value of durum wheat (T.durum Desf.): Study of the

relations between the electrophoretic diagram of gliadins and some technical characteristics. (Fr)
Agronomie (France), 4:1-10.

Polyacrylamide gel electrophoresis of durum wheat gliadins makes a clear distinction between several groups of genotypes. The technological characteristics of both the main types (42 and 45) were compared as follows: 1) the mean sedimentation values were significantly different for types 42 and 45; for both types the histogram frequencies were of bimodal form; 2) the mean values of gluten viscoelasticity were significantly different between them; 3) there was highly significant correlation (r2 = 0.76) between the gluten viscoelasticity scores and the results of the sedimentation test: there was no relationship between the results of these previous tests and the protein content of the grain; 4) no significant differences could be noticed between the viscoelasticity of the groups of genotypes as defined on the basis of their electrophoretic characteristics. In conclusion, a series of tests for breeding durum wheats for dough value is proposed.

930. MONNEVEUX,Ph. 1983
Selection of durum wheat (T. durum) Desf.) varieties, quantity and quality of grain protein: technological quality of the product. (Fr)
Industries des Cereales (France), 21-25.

The improvement of protein content of the grain requires a previous study of fluctuation and variability of the character; this study reveals the leading part played by the environment and the difficulty to combine high protein and productivity. This last point is being discussed and a general breeding scheme for protein improvement is put forward. The improvement of protein quality is based mainly on the electrophoresis of gliadin fraction and the sodium dodecylsulfate sedimentation test.

931. MONNEVEUX,Ph. 1983
Presentation of a simple test for evaluating the bread making quality of soft wheat and the pasta quality of durum wheat: Sedimentation by means of sodium dodecyl sulfate or S.D.test. (Fr)
C.R.Seanc.Acad.Agric.(France), 1155-1165.

A method for the evaluation of breadmaking quality and pasta making quality is presented and described. This method is compared to those generally used in selection, on the results published by different research workers, or obtained in the Plant Breeding Station of Montpellier. Advantage of the test and its place in breeding schemes are discussed.

932. NAGL,K. 1973
Responses of induced mutants in duzum wheat cv. Adur selected for improved protein.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 661-677.

Advanced breeding material (M7 and M8) of the Austrian spring durum variety Adur following DES and combined gamma + DES mutagen treatment was screened using the dye binding method and resulted in different mutant types with improved seed protein. Drastic morphological mutants such as different dwarfs and a sphaerococcoid mutant exhibit increased content of limiting amino acids together with remarkable increase in protein. Other mutants and recombinants were investigated with regard to seed production and some other characteristics of economic interest. From the data obtained it could be concluded that together with positive changes in protein content and composition, genetic variability for different response patterns have been induced.

933. NAGL,K 1974
Possibilities of using a sphearococcoid mutant and compactoid mutant in crosses in order to improve the protein of Triticum durum . (De)
Bundesv.Alpen.Landw.(Austria), 329-350.

These mutants of T. durum 'Adur' were used in crosses involving Adur, T. dicoccum var. farrum and T. aestivum. Both are considered useful in attempts to improve grain protein and, at the same time, to obtain a shorter culm and improved shape of the grain.

934. NAGL,K. 1976
Studies on cross progenies (F2) of two drastic morphological high-protein mutants in durum wheat.

Proc.Int.Symp.IAEA.Vienna (Austria), 137-138.

935. QUICK,J.S. and DONNELLY,B.J. 1980
A rapid test for estimating durum wheat gluten quality.
Crop Sci. (USA), 20:816-818.

A rapid sedimentation test requiring a 6 g whole meal sample was compared to the micromixogram test requiring a 20 g sample. Correlations between sediment volumes and mixogram scores were significant and the coefficients of determination indicated that about 65% of the variation in micromixogram score was attributable to its association with sediment volume. Eighty-four percent of wheats previously selected on the basis of micromixogram score, were predicted by the sedimentation test.

936. SALLAI,J., ERDKI,P. and GYENES,I.G. 1983
View points in the determination of acceptance quality in durum wheat. (Hu)
Novenytermeles (Hungary), 32:131-135.

Winter durum wheat cv. GK Basa was studied for relationships between yield and quality of the grain in order to establish parameters for the assessment of processing value. 1000-grain wt. and protein or gluten content were correlated with each other and with the indices examined. Vitreousness was a less suitable quality parameter.

937. TAHIR,M. 1983
Genetic variability within protein content T. aestivum, T. durum and T. dicoccoides.
RACHIS (ICARDA,Aleppo,Syria), 14-16.

Selected cold-tolerant lines of T. durum and T. aestivum were tested to determine protein content, and a project has begun to screen T. dicoccoides to derive desirable traits for incorporating into selected T. durum lines. Some 356 lines of durum were evaluated. The checks were Waha'S' and Haurani. The majority of durum lines had 13-17% protein, and about 200 lines had higher protein contents than the improved check Waha'S'. The results show great genetic variability in durum germplasm and potential for improving it by transferring high protein genes to cultivated varieties. Protein content of T. dicoccoides lines ranged from 20.4 to 24.9% and it appears to be good source of high protein genes for improving durum wheat.

938. VENEZIAN,M.E.S. 1975
Study on the quality characteristics of durum wheat by factor analysis. (It)
Ann.Ist.Sper.Agron.Bari (Italy), 6:329-346.

Twenty one characters were studied in eleven varieties grown at two sites with two replicates. The highest heritability estimate was seen for pigment content (96.29 per cent) and relatively high estimates were found for six other characters. By factor analysis, a grouping of the 21 varieties into five principal factors which accounted for 89 per cent of the total variability was possible.

939. WILLIAMS,P.C. and JABY EL-HARAMEIN,F. 1982
The screening and evaluation of cereals for grain quality at ICARDA.
RACHIS (ICARDA,Aleppo,Syria), 9.

940. WOREDE,M. 1975
Genetic improvement of quality and agronomic characters for Ethiopia.
Diss.Abstr.Int.(USA), 35:3720.

A study of 3399 lines from the USDA World Wheat Collection revealed substantial differences between lines in protein content. The variation in protein was from 7.3 to 21.3 per cent and the variation in lysine from 2.43 to 4.29 per cent. Two hundred lines that exhibited unusual properties of protein and lysine were grown at sites in Ethiopia and the USA. Large effects of environment and genotype X environmental interaction were detected. Varieties which exhibited high protein and normal lysine levels include CI7796, PI192711P and PI185734P.

941. YARINA,G.N. 1978
Initial material for breeding durum wheat for grain quality under irrigation in the Volga area. (Ru)
Kuibysh.Kniz.Izadet'stov.(USSR), 81-85.

Lists are given of breeding material with large grain, highly vitreous grain and good grain quality. Detailed descriptions are given of the quality characters of three selected lines which had better quality grain under

irrigation than under rainfed conditions.

942. YARINA,G.N. 1981
Breeding material of durum wheat for the irrigated agriculture of Uzbekistan.(Ru) Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 38-41.

Lists are given of varieties with consistently high vitreousness quality, on the basis of a three-year evaluation of Triticum durum collection of the Vavilov Institute. Three varieties which regularly had good scores for quality characters were selected for use in breeding, viz. the Tajik variety Khoranka 46, Lakota from the USA and the local Pakistani variety K33410.

943. YARINA,G.N. and MIGUSHOVA,E.F. 1979
Macaroni making qualities of hybrids between T. durum and T. dicoccoides. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 32-37.

Three lines of T. dicoccoides were crossed with the Italian durum wheats Trentino and Graigliano. The F1s were back crossed to Candeal 17, Candeal 18 and an Albanian local variety K43154. Information is presented on quality in the F5, F6 and F9.

944. YARINA,G.N. and REMIZOVA,E.P. 1981
High-quality forms of durum wheat. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 32-37.

Of 1614 varieties tested, 26 Soviet and 31 foreign varieties showed consistently high values for quality characters. Of these, 11 Soviet and 18 foreign varieties which gave high values for three or more years are listed and briefly described.

945. YARINA,G.N., SHITOVA,I.P. and CHMELEVA,Z.V. 1980
Durum wheat varieties promising for quality. (Ru)
Selekets. Semenov.(USSR), 20-22.

Lists are given of varieties with large grain, highly vitreous grain and good macaroni quality and of 418 varieties studied at the Dagestan Experiment Station in Derbent, USSR, during 1974-78. Tabulated data are presented on 1000-grain weight, protein content and lysine content in 34 varieties with a high protein content. Hicas, Sert, Rus, Akharan and Siha combined high protein content with good macaroni quality.

946. ZITELLI,G., VALLEGA,V. and BIANCHI,A.A. 1983
Correlations in lines derived from crosses with high protein Durum variety "Trinakria".
Proc.6th,Int.Wheat Gen.Symp.Kyoto(Japan) 843-849.

During the years 1980, 1981 and 1982 a total of 217 lines derived from crosses between Trinakria and Valgerardo, Trinakria and Vaifora as well as from Trinakria and Cappelli, were analysed for the following characters: protein content (%), 1000-kernel weight, heading date, protein content per seed, height and waxiness. Protein percentage and kernel weight of tall lines were significantly higher than those of genotypes carrying (Norin 10) dwarfing genes, but grain yield was identical. Linkage between height and high protein genes appears to be responsible for the protein differences between tall and dwarf types. Very low, not significant correlations were found between protein percentage and grain yield. Thousand-kernel weight and grain yield were significantly greater in waxy types.

Plant Morphology

947. BALLATORE,G.P., PRIMA,G.Di. and SARNO,R. 1973
Correlation of morphological and physiological characters in T. durum Desf.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 41-55.

The results of a study of correlations among some biometric characters taken by F5-F9 series of intra- and inter-specific crosses are reported. The production of the whole plant was directly correlated to the number of fertile culms and in the majority of cases to the production of the main spike; no correlations were found between production of plants and length of the main culm, length of the last internode and number of nodes of the main culm, except for some crosses and

lines. In the main spike the production was correlated to length, number of fertile spikelets, number of kernels and spikelet fertility. The length of the main spike directly correlated also to the number of fertile spikelets and the number of kernels, while no correlation was found with the spikelet fertility. The number of kernels was directly correlated to the fertility of the spikelet and the number of fertile spikelets. No correlation was found between spikelet fertility and number of fertile spikelets.

948. BRETH,S.A. 1976
Durum wheat: A new era for an old culture. (Es)
Campo (Mexico), 51:3-24.

949. GAUR,V.K. and SINGH,C.B. 1981
Naturally occurring teratological stamens in the flowers of a cross of T. durum X T. aestivum.
JNKVV Res.J.(India), 15:109-113.

In the F2 of this cross, normal, teratological and intermediate stamens were observed. Sterility was 53.79% in normal anthers and increased according to the degree of abnormality. Stamens which were completely transformed into structures like ovaries did not produce pollen.

950. LEONARDIS,M.de., LONGHITANO,N. and PICCIONE,V. 1983
Characterization of the pollen of the cultivars Patrizio 6 and Capeiti 8 (Triticeae). (It)
Sementi Elette.(Italy), 29:3-7.

Electron microscopy studies of two durum wheat cultivars (which derive from the same cross and which are indistinguishable except by electrophoresis of grain gliadins) showed that measurement of the longest and shrotest diameters of the pollen grain pore served to differentiate the two cultivars. The pore was bigger in Patrizio 6.

Plant Tissue Culture

951. BENNICCI,A. and D'AMATO,F. 1977
Regeneration of T. durum plants from somatic tissues grown in vitro.
Z. Planzenzuchtung. (F.R.G), 81:305-311.

Durum wheat plantlets were regenerated from the primary callus developed from mesocotyl explants of five cultivars and five selected lines. Rooted plantlets could be transplanted to soil in pots and grown to maturity. Chromosome counts in shoot and root apices of in vitro regenerated plantlets showed chromosome-number mosaicism (one or more aneuploid chromosome numbers in addition to the diploid number) in all apical meristems analyzed.

952. KAPEN,S. and RAO,P.S. 1982
Plant regeneration from callus cultures of durum and emmer wheat.
Plant Cell Reports, 1:215-218.

Callus cultures were initiated from isolated mature embryos of two cultivars of Triticum turgidum subsp. durum (T. durum) and one cultivar of T. turgidum subsp. dicoccum (T. dicoccum) on a basal medium supplemented with 2,4-D, 2,4,5-trichlorophenoxypropionic acid (2,4,5-Cl3POP) or 2,4-D + coconut milk. The regenerated shoot buds were induced to root on basal medium supplemented with NAA. The regenerated plantlets were transferred to soil and successfully grown to maturity.

953. GRECO,B., TANZARELLA,O.A. and BLANCO,A. 1984
Plant regeneration from leaf base callus in durum wheat(Triticum durum Desf.)
Cereal Res.Commu.(AUB), 12:171-177.

Leaf base segments and the mesocotyl were sectioned from 1- WK-old seedlings of durum wheat cv. Cappelli, Appulo and Trinakria into Murashige and Skoog's (MS) medium supplemented with 2 mg 2,4-D/l. For plant regeneration, Calli were transferred to MS medium supplemented with 0.05 mg NAA and 0.5, 1.0 or 2.0 mg BA/l. The highest percentage of callus induction was obtained from the lowest leaf base segment, followed by the mesocotyl, for all cv. Cv. Cappelli and Appulo regenerated shoots on media containing 0.5 or 1.0 mg BA/l, while cv. Trinakria showed shoot regeneration only on medium containing 2.0 mg BA/l.

954. INNOCENTI,A.M., BITONTI,M.B., BENNICCI,A. and GENNAI,C. 1981
Cytophotometric and regeneration analyses in the first embryo node in old seeds of T. durum. (It)

Caryologia (Italy), 36:83-87.

In the 1st embryo node from aged non viable T. durum seeds, the histone:DNA ratio did not increase during aging and when cultured in vitro large amounts of callus were generated.

955. SHARMA,G.C., WANG,W.C. and SAPRA,V.T. 1982
Effect of genotype, media, temperature, pretreatment on callus initiation in triticale, wheat, and rye anther cultures.
Cereal Res Commu.(USA), 10:143-150.

Anthers from varieties of Secale cereale, five of Triticum aestivum, two of T. durum and ten of triticale were cultured under various conditions. The callus initiation frequency ranges observed for rye and wheat were narrower than that for triticale. The highest frequencies found among rye varieties were for Rymin and PI243741, and among wheat varieties for T. durum 'Cando' and T. aestivum 'Atlas 66'. Overall frequencies were 14.8% for triticale, 7.6% for rye and 4.5% for wheat.

956. ZHU,Z.Q., WANG,J.J. and SUN.J.S. 1979
The induction of albino pollen and preliminary observation of their ploidy in T. durum Desf. (Ch)
Acta Bot.Sinica (China), 21:295-296.

Albino plants were produced in anther cultures of cv. Tripolo in which callus was induced by 2 mg 2,4D/l with an induction frequency of 9% and differentiation was carried out in a medium without either NAA or Kinetin.

Genetic Diversity and Resources

957. ADARY,A.H. and QUALSET,C.O. 1978
Genetic variability in landrace populations of durum wheat.
Diss.Abstr.Int.B, 1979, 40, 1 (USA).

958. ALBERTINI,L. and MIAYOUKUO,J.F. 1976
Cytophotometric studies of chloroneb and methoxyethylmercury silicate actions as the nuclear content of basic proteins, -SH, protein-S -S and RNA in T. durum Desf. (Fr)
Rev.G.Bot.(France), 83:187-198.

959. DAMANIA,A.B. and PORCEDDU,E. 1983
Variation in landraces of Turgidum and bread wheat and sampling strategies for collecting wheat genetic resources.
Proc.6th Int.Wheat Gen.Symp.Kyoto(Japan) 123-136.

Sixteen landrace populations of Triticum turgidum from four distinct areas of the Yemen Arab Republic and an equal number of T. aestivum landrace populations from four valleys of western Nepal were evaluated to study the distribution and extent of variability within a country and in farm fields. The material was grown at Bari, Italy and morphological characters were recorded on fifty plants per landrace population. Statistical analyses of variance and covariances made it possible to ascertain significant differences among regions (river valleys in Nepal) and also among fields in the same regions (valleys). The characters most responsible for these differences were also determined. The sampling strategy for collection of wheat germplasm in hilly terrain is reviewed and recommendations made for improvement.

960. DEPACE,C., SPAGNOLETTI,Z.P.L. and PORCEDDU,E. 1983
Variability in durum wheat (T. durum Desf.) populations from different geographical origins. 2.Analysis of variation and covariation. (It)
Riv.Agron.(Italy), 17:397-403.

961. DOROFEEV,V.F. and JAKUBZINER,M.M. 1973
The gene pool of Durum wheat (T. durum Desf.)
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 141-150.

The Soviet gene stock of T. durum Desf. is exceptionally rich according to its botanical constitution and biological traits diversity. It especially concerns the local populations of Transcaucasus. Durum wheats of USSR comprise many varieties, donors of valuble traits and characteristics, including forms of high lysine content and large kernels, resistant to lodging and diseases and having immunity to a group of parasites and the race complexes of each. Some hexaploid triticales and a large number of strong common spring wheat varieties are

connected in their origin with durum wheats of USSR.

962. DOROFEEV,V.F., YARINA,G.N., MEREZHKO,A.F. and ARTAMONOVA,V.D. 1976
Initial material for improving grain quality in durum wheat. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 65-68.

List are given of varieties from the world collection of the Soviet Institute of Plant Industry (VIR) which combine good technological qualities with high yield and with other economic characters.

963. HADJICHRISTODUOLOU,A and DELLA,A. 1976
Evaluation of durum wheat, barley and common vetch germplasm in Cyprus.
Plant Genet.Res.Newslet.(FAO), 32:8-15.

The range of genetic diversity present in local and commercial varieties of durum wheat, barley and vetch was investigated. The data indicated that, although a considerable portion of genetic variability in field crops grown in Cyprus has been lost by genetic erosion, a large range of adaptive genetic diversity has been conserved, mainly in the commercial varieties. The genetic variability found was either phenotypically expressed or hidden as cryptic genetic variability.

964. JAIN,S.K., QUALSET,C.O. and BHATT,G.M. 1975
Geographical patterns of phenotypic diversity in a world collection of durum wheats.
Crop Sci.(USA), 15:700-704.

More than 3000 durum wheats (Triticum turgidum L. durum group) from the USDA world wheat collection were grown in the field and classified for leaf sheath glossiness, glume pubescence and color, awn color, kernel color, and basal spike node fertility. The entries were grouped by geographic origin, and frequencies of the various phenotypes were examined. Variation for all characters was found, and usually within each geographic region. The number of entries in the collection was very small from some areas known to be important sources of germplasm, pointing to the importance of intensifying efforts in germplasm exploration and conservation. The Shannon-Weaver diversity index (H') was used to examine overall genetic divergence on a country and regional basis. In collections of substantial size, Ethiopia and Portugal had the greatest diversity (H'= 0.87 and 0.86), and Turkey, Bulgaria, and the United States had significantly less diversity (H' = 0.50, 0.42, and 0.39). Based on the characters studied and the relatively small collection evaluated, the centers of diversity seem to be Ethiopia, the Mediterranean region, and India.

965. KONZAK,C.F., BEHRE,T., DAVIS,M.A. and SADAM,M. 1973
Geographic origin and usefulness in breeding of durums from Turkey and Ethiopia in the USDA world collections. (Abstract)
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 179.

A series of durum introductions originating in Turkey were evaluated in 1970 and 1971 for their reaction to mildew in central Washington and for the estimated yellow berry content of the grain produced. A range of mildew reactions classified as resistant, moderately resistant, moderately susceptible or susceptible were identified and lines with apparently higher than usual tolerance to yellow berry also were selected.

966. MEDVEDEV,A.M. 1978
The world collection of the Vavilov Institute of plant industry (VIR) breeding material of wheat. (Ru)
Kuibysh.kniz.izadet'stvo (USSR), 74-80.

On the basis of a study of more than 3000 forms during 1965-75, lists are given of useful material for breeding for drought resistance, such as Bezenchuk 102, Bezenchuk 105, Melanopus 69, Melanopus 26, Krasnokutka 6 (wheat from Krasnyi kut 6) and Khar'kov 51. For protein content and macaroni quality, cv. such as CB8231, Hercules, Lakota, Wells, Leeds and Bezenchuk 105, were found useful. A combination of useful characters was found in Candeal 1, Candeal 17, Candeal 19, Lakota and Wells.

967. MU'ALLEM,A.S. 1982
Mid-altitude wheat collection in PDR Yemen.

Plant Genet.Res.Newsl.(Italy), 9-10.

Four exploration from 1970-72 collected germplasm from 50 sites. The local cultivars were mainly Triticum aestivum, but a mixture of T. aestivum and T. durum types was noticed in a few small areas. Ten local cultivars were identified from the collection.

968. PERRINO,P. and HAMMER,K. 1983
Collection of land-races of cultivated plants in south Italy.
Kulturpflanze(F.R.G), 31:219-226.

Of the 144 samples collected, 80 were of cereals and 41 were pulses. Cultivation of Triticum dicoccum and of old land races of T. aestivum, T. durum, Secale cereale (only two samples) and Zea mays was observed. Vicia faba was the most variable of the pulses. The material collected is maintained in gene banks at Bari and Gatersleben (German Democratic Republic).

969. PERRINO,P., POLIGNANO,G.B., PORCEDDU,E., OLITA,G. and VOLPE,N. 1976
Wheat in North Africa. 3: Results concerning an expendition to the East Atlas mountains. (It)
Ann.Fac.Agr.Univ.Bari (Italy), 28:401-414.

Information concerning an expedition to Tunisia and Algeria with the main aim of collecting old wheat varieties in some regions of those countries is given. From 147 spike samples, 14 durum and 3 bread wheat varieties were identified. Distribution and frequency of collected varieties are discussed together with the visited areas.

970. PERRINO,P., POLIGNANO,G.B. and PORCEDDU,E. 1976
Wheat in North Africa.2: Results concerning an expendition to West Atlas mountains and the oases. (It)
Ann.Fac.Agr.Univ.Bari.(Italy), 27:13-39.

Preliminary information concerning an expedition to Algeria with main objective of collecting old wheat varieties in some regions of that country is given. From 115 spike samples, 36 varieties were identified. During the expedition spikes and seeds of other cultivated or wild plants were observed and, in some cases, collected. The areas visited are described and the distribution of the material within each area is discussed.

971. PLONIKOVA,L.N. 1980
The world collection of wheat and triticale in the Altai. (Ru)
Genetike i Selektsii (USSR), 68:139-142.

Lists are given of spring wheats promising for earliness, drought resistance, yield and disease and lodging resistance, and of winter wheats and triticales promising for winter hardiness, yield and resistance to Sclerotinia. The wheats Prima, Hesbynon, Sibiryachka 105, Krasnodarskaya and Skorospelka 3b and the triticales NAD430, NAD432 and NAD327 were resistant to Sclerotinia.

972. PORCEDDU,E. 1976
Variation for agronomical traits in a world collection of durum wheat.
Z.Pflanzenzuchtung (F.R.G), 77:314-329.

Growth habit, time to shooting, time to heading, plant height, number of elongated internodes in the main culm and wall thickness was scored for 2400 cultivars from 25 countries grown at one Italian site. Clear differences were found between entries from the different countries. Two groups were identified by multivariate analyses. One comprised material from western and central Mediterranean countries and Hungary, and the other material from Cyprus, Egypt, and Jordan. Material not included in these groups was largely scattered but accessions from the USA and Turkey were very similar. Values of the Shannon-Weiner diversity index suggested that there were significant differences among characters but not among countries.

973. PORCEDDU,E. 1979
Genetic variability in durum wheat germplasm of different origins.
Monografie Genet.Agr.(Italy), 0:39-69.

One hundred grains from 15 populations, five each from Italy, Algeria and Ethiopia, were grown and the variance and covariance of eight characters were measured. For most of the characters (heading time, flag leaf senescence, culm senescence, height, uppermost internode length, leaf sheath length, flag leaf length and flag leaf breadth) differences among origins, among

populations within origin, and among families within populations were highly significant. Families from the same population showed a wide range of means for various characters, indicating that large numbers of different genotypes were present in each population.

974. PORCEDDU,E. 1981
Report on genetic resources of durum wheat in Europe (De)
FAO, Rome (Italy) 1981: 4p.

975. PORCEDDU,E., MARTIGNANO,F. and SCARASCIA,M.G.T. 1979
Intrapopulation variability of coleoptile and primary root length in durum wheat. In Proceedings of the Fifth International Wheat Genetics Symposium Vol.1.New Delhi.
Indian Soc.Plant Breed.Genet.(India), 852-860.

Measurements of coleoptile and root lengths were made on 100 seedlings from each of a number of diverse populations 10 days after water had been added to the grains in vermiculite. The populations consisted of (1) two different collections each from five remote areas of Sicily and (2) parents F1s and F2s from crosses between Casteldelmonte and five random lines from a population in the first collection. Analysis of the data revealed that (1) the populations differed both in mean values and variability for both trials and (2) additive and dominance effects were significant for both traits, additive effects being the more important. Heritability estimates for coleoptile length ranged from 17 to 53% and for root length from 14 to 51%.

976. PORCEDDU,E. and OLITA,G. 1975
Wheat in North Africa. The preliminary results of the mission to North East Algeria. (It)
Ann.Fac.Agr.Univ.Bari,Italy, 27:671-686.

The preliminary results of the mission to Algeria for the collection of old wheat land races are reported. Descriptions of the areas explored, the material collected, the variability of the wheats, and their distribution over various areas are given. The results indicate that although the major part of the grain cultivated is composed of selections recently released to the farmers, it is possible to find old local varieties of notable variability in zones of marginal agriculture. However, ears of the old varieties may be found in many cultivated fields even if their discovery requires careful investigation.

977. PORCEDDU,E., PERRINO,P. and OLITA,G. 1973
Preliminary information on an Ethiopian wheat germplasm collecting mission.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 181-199.

978. PORCEDDU,E. and SCARASCIA,M.G.T. 1983
Genetic variation in durum wheat.
Proc.6th.Int.Wheat Gen.Symp.Kyoto(Japan) 241-252.

A series of studies aimed at ascertaining the genetic variation present in landraces of durum wheat from different origins were carried out utilizing: 1. populations: from Ethiopia (5), Algeria (6) and Italy (5); 2. F1s (15) from crosses among lines extracted from two populations per country and 3. segregating generations from crosses and intermatings of two Ethiopian lines and three Italian varieties. Analyses of morpho-physiological characters showed that:
1. a. Clear separation occurred between the Ethiopian and the Italian material; b. Italian populations were more differentiated from one another than Ethiopian ones; c. Differences among populations were larger in the Algerian materials than in the Ethiopian and Italian ones.
2. a. Additive genetic variance represented a large portion of the total genetic variance, but also non-additive effects contributes significantly for some characters; b. Genetic divergence among origins was in agreement with the level of heterotic response; c. Additive variance was important in plant dimension characters, while the non-additive one was relevant for fitness characters.
3. Linkage appeared to be an important component of the genetic architecture between loci controlling the same characters as well as different characters.

979. PORCEDDU,E., VANNELLA,S. and PERRINO,P. 1981

Character analysis and numerical classification in a wheat collection from Sicily.
Kultuepflanze,Berlin (F.R.G), 24:251-266.

A study was undertaken using 48 characters observed in plants, spikes and seeds in order to determine the amount of information of different characters and their taxonomic importance in tetraploid wheat samples from Sicily. A classification of the material was also attempted using similarity indices. The most important characters appear: leaf pubescence, glume colour and length, and seed colour. Using all characters, similarity indices among samples were computed and a classification was worked out. This classification, which is very similar to those proposed by various scientists, produces heirarchical groups, showing different levels of merging, and offers very interesting hypotheses on the evolution of the Sicilian durum wheats.

980. QUALSET,C.O. 1974
Sources of earliness and winter habit in durum wheat.
Wheat Infor.Serv.(Japan), 38:13-15.

The durum collection of USDA (about 3500 entries) was grown at Davies (38o2'N; 16m elevation) with July planting in 1969 and Tulelake, California (41o58'N; 1240m elevation) with spring planting. By examining the heading responses jointly for the two locations it was possible to identify very early heading types (about 350 entries) that are very likely both photo-and thermal insensitive.

981. QUALSET,C.O. and PURI,Y.P. 1973
Heading time in a world collection of durum wheat: Photo and thermal sensitivity related to latitudinal responses and geographic origins.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 165-174.

An evaluation of USDA world durum collection (about 3700 lines) was undertaken. Complete data were obtained from 2957 varieties. The largest groups analysed were from Turkey (803), Portugal (525), Russia (342), and Ethiopia (234). From 22 other areas 17 to 143 varieties were observed. These were predominantly found in European and Afghanistan collections. A wide range of heading time was observed in collections from all areas. There were some entries from each that did not head from the summer planting at Davis. Most of these headed when planted at Tulelake, thus indicating that they had a cold requirement. Only 2.9% of the entire collection did not head at Tulelake. These were predominantly of European origin, but 16% of the Afghanistan collection had winter habit. The extremely photoinsensitive types were found in only six areas: Ethiopia. Egypt, Afghanistan, Russia, India, and U.S. Of the Ethiopian collection, 67% flowered very early at Davis and 5% were very early at both Davis and Tulelake. This group is apparently unique for flowering time and provides the most promising photoinsensitive material.

982. SCARASCIA,M.G.T. and PORCEDDU,E. 1978
Experiences and perspectives on problems of wheat germplasm preservation.
Proc.5th Int.Wheat Genet.Symp.New Delhi. 204-215.

Discusses some of the more important practical problems with which these gene banks are confronted. The discussion based mainly on the experiences of the Laboratory at Bari, Italy.

983. SPAGNOLETTI,Z.P.L. and DE PACE,C. 1980
Differences among T. durum populations from different origins. I: spike morphological characters. (It)
Genetica Agraria. (Italy), 34:189.

Variability within durum wheat populations from Sicily, Ethiopia and Algeria was analyzed. Spike's characters were scored. An index was obtained by using genetic-environmental variance components ratio. Characters where variability was mainly due to genetic effects were detected. These characters were examined by using principal component, canonical and discriminant analysis.

984. SPAGNOLETTI,Z.P.L., DE PACE,C., BENEDETT-ELLI,S., LA FIANDRA,D. and PORCEDDU,E. 1983
Variation in durum wheat populations from different geographical origins: 4. Comparison between advance and primitive

cultivars.
Workshop Breed.Method D.W.Viterbo(Italy) 55-67.

Crosses between Italian varieties and Ethiopian lines were made in order to compare the relative contribution of advanced and primitive cultivars to the genetic variation in their progeny. The P1, P2, F1, Bc1, Bc2, F2, F2 X F2 and F3 families were grown and analyzed for eight characters. The additive and non-additive components of genetic variance were calculated by utilizing the least square method. F2 phenotypic variance were generally larger in crosses between parents from different origins than in those from the same one. The diversity between Ethiopian lines, nevertheless, was reflected in their progeny. The additive genetic component accounted for most of the variation in every cross studied.

985. SPAGNOLETTI,Z.P.L., DE PACE,C., PORCEDDU,E., SCARASCIA,M.G.T. and VOLPE,N. 1983
Variability in durum wheat populations from different geographical origin. 4: Genetic analysis of correlated sequential characters.
Proc.6th Int.Wheat Gen.Symp.Kyoto(Japan) 97-107.

Six lines (two each from Italy, Algeria, and Ethiopia) were crossed according to a diallel design. Variability and covariability, both phenotypic and genotypic, of plant and spike characters related to yield were estimated on F1 progenies. The discriminant ability of groups of characters describing the whole plant or the single main spike were discussed and genetic relations among temporally sequential characters assessed. Genotypes from Ethiopia and Algeria exerted the largest genetic effect on the variation of the characters that explain yield performance.

986. SPAGNOLETTI,Z.P.L., DEPACE,C. and PORCEDDU,E. 1983
Variation in durum wheat populations from three geographical origins.1: Material and spike characteristics.
Euphytica (Netherlands), 33:563-575.

Sixteen durum wheat landraces, i.e. 6 from Algeria, 5 from Ethiopia and 5 from Italy were analysed in order to ascertain the amount of variation for all 11 spike characters. For each population the differences among spike progenies were significant for all the observed characters. Principal component analysis showed that 4 factors accounted for 80% of the total variation. In scatter diagram of all 1127 spike progenies for the first two principal components, the material from Ethiopia and Italy clustered at two opposite sides, while the material from Algeria had the largest swarm and overlapped the other two groups of material. Differences among populations from the same origin were found. The ecological and anthropological causes that may have played a role in the creation of the observed variation in the examined populations, are discussed.

Physiology

987. ABDEL-FATTAH,K.S. 1977
Effect of varying calcium-magnesium ratios on micronutrient uptake by wheat (T. durum) in water culture experiment.
Egyptian Journal of Soil Science., 17:67-77.

The effect of varying Ca:Mg ratios (from 64:1 to 1:64) on Cu, Zn, Fe and Mn uptake by durum wheat cv. Leeds 137 was studied. With increasing salt conc.in young plants, high levels of Zn and Cu uptake occurred, but in older plants, Cu, Zn, Fe and Mn uptake was greatest at low salt conc.

988. AGGARWAL,P.K., CHATURVEDI,G.S. and SINHA,S.K. 1981
Frequency distribution of yield component as an index of stability in wheat at different levels of water availability.
Proc.Indian Nat.Sci.Acad.(India), 47:756-767.

The ear characters of the mother shoot [main tiller] were compared with those observed in a population through frequency distribution analysis in 4 cv. each of Triticum aestivum, T.durum and triticale. The stability in frequency distribution of ear wt., grain wt./ear and grain number/ear was in the order T.aestivum > T.durum >triticale. However, there were cv. differences and

some cv. with greater stability were identified. Phenotypic features of these cv. are described.

989. ALESSANDRONI,A., D'EGIDIO,M.G., STEFANIS,E.De., FORTINI,S. and GALTERIO,G. 1977
Yield and quality of grain in relation to nitrate reductase and ribulose diphosphate carboxylase in leaves of T. durum.
Genetica Agraria.(Italy), 31:1-19.

In flag leaf of seven Italian varieties of T.durum: Appulo, Trinakria, Valgerardo, Raineri, Valsacco and Granato, nitrate reductase and ribulose diphosphate carboxylase activities were determined from boot phase to twenty days after flowering. Protein and starch synthesis were followed during seed ripening. NRA in leaves showed similar values for the varieties and for different quantities of nitrogen. This levelling effect is likely accountable to the unusual season. There was a positive correlation, statistically significant at 1% level, between grain yield and ribulose diphosphate carboxylase activity in leaves. Activity on this enzyme increased with higher nitrogen fertilization in all varieties. Starch-protein ratio and the vitreous feature of seeds were inversely correlated. Two "types" of T.durum were defined on the basis of chemical and metabolic traits.

990. ALESSANDRONI,A., FORTINI,S., GALTERIO,G., SGRULLETTA,A. and D'EGIDIO,M.G. 1976
Resistance to yellowberry in T. durum varieties as related to protein synthesis and leaf nitrate reductase activity. (It)
Genetica Agraria.(Italy), 30:1-18.

In six Italian varieties, Valtarquinio, Valsacco, B.52, Creso, Cappelli and Granato, which differentiate for resistance to yellow-berry, nitrate reductase activity and soluble protein content in flag leaf were determined from boot phase to the yellowing of the leaf tissue. Nitrogen quantity was determined in grains from six day time from flowering to complete ripening. Varieties more resistant to yellow-berry show a higher nitrate reductase activity in leaves and a higher rate of protein synthesis in grains, the latter clearly visible 28 days after flowering. In the phase of gluten formation the synthesis of hydrocarbon materials, in less resistant varieties, is less balanced in relation to the synthesis of nitrogen compounds.

991. ALESSANDRONI,A. and SCALFATI,M.C. 1973
Effect of environment on relationship between yield and the yield components: seed weight per ear and ear number per plant, in T. durum Desf.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 297-302.

Two T.durum varieties: Cappeli and B 52, grown at Foggia during the years 1963-65 were analysed for a first approach on the study of environmental influence on the relation between yield and two important components: seed weight per ear and number of ears/plant. The environments were created by using different rates of nitrogen fertilization, seed rates, planting dates and dates of nitrogen applications during the development stages. Simple correlations as well as regression were computed. The analyses, performed with the overall results and isolating the specific data of the single levels of the variation factors, have confirmed a significant relationship between yield and seed weight per ear. On the other hand the ear number per plant has been found related inversely and significantly with yield and such a relationship has been influenced by some agronomic variable. Comparisons were also performed among estimates of variance for yield, seed weight per ear and number of ears per plant.

992. ALIMOV,F.M. 1980
Interrelation between flag leaf area and grain weight from the main ear in different genotypes of durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 12:165.

The short variety Oviachik 65, the medium height Dzhafara and the tall Sary (yellow) were sown at 100, 200, 300, and 400 grains/m2. Grain weight was more stable in Oviachik 65 than in the other varieties. Flag leaf area was weakly correlated with grain weight, regardless of variety and sowing rate. Number of productive tillers was correlated closely with number of leaves per plant.

993. ANDERSON,W. 1982
Differences in nitrogen use efficiency in cereal genotypes.
RACHIS (ICARDA,Aleppo,Syria), 10-12.

Work at ICARDA began in 1979-80 to characterize the N response of a small number of genotypes, including the durum varieties Waha and Haurani. Differences were found in the yield obtained, when no N was added, in the yield per unit of N applied, and in the maximum yield response to N fertilizer.

994. ASHRAF,C.M. and ABU-SHAKRA,S. 1978
Wheat seed germination under low temperature and moisture stress.
Agronomy Journal (USA), 70:135-138.

Seed germination of four wheat cultivars, 'Najah' and 'Mexipak' (Triticum aestivum L.), and 'Haurani' and 'Jori' (Triticum durum L.), were compared under suboptimal temperatures and various levels of simulated moisture stress. Components of water uptake, germination percentage, speed of germination, root growth, respiration rate, and germination recovery from stress were measured. The rate of water uptake decreased and the time required for germination increased when the seeds were incubated at 6 atm and higher. Seeds of the four cultivars germinated when their moisture content was approximately 50% on a fresh weight basis. Total germination was not affected by moisture stress levels up to 12 atm but was significantly reduced at 15 and 18 atm osmotic tensions. Rate of root growth, speed of germination , and respiration rates were inversely related to moisture stress. Low moisture stress (3 atm) did not inhibit root growth. Significant differences were found among cultivars in the parameters studied. Perforating the pericarps did not eliminate the differences in water uptake and respiration rates between cultivars. Prolonged exposure of ungerminated seed to high osmotic tensions at low temperatures showed high seed germination recovery. These data suggest that any of the germination criteria used can be effective in selecting drought-resistant cultivars.

995. BAROCCIO,A. 1975
Variations in aminoacids content of proteins of some durum wheat lines. (It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 5:95-104.

996. BAROCCIO,A., MARIANI,G., COLESANTI,F., DESIDERIO,E. and INCORVALA,F. 1976
Variations of mineral content in the plant of T. durum Desf. cv. Cereso, with increasing doses of normal and slow-releasing nitrogen fertilizers.
Voor Analytishe en Agrochemie (Belgium). 2:513-520.

997. BIANCHI,A.A. and MONOTTI,M. 1975
Results of trials with 2 chloroethyl trymethylammonium chloride (CCC) on bread and durum wheat.
Ann.Fac.Agr.Univ.Perugia (Italy), 29:517-532.

CCC applied to wheat by foliar application at the beginning of stem elongation showed the highest reduction of stem length . All the internodes of the culm were reduced but not the spike. The optimum rate of CCC was between 2 and 3 kg/ha of active matter. On durum wheat CCC produced a significant dwarfing of the culms, and reduced the lodging of the treated plots to one third with respect to the untreated ones. As a consequence grain yield was significantly increased and the percentage of yellow berry kernels was reduced.

998. BLANCO,A. 1981
Response to gibberellic acid of durum wheat (T. durum Desf.)
Genetica Agraria (Italy), 35:347-355.

999. BLANCO,A., TANZARELLA,O.A., SIMEONE,R., CAIRO,F. and SCARASCIA,M.G.T. 1981
Inheritance of plant height in durum wheat (T. durum Desf.). (It)
Genetica Agraria (Italy), 36:393-406.

The response to gibberellic acid of 45 Italian durum wheat (Triticum durum Desf.) varieties was studied. With Riago, Gabbiano, Sansone excluded, all the insensitive varieties, including the most recent and successful ones, should have at least one semi-dwarfing gene (Rht) associated with the insensitivity to gibberellin and should be regarded as Norin 10 derivatives. The sensitive varieties showed a negative correlation between the length of their second leaf sheath and their responses to gibberellin. Such correlation was not obtained with the insensitive varieties and with all the varieties examined.

There was a positive correlation between plant height and relative response to gibberellin. Some short varieties, however, showed high response to gibberellin, indicating the presence of genes for reduced height other than Rht.

1000. BLUM,A., SIMEONA,B. and EIVO,O. 1980
An evaluation of seed and seedling drought tolerance screening tests in wheat.
Euphytica (Netherlandss), 29:727-736.

A series of experiments was performed in order to evaluate the significance of seed germination and seedling growth in osmotic media as screening methods for drought tolerance. Ten spring wheat (T.aestivumL.em Thell.) and one durum wheat (Triticum durum Desf.) were tested under controlled environments, using polyethylene glycol-6000 (PEG) solutions as the moisture stress inducing media. Tolerance in the rate of endosperm utilization, under stress, prior to the onset of germination varied among cultivars. Germination rate or injury to germination at various concentrations of PEG differed significantly among cultivars. Cultivar rating with respect to injury to germination changed with stress levels. Injury to germination did not correlate with endosperm utilization rate in PEG or in water. Germinating seedlings were tolerant to extreme desiccation up to the stage of emergence of the first leaf from the coleoptile. Growth of photosynthesizing seedlings was monitored as they were carried through an increasing concentration gradient of PEG solutions, ranging from- 5.9 to-11.3 bars of water potential. Cultivars significantly differed in seedling growth tolerance to increasing levels of water stress. Seedling growth tolerance across cultivars was not correlated with germination responses under stress. It is concluded that tolerance to water stress in growing seedlings can be screened for by using PEG-containing nutrient solutions. It cannot be predicted from germination tests in osmotics.

1001. BOURGEOIS,M. 1979
Model of assimilate partition in T . durum (wheat). (Es)
Balcarce,Bs.As. (Argentina)1979:34p.

1002. BRUNETTI,N., FERRANDI,L., BOZZINI,A. and MOSCONI,C. 1976
Effect of nitrogen fertilization on nitrate reductase activity on grain, straw and protein yields in durum wheat.
Riv. Agron.(Italy), 1:171-177.

Studies were conducted on ten lines of durum wheat, Triticum durum grown in field to determine if nitrate reductase activity and protease levels could be correlated with water soluble leaf protein, reduced nitrogen, grain and grain protein (% and total) production. Nitrate reductase activity and reduced nitrogen were determined at intervals throughout the reproductive and maturation phases, protease activity and water soluble leaf protein only during maturation phase. Flag leaf was used for enzyme assays. The major conclusions are: a) grain yield is correlated with nitrate reductase activity at anthesis, if any other factor is not limiting: b) varieties which maintain their nitrate reductase activity, for a long period in the late stage, synthesize more protein than varieties which have high activity for only a short period; c) high flag leaf protease activity at maturation phase is related to high grain protein content; d) nitrate reductase activity and protease activity appear promising for prediction of wheat and protein yields if the tests are conducted during particular stages in plant development

1003. BRUNETTI,N., ROSSI,L. and FERRANDI,L. 1975
Protease and nitrate reductase activities and their relation to yield and grain protein in Triticum durum . (It)
Genetica Agraria (Italy), 29:79-94.

1004. CAMPBELL,C.A. 1979
Effect of temperature, nitrogen fertilization and moisture stress on growth, assimilate distribution and moisture use by Manitou spring wheat.
Can.J.Plant Sci (Canada)., 59:603-626.

1005. CARCELLER,M. and SORIANO,A. 1977
Effect of cytokinins on growth of wheat seedling under water stress conditions.
Turrialba IICA. (Argentina), 27:293-298.

The effects of benzyladenine and water stress, applied to young wheat plants were investigated. On specially

designed tubes and lucite boxes, the whole root, or its apical or basal portion could be submitted to drought. Benzyladenine was provided to leaf or root. When water was available, benzyladenine did not have any significant effect on leaf and root growth at low concentrations, and was inhibitory at higher concentrations. Under drought conditions, benzyladenine was found to promote growth in certain cases, while in others an inhibitory effect was found, even at low concentrations. This variable effect could be explained on the basis of interactions at the endogenous level, the amount of exogenous benzyladenine translocated and water availability.

1006. CHARLTON,J.L., HUNTER,N.R., GREEN,M.A., FRITZ,W. and ADDISON,B.M. 1980
The effects of triacontanol and triacontanol derivatives on germination and seedling growth of Leeds durum wheat.
Can.J.plant Sci.(Canada), 60:795-797.

No enhancement of the rate of germination or growth was found.

1007. CHETAL,S., WAGLE,D.S. and NAINAWATEE,H.S. 1983
Phospholipid changes in wheat and barley chloroplast under water stress.
Plant Sci.Letters(Netherlandss), 29:273-278.

1008. CIOCCA,L., D'EGIDIO,M.G., GALTERIO,G., MARDI,S. and ALESSANDRONI,A. 1979
Glutamate-oxaloacetate transaminase, phosphoglycerate mutase activity and protein content in the grains of durum varieties during ripening. (It)
Ann.Ist.Sper.Cerealicoltura (Italy), 10:125-133.

In grains of the following varieties of T.durum: Berillo, Capeiti, Creso, Trinakria and Valgerardo, glutamate oxaloacetate transaminase (GOT) and phosphoglycerate mutase (PGM) activities were measured from seven days after anthesis until ripening. In the same materials protein synthesis was followed. GOT activity increased linearly with dry matter accumulated in the grain until 26 days after anthesis; PGM instead showed a regular decline. The importance of GOT for protein synthesis is confirmed; moreover a relation with activity of GOT and gliadin quality present in grain may be postulated. PGM catalyzes a reaction that may be considered to function as a master reaction in bringing photosynthetic product towards amino acid synthesis.

1009. CIONINI,P.G., BARONCELLI,S., MASERTI,B.E. and ROCCA,M. 1981
Influence of light and of gibberellic acid treatment on the growth of two Triticum durum cultivars. (It)
G.Bot.Italiane (Italy), 115:238.

In 2 durum wheat cv. germinated and grown without light or in red light at 2000 or 18 000 lx, and with or without GA, coleoptile and 1st leaf growth was greater in Cappelli than in Creso with GA, particularly at the higher light intensity.

1010. CIONINI,P.G., BENNICCI,A. and MASERTI,B.E. 1980
Study of the meristematic activity in the radicle apex of germinating seeds of T. durum during the dormancy period. (It)
G.Bot.Italiane (Italy), 114:118-119.

Dormancy in seeds of durum wheat cv. Cappelli was broken progressively from the time of harvest in July to complete loss by 1 Nov. In seeds in which dormancy was broken, increase in growth in initial and final phases were smaller, the final radical length was shorter, a smaller number of cells were found in the radical meristem and the pre DNA synthesis phase was longer than in nondormant seeds. The total length of the mitotic cycle was the same in dormant and non dormant seeds. The changes in behaviour of the dormant seed were related to changes in GA levels

1011. CLARKE,J.M. and McCAIG,T.N. 1982
Excised-leaf water retention capability as an indicator of drought resistance of Triticum genotypes.
Can.J.Plant Sci. (Canada), 62:571-578.

Leaves from 16 T.durum lines were excised, weighed and then reweighed at intervals after standing in a controlled environment room and after oven drying. A 6-10 h interval improved the differentiation between lines. In T. durum, water loss was slowest in

Perlissier and fastest in Hercules. Fifty-two lines from a Hercules x Pelissier cross ranged in water retention capabilities between the parental values. Good water retention in excised leaves appeared to be characteristic of known drought resistant plants. There was a significant positive correlation between yield and leaf water retention.

1012. CLARKE,J.M., TOWNLEY-SMITH,T.F., McCAIG,T.N. and GREEN,D.G. 1984
Growth analysis of spring wheat cultivars of varying drought resistance.
Crop Sci.(USA), 24:537-541.

Field studies were undertaken to relate dry matter accumulation and loss patterns to drought resistance and yield performance of wheat. A total of 23 hexaploid (Triticum aestivum L.) and tetraploid (T. turgidum var. durum L.) wheat genotypes were grown under rainfed field conditions at Swift Current, Saskatchewan from 1975 to 1978, and under both rainfed and irrigated conditions in 1979 and 1980. The genotypes were divided into drought susceptible and drought resistant groups on the basis of a drought susceptibility index. In contrast to results in some other studies, Pitic 62 appeared to be somewhat drought susceptible, perhaps because of late flowering. Mean head yield: biological yield ratios (approximation of harvest index) ranged from 0.52 to 0.60 over the 5 years, and tended to be higher under moist or irrigated conditions than under dry conditions. There were consistent cultivar differences in stem dry weight reduction prior to maturity, but there was no obvious relationship between this trait and drought resistance.

1013. COMENGE ENSEHAT,J. 1978
Nitrogen-quality relation in durum wheat (Triticum durum). (Es)
Cogullada (Spain), 46:21-24.

1014. COTTONET,M., KOBREHEL,K. and AUTRAN,J.C. 1983
Hydrophobicity of Y-gliadins 45 and 42 of T. durum wheat (T. durum Desf.).
Sciences des Aliments (France), 4:483-504.

Gamma gliadin components 45 and 42 isolated from durum wheat are clearly characterized through two different electrophoretic systems. These two proteins have the same molecular weight (45 000 daltons) and a similar amino-acid composition. The hypothesis of a relationship of both a genetic and functional type based on the hydrophobicity of proteins with viscoelastic properties of gluten and the presence of 45 and 42 gliadin fractions is discussed.

1015. D'YACHENKO,N.I. and CHILIKINA,L.A. 1981
The amylolytic activity of germinating grain in tall-strawed and dwarf of durum wheat. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 4:65-78.

Data on grain subjected to preliminary treatment with GA indicate that, within the limits of a single botanical variety, the highest amylase activity occurs in tall-strawed forms and the lowest in dwarf forms.

1016. DEXTER,J.E. and DRONZEK,B.L. 1975
Protein synthesis in triticale and its durum wheat and rye parents.
Cereal Chem.(USA), 52:577-586.

The solubility distribution of protein in the triticale was generally intermediate to that of the parents at all stages of development. 14C-Leucine incorporation into the total grain protein reached a maximum at 2 weeks after anthesis and then declined as the grain developed. Some differences in the proportion of 14C-leucine incorporated into the protein solubility fractions of the three grains were observed with the largest differences in incorporation obtained for the albumins and gliadins. The 14C-leucine incorporated into triticale protein fractions was, in general, intermidiate between those for the same fractions of the parents for all fractions except the glutenins. Triticale glutenin incorporated more 14C-leucine than the durum wheat or rye glutenins at all stages of development

1017. DEXTER,J.E. and DRONZEK,B.L. 1975
Amino acid composition of maturing endosperm from hexaploid triticale and its spring rye and durum wheat parents.
Can.J.Plant Sci.(Canada), 55:537-546.

The amino acid composition of the maturing endosperm of a triticale (X Triticosecale Wittmack) designated line 6A190 and its rye (Secale cerale L.) and durum wheat (Tritlcum durum Desf.) parents were determined. In all three cereals, rapid changes occurred during development in the free amino acid levels and in the nature of the endosperm proteins. The composition of the free amino acids of triticale more closely resembled the rye parent than the durum wheat parent throughout endosperm development. The amino acid composition of the proteins and peptides of triticale was intermediate to the rye and durum wheat parents at all stages of development.

1018. DHIMAN,S.D. and SHARMA,H.C. 1979
Contribution of awn and flag leaf in durum wheat and aestivum wheat.
Haryana J.Agr.Res. (India), 9:340-341.

Reduction in grain yield following the removal of the flag leaf, awns and flag leaf + awns was 13.1, 9 and 25.2% in T. durum cv. Raj-911.

1019. DRINKWINE,A.D. and FLEEKER,J.R. 1981
Metabolizm of 2,5 dichloro-4-hydroxy phenoxyacetic acid in plant.
J.Agri.Food Chem. (USA), 29:763-766.

1020. DUWAYRI,M. 1983
Effect of flag leaf and awn removal on grain yield and yield components of wheat grown under dryland conditions.
Field Crop Res.(Netherlands), 8:307-313.

Effect of flag leaf and/or awn removal on grain yield, kernel number and single grain weight were investigated in nine Triticum durum Desf. and one hexaploid Triticum aestivum L. wheat genotypes grown under dryland conditions in Jordan. The treatments were control, removal of the flag leaf, removal of the awns, and combination of awn and flag leaf removal. Genotypes studied differed in the traits investigated in addition to other agronomic characters. Flag leaf removal, awn removal and their combination significantly reduced grain yield by 10.7, 15.9 and 21.2%, respectively. Reduction in kernel number per plant was 11.1, 11.3 and 11.2%, respectively. Kernel weight was decreased by 5.2 and 11.3% as a result of awn removal and the combination treatment, respectively, but not by flag leaf removal. Although no genotype X treatment intraction was detected for any of the traits studied, grain yields of the local cultivars which are adapted to dryland conditions were affected more than other genotypes by awns' removal.

1021. Di MARCO,G., GIOVANNOZZI,S.G., GRECO,S., VERI,G. and PIETROSANTI,T. 1976
Daily fluctuation of some metabolic characters of durum wheat under field conditions.
Crop Sci. (USA), 16:343-347.

Physiological and biochemical parameters have been studied simultaneously with micrometeorological characters of a crop of durum wheat. Micrometeorological measurements and plant analysis on flag leaves before spike appearance were done during 2 days in May 1973 to ascertain the fluctuation of chosen leaf parameters in comparison with the micrometeorological ones. The results indicate that biochemical and physiological changes occur during the day and night and that stomatal opening is the main factor dependent on climatic conditions. Specific leaf weight seems to vary with the level of free amino acids. Ribulose diphosphate carboxylase showed daily fluctuations insensitive to climatic conditions, whereas phosphoenolpyruvate carboxylase exhibited little day change.

1022. Di MARCO,G., GRECO,S. and TRICOLI,D. 1979
Homoserine dehydrogenase in two field grown cultivars of Triticum (aestivum and durum).
Agrochimica (Italy), 23:357-366.

1023. FARMER,I. and LEE,P.E. 1977
Culture of protoplasts derived from Ramsey durum wheat.
Plant Sci.Letters.(Netherlands), 10:141-145.

Viable cultures of protoplasts derived from wheat leaves (Tricicum durum) were obtained. The protoplasts were isolated by enzymic degradation and kept viable in a defined medium supplemented with l-glutamine, 2,4-D and kinetin.

1024. FERRETTI,R., FILESNI,C., SERLUPI,C.G. and TASSIMICCO,C. 1982

Analysis by high pressure liquid chromatography (HPLC) and gas chromatography of lipidic extracts from durum wheat(T . durum) and normal wheat (T . aestivum). (It)
Riv.Soc.Italiana.Sci.Alimentaz. (Italy), 11:219-222.

1025. FISCHER,R.A. and MAURER,R. 1978
Drought resistance in spring wheat cultivars, 1. Grain yield responses.
Australian J.Agric.Res.(Australia), 29:897-912.

With a view to understanding the basis of cultivar differences in yield under drought, a wide range of cereal cultivars representing durum wheats (Triticum turgidum L.), triticales (X Tritosecale Wittmack), barley (Hordeum vulgare), and especially tall and dwarf bread wheats (T. aestivum L.) were studied in field experiments in north western Mexico over three seasons. Drought was created in this rain-free environment by permanently terminating irrigation at various stages before anthesis. Control treatments were well watered throughout the growing period. Drought levels were such that the mean yield of all cultivars under trial ranged from 37 to 86% of control yield, corresponding to irrigation cut-offs varying from 69 days before mean anthesis date to 10 days before. In each experiment the grain yield under drought showed highly significant cultivar differences, which appeared consistent between years. The demonstration of linear relationships between cultivar yield and drought intensity, as indicated by the mean yield of some or all cultivars, prompted the consideration of cultivar yield under drought as the function of yield potential (Y p, yield without drought), drought susceptibility index (S), and intensity of drought. The cultivar groups showing lowest S values (most drought-resistant) were tall bread wheats and barley; dwarf bread wheats were intermediate, and durum wheat and triticales were the most susceptible.

1026. FISCHER,R.A. and SANCHEZ,M. 1979
Drought resistance in spring wheat cultivars, 2. Effect on plant water relations.
Australian J.Agric.Res.(Australia), 30:810-814.

Cultivar and drought effects on the water relations were studied of a large set of cultivars of bread wheat (Triticum aestivum L.), durum wheat (T. turgidum), triticale (X Tritosecale Wittmack) and barley (Hordeum vulgare L.), grown in field plots in north western Mexico in the presence and absence of simulated late drought. Leaf water potential (wp) and osmotic potential (op), and leaf permeability (lp) to viscous air flow were measured between 1000 and 1600 hours on many dates;leaf turgor potential (p) was calculated. Drought caused associated reductions in wp, op and lp. Cultivar effects on these variables were usually significant on given dates, and reasonably consistent between dates and drought intensities in the case of wp, but less so for op and lp. There were consistent positive phenotypic correlations between wp and lp, and wp anthesis date, and negative correlation between wp and stature in the absence of drought. The relationship of lp to wp for different cultivars differed significantly: in particular, tall bread wheats had lower lp than dwarf cultivars at high values of wp, whereas at low wp they had higher lp than the dwarf cultivars.

1027. FISCHER,R.A. and WOOD,J.T. 1979
Drought resistance in spring wheat cultivars, 3. Yield associations with morpho-physiological traits.
Australian J.Agric.Res.(Australia), 30:1001-1020.

1028. FORTINI,S., ALESSANDRONI,A. and GALTERIO,G. 1975
Protein synthesis and resistance to yellowberry in seeds of Triticum durum . (It)
Genetica Agraria (Italy), 29:111-122.

In order to obtain information on the componentr of the varietal resistance to yellow berry in T. durum we have studied protein synthesis in grains of varieties differing in degree of resistance. The research was done with grains of Cappelli (a resistant variety) and of Sincape 9 (a more susceptible variety) coming from plants that have been grown with two levels of nitrogen fertilizer, and that have been analyzed at different stages from flowering to complete ripening. Grain protein synthesis rate was superior in Cappelli. Nitrogen

compounds percentage was higher in Cappelli in all the phases that have been analyzed, with greater differences in the first stages and for grains obtained from plants that have been grown with a smaller amount of nitrogen fertilizer. Protein fractionation was performed on vitreous and yellow-berry grains and the effect of the yellow-berry appeared to be considerable.

1029. GALLESCHI,L. and FLORIS,C. 1979
Regulation of the activity of succinate semi-aldehyde dehydrogenase in seeds of T. durum. (It)
G.Bot.Italiane. (Italy), 13:476-477.

Succinic semialdehyde dehydrogenase purified from seeds of durum wheat was inhibited 100% by oxaloacetate and succinic acid. Glutamic acid, alpha - aminobutyric acid, AMP, ADP, ATP, thiamine pyrophosphate and NADP had no effect on it.

1030. GALLESCHI,L. and FLORIS,C. 1979
Detection of succinic semi-aldehyde dehydrogenase in durum wheat by means of polyacrylamide gel.(Fr)
Biochem.Physiol.Pflanz.(F.R.G), 173:456-459.

Succinic semialdehyde dehydrogenase activity is detected by electrophoresis on polyacrylamide gel. An activity band appears when NAD or NADP are present. These bands have the same migration rate as bromophenol blue. This result together with the same specificity to oxidation of succinic semialdehyde, the same optimum PH and stability PH and the same elution profiles for the succinate semialdehyde dehydrogenase activity confirm the hypothesis of the presence of NAD dependent enzyme in Triticum durum.

1031. GALLESCHI,L., FLORIS,C. and MELETTI,P. 1980
Succinic semialdehyde dehydrogenase activity in durum wheat during physiological phases of seed ripening.
Biochem.Physiol.Pflanzen.(F.R.G), 175:87-90.

Succinic semialdehyde dehydrogenase activity was evaluated in wheat embryos. Enzymatic activity was constant from milk- up to dough-ripe stages of development. It decreased at the completion of seed dehydration. Germination of dormant seeds was 5% over 30 days of imbibition, in nondormant seeds it was 85%. Specific activity of succinic semialdehyde dehydrogenase reached a max. over 3 days imbibition then decreased in dormant seeds but in nondormant seeds it increased, over the imbibition period and was always higher than in the dormant seeds.

1032. GALLESCHI,L., NOCCHI,C., FLORIS,C., BEDINI,G. and ANGUILLESI,M.C. 1983
Succinic semialdehyde dehydrogenase in higher plants: Purificaton and properties of the enzyme from T. durum embryos.
Biochem.Physiol.Pflanzen.(F.R.G), 178:645-651.

1033. GALTERIO,G., BRUNORI,A., VALLEGA,V. and ZITELLI,G. 1983
DNA, dry matter and nitrogen accumulation in the developing grain of the durum wheats Valgerardo, Trinakria and two F8 lines from Valgerado X Trinakria.
Genetica Agraria (Italy), 37:421-428.

Trinakria had larger grains, a higher protein content and a higher grain nitrogen content than Valgerardo. The DNA content per endosperm (microg) of mature grains was higher in Valgerardo and Trinakria than in F8 lines, 5022 and 5122. The rate of DNA accumulation was slower in Valgerardo than in Trinakria, but in the former, the accumulation lasted longer. Throughout grain development, Trinakria had a higher rate of nitrogen accumulation than Valgerardo.

1034. GALZIN,A.N. and MONTIES,B. 1979
Glycollate oxidase activity in wheats species: Genetic control of activity by polyphenols. (Fr)
Physiol.Veg.(France), 17:869-882.

1035. GAMZIKOVA,O. and SAVITSKAYA,V.A. 1979
On cold hardiness and drougnt resistance of durum wheat. (Ru)
Sibr.Vest.Sel'sk-Khoz.Nauki.(USSR), 54:18-22.

From emergence to the shooting stage, durum wheat did not differ in its

reaction to low temp. from soft wheat and was not killed by temp. of -1% in the young growth stage. Damage was not less pronounced in late-maturing cv. During grain ripening, durum wheat required higher temp, than soft wheat and ripening was delayed in cool cloudy weather. Durum wheat was sensitive to drought during the tillering-shooting stage. Durum wheat was characterized by slow growth of the primary root system and relatively poor ability to germinate under conditions of physiological drought.

1036. GAVAZZI,C. and PARIS,P. 1973
Accumulation rates of the principle nutritive elements in wheat grains. (It)
Ann.Fac.Agr.Univ.Cathol.Sacro C.(Italy), 13:113-136.

Of the three cv. studied, dry and fresh-matter accumulation rate ten days after flowering was highest in 6003. This variety also showed the sharpest decrease in water content between 31 and 38 days after flowering. Patrizio 6 showed a continual decrease in percentage ash content. There was a highly significant positive correlation between ash content and nitrogen content in all three varieties. Final phosphorous content ranged from six times the initial content in 6003 to nine times in Patrizio 6 and Conte Morando Bolognini. The accumulation of potassium followed a similar course in all three varieties.

1037. GEBEYEHOU,G., KNOTT,D.R. and BAKER,R.J. 1982
Rate and duration of grain filling in durum wheat cultivars.
Crop Sci.(USA), 22:337-340.

Eleven durum wheat cv. were grown on a clay soil under rainfed and irrigated conditions. A cubic polynomial was used to describe the relationship between grain wt. and days from anthesis and to give information on the rate and duration of grain filling. Cv. differed significantly in all of the criteria measured, but thiee seemed to be no correlation between rate and duration of grain filling.

1038. GEBEYEHOU,G., KNOTT,D.R. and BAKER,R.J. 1982
Relationships among durations of vegetative and grain filling phases, yield components, and grain yield in durum wheat cultivars.
Crop Sci.(USA), 22:287-290.

Path coeff. analysis revealed a positive relationship between the duration of vegetative growth and the number of grains/ear and grain wt., which in turn had a positive effect on grain yield. The number of ears/m2 was negatively correlated with grain-filling period, number of grain/ear, grain wt. and length of vegetative period.

1039. GENKEL,P.A., BADANOVA,K.A., PRUSAKOVA,L.D. and BOKAREV,K.S. 1979
Multiple method to increase the heat and drought resistance of spring wheat.
Soviet Plant Physiol. (USA), 26:518-523.

1040. GIOVANNOZZI,S.G., DI MARCO,G., TRICOLI,D., GRECO,S. and ROSSI,W. 1973
Ribulose-1,5 diphosphate carboxylase and phosphoenolpyruvic carboxylase in Triticum genus.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 211-215.

As first step of a research of the wheat photosynthetic capacity an analysis was performed with the aim to ascertain whether differences in ribulose - 1 - 5 diphosphate carboxylase (Calvin and Bassham cycle) and phosphoenolpyruvic carboxylase (Hatch and Slack cycle) could be detected in different species of Triticum. The results showed different ratios of Ru-di-P carboxylase/PEP-carboxylase in diploids, tetraploid and hexaploid wheats. This ratio is rather constant in tetraploids and hexalpoids while it shows variability in diploid species.

1041. GRILLI,I., ANGUILLESI,M.C. and FLORIS,C. 1979
Effect of GA3 on the synthesis and polyadenylation of RNA during the initial phases of germination in dormant seeds of Triticum . (It)
G.Bot.Italiano (Italy), 13:477-478.

Durum wheat seeds (a) 1 wk or (b) 8 months after harvest were fed 3H-uridine and GA was applied. In (a), RNA synthesis was the same with or without GA.

1042. GULLECHI,L. and FLORIS,C. 1978
Detection on polyacrylamide gel of succinic semialdehyde-dehydrogenase from

T . durum .
Biochem.Physiol.Pflanzen.(F.R.G), 173:456-459.

Succinic semialdehyde dehydrogenase activity was detected in durum wheat embryos using polyacrylamide gel electrophoresis. One band of activity appeared in the presence of NAD or NADP.

1043. HARHOURI,A. 1980
Contribution to the study of drought resistance of hard wheat (T . durum Desf.) and of soft wheat (T . aestivum): Study of proline accumulation under the effect of water stress. (Fr)
Pub.INRA (France), 65.

1044. HERZ,M. and BRUNORI,A. 1982
Variation of DNA content and nuclear DNA cytophotometry in the endosperm of developing grains of hexaploid primary triticales and parents.
Genetica Agraria (Italy), 36:180-182.

In endosperms of the primary triticale, DNA accumulation was completed 28 days after flowering, while in the rye and durum parents it was completed 28 and 20 days after heading respectively. Once the maximum DNA content was reached, there was a progressive reduction in content. In the starchy endosperm, the most frequent ploidy level was 12C in T. durum and 6C in rye and triticale.

1045. INNOCENTI,A.M. and BITONTI,M.B. 1979
Variations in the ratio of histones:DNA in radicle meristems of Triticum durum during aging. (It)
G.Bot.Italiano.(Italy), 13:478.

1046. INNOCENTI,A.M. and BITONTI,M.B. 1981
Variations in the histone: DNA ratios in the scutellum of aged seeds of Triticum durum . (It)
G.Bot.Italiano.(Italy), 15:120.

1047. INNOCENTI,A.M. and FLORIS,C. 1979
Metabolic activity distribution in the embryo of naturally aged seeds of durum wheat.
Biochem.Physiol.Pflanz.(F.R.G), 174:404-410.

Seeds of durum wheat cv. Capelli harvested in 1966 and 1974 were allowed to imbibe sol. containing tritiated thymidine, uridine and lysine. In light microscope studies of sectioned autoradiographed tissues, the label was found in the areas of the 1st node and scutellum of aged embryos only and the rate of incorporation was similar to that in the young embryos.

1048. INTERSSE,F.S., RUGGIERO,P., LAMPARELLI,F. and AVELLA,G. 1982
Studies on the phenolase enzymatic system in durum wheat.
J.Agric.Food Chem.(USA), 30:1198-1203.

The purified enzyme showed activity towards di-and polyphenolic substrates but not monophenols. With 4-methylcatechol as substrate the enzyme had 2 PH optima at 5.3 and 7.3. Three isoenzymes with different specific activities were separated. Durum wheat o-diphenolase differed from that of common wheat.

1049. JOHNSON,D.A., RICHARDS,R.A. and TURNER,N.C. 1983
Yield, water relations, gas exchange, and surface reflectances of near-isogenic wheat lines differing in glaucousness.
Crop Sci.(USA), 23:318-325.

Four pairs of nearly isogenic lines (three of Triticum aestivum and one of T. durum that were glaucous (G) or nonglaucous (NG) were grown in plots which were irrigated, rainfed or kept dry after initial seedling establishment. G lines yielded significantly more grain and dry matter than NG lines in the irrigated and rainfed plots but not in the dry plot where average yield was 66 g/m2. Surface reflectances in the 400 to 700 nm wavelengths were same for the adaxial surface of the flag leaf, but were 8 to 15% higher in the G than NG line on nearly isogenic pair for the ear, sheath and abaxial flag leaf surface.

1050. JONES,B.L., COOPER,D.B. and LOOKHART,G.L. 1979
Purothionins and homologous protein from various grains.
Cereal Foods World (USA), 24:444.

1051. KASTINA,E.E. 1984
Photoperiodic response of spring durum wheat plant grown under artificial light. (Ru)
Sel'sk-Khoz.Biol (USSR), 67-71.

Eight spring durum wheat genotypes were divided into 2 groups on the basis of developmental response of their plants to lengths of photoperiods. Compared with a 24-h photoperiod, heading of plants in 20-, 16- and 12-h photoperiods was delayed by 3.8-4.3, 14-17.3 and 65.6-77.6 days, respectively in genotypes of the 1st group; it was delayed by 5.1-5.2 and 22.9-27.3 days in 20- and 16-h photoperiods, respectively, and plants failed to reach the heading stage in a 12-h photoperiod in genotypes of the 2nd group.

1052. KRASTINA,E.E. 1982
The inhibition of durum and spring wheat development by a high level of mineral nutrition and artificial lighting. (Ru)
Izv.Timiryazev.Sel'Sk-Khoz.Akad.(USSR), 3-11.

The response of 5 durum and 1 soft spring wheat cv. to growing conditions was studied, in sand-culture and in sol. culture. Artificial light or natural light plus DRLF-400 lamps were used to give a 16-h photoperiod. All the genotypes of durum wheat were more strongly inhibited at the higher levels of nutrition than the soft spring wheat. The combination of high nutrition with artificial lighting was particularly unfavourabl for generative development of durum cv. Heading of durum cv. began later than heading of soft wheat cv. under these conditions.

1053. KRUGER,J.E. 1976
Changes in the polyphenol oxidases of wheat during kernel growth and maturation.
Cereal Chem.(USA), 53:201-213.

Polyphenol oxidase (PPO) activities were determined at various stages in the growth and maturation of hard red spring, soft white spring, and durum wheat kernels. PPO activity was formed early in kernel development and decreased with kernel maturation. Dissection studies indicated that a large part of the PPO in the immature wheat kernel was present in the endosperm. Polyacrylamide-slab electrophoresis of immature kernel extracts indicated that up to 12 PPO isozymes were present. These isozymes were located in different parts of the kernel. Upon germination, PPO activity increased.

1054. KRUGER,J.E. 1977
Changes in the catalases of wheat during kernel growth and maturation.
Cereal Chem.(USA), 54:820-826.

Changes in catalase activity have been determined for two hard red spring and two durum wheat cultivars during growth and maturation. Activity increased during early kernel growth and decreased as the kernel ripened. Maximal activity occurred at a later stage of development in durum and hard red spring wheats. The majority of the catalase activity was present in the endosperm during development of the kernel. The rise and fall in activity of this tissue accounted primarily for changes seen in the whole kernel. Polyacrylamide slab electrophoresis indicated that different anatomical parts of the immature wheat kernel contained electrophoretically different catalase isozymes. Upon germination of Manitou wheat, catalase activity increased to twice the maximal amount present in the immature kernel.

1055. KRUGER,J.E. and La BERGE,D.E. 1974
Changes in peroxidase activity and peroxidase isozymes of wheat during germination.
Cereal Chem.(USA), 51:578-585.

Thirty-two varieties of sound Canadian hard red spring (HRS) and durum wheats were analyzed for peroxidase isozymes by polyacrylamide-slab electrophoresis. Small variations in isozyme patterns were found. Germination of one HRS variety, Manitou, indicated that a fivefold increase in peroxidase activity occurred after 5 days of germination. This was due to increases in amounts of pre-existing isozymes rather than formation of new components. Isoelectric focusing experiments indicated that immature and germinated wheat extracts contained isozymes with similar Pl values. The anatomical location of some of these isozymes was determined by isoelectric focusing of dissected tissues from immature wheat kernels.

1056. KRUGER,J.E. and MARCHYLO,B.A. 1978
Note on the presence of debranching enzymes in immature wheat kernels.
Cereal Chem.(USA), 55:529-533.

Aminopeptidase activities were determined at various stages in the

growth and maturation of hard red spring, soft white spring, and durum wheat kernels. Activities with all substrates were found to rise and fall during growth and maturation. Dissection studies indicated that a large part of the aminopeptidase was present in the endosperm and aleurrone tissues. On germination, no large changes in aminopeptidase activities were found. Isoelectric focusing on polyacrylamide slabs indicated that two main aminopeptidase components were present in immature and germinated wheat. Both components had dipeptidase activity associated with them.

1057. KRUGER,J.E. and MATSUO,R.R. 1982
Comparison of alpha-amylase and simple sugar level in sound and germinated durum wheat during pasta processing and spaghetti cooking.
Cereal Chem.(USA), 59:26-31.

Sugar and alpha-amylase levels of ungerminated durum wheats were compared at various processing stages. Alpha-amylase levels in the wheat germinated for 72 and 120 hr increased 155-fold and 320-fold, respectively. Processing into semolina and spaghetti decreased alpha-amylase levels in both ungerminated samples. When spaghetti was cooked alpha-amylase was present in the germinated sample for at least 6 min of boiling. The levels of glucose and sucrose increased approximately 50% on germination, whereas the maltose level doubled. Conversion to the respective semolinas decreased sugars, whereas processing into spaghetti increased maltose and glucose. Cooking of spaghetti did not increase the total amount of a particular sugar in the solid and the cooking water combined. Increased cooking time, however, released more sugars as well as residue into the cooking water and decreased the sugars in the solid. Because spaghetti made from germinated wheat had a higher initial concentration of free sugars, loss of such sugars into the cooking water was correspondingly greater.

1058. KULSHRESHTHA,V.P. and TSUNODA,S. 1980
Activity of nitrate reductase in several cultivars of wheat.
Tohoku J.agric.Res.(Japan), 31:156-158.

In 84 cv. and lines of wheat and 19 of durum wheat, nitrate reductase activity in levels was measured in vivo. On a fresh wt. basis the activities ranged from 1.57 to 13.98 mu mol nitrate/g h. The activity of the durum wheats was 4.25 mu mol.

1059. LAMLKIN,W.M., MILLER,B.S., NELSON,S.W., TRAYLOR,D.D. and LEE,M.S. 1981
Polyphenol oxidase activities of hard red winter, soft red winter, hard red spring, white common, club, and durum wheat cultivars.
Cereal Chem.(USA), 58:27-31.

When 30 cultivars were examined with a view to identifying varieties or classes, comparable activities were found in different samples of the same cultivar from different sites and different crop years. In many cases individual cultivars could be identified on the basis of polyphenol oxidase activity alone. Durum wheats, with lower activities, could be distinguished from other classes.

1060. LEVI,M. 1976
L-phenylalanine ammonia-lyase activity and culm anatomy in two durum wheat cultivars, differing in lodging resistance.
Angewandte Botanik (F.R.G), 50:301-306.

Ph nylalanine ammonia-lyase (PAL) and tyrisine ammonia-lyase (TAL) activity in two durum wheat cultivars was determined. Activity levels were always higher in the internodes of Lambro (lodging-resistant variety) than in the corresponding internodes of Capeiti 8. These results were directly correlated with anatomical observations and lodging resistance.

1061. LIOI,L. 1981
Changes in proteolytic activities duruing the development and maturation of durum wheat seeds (Triticum durum). (It)
Tecnica Molitoria (Italy), 32:313-317.

1062. LORENZ,K. and REUTER,F.W. 1976
Mineral composition of developing wheat, rye and triticale.
Cereal Chem. (USA), 53:683-691.

The deposition of minerals (K, Ca, Mn, Fe, Cu, Zn, and Br) in kernels of wheat,

rye, and triticale grown side by side under the same agronomic and environmental conditions was followed from very early kernel development (4 weeks before maturity) up to full maturity. Results indicated that the minerals in kernels of triticale are deposited quite early in the development and in similar pattern as that observed for kernels of the rye and wheat cultivars. There were, however, slight variations in redistribution, translocation, or dilution among cultivars as the kernels matured and the major components of cereal grain starch and protein were deposited and moisture content decreased.

1063. LUPI,M.C., BENNICCI,A., BARONCELLI,S., GENNAI,D. and D'AMATO,F. 1981
In vitro regeneration of durum wheat plants. 2: Diplontic selection in aneusomatic plants.
Z.Pflanzenzuchtung. (F.R.G), 87:167-171.

Plantlets regenerated from mesocotyl explants were generally aneusomatic. At an advanced stage of spike development, the frequency of diploid cells in the spike increased substantially. All PMCs observed in regenerated plants were diploid with normal meiosis. Since the individuals obtained by selfing regenerated plants were diploid, it is concluded that diplontic selection (reestablishment of diploidy, 2n = 14) permitted normal meiosis in megaspore mother cells.

1064. MAK,A. 1976
Studies on the primary structure of purothionins and purothioninlike proteins from cereals.
Diss.Abstr.Int.B (USA), 37:2829.

Purothionins were extracted from hexaploid wheat, tetraploid wheat, and diploid wheat, and barley, and their amino acid composition determined.

1065. MALIANI,C. 1973
The durum wheat proteins: Third year of research on 1972 crop.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 643-650.

1066. MANENTI,G. 1978
Studies on the resistance mechanism of durum wheat to flattening. (It)
Ann.Fac.Agr.Univ.Cathol.Sacro C.(Italy), 18:58.

A two year study was conducted to examine the relationship between lodging resistance and the biochemical compounds involved in the lignin cycle. Correlations between PAL activity and lodging resistance are given. Nitrogen fertilization tends to decrease PAL activity, while CCC tends to increase it.

1067. MARANO,B. 1979
Effect of light and available phosphorus on variation in some yield parameters and phosphorus fractions in grain of durum wheat. (It)
Ann.Fac.Sci.Agr.Univ.Napoli.(Italy), 13:161-174.

High amounts of available P between heading and grain maturity increased leaf longevity, number of ears and number of vitreous grains. There was a linear relationship between available P and content of nucleic acids in the endosperm. Reducing illumination by 50% during the vegetative cycle prolonged leaf activity, and increased yield and proteic-P contents. Full illumination significantly increased nucleic-P content.

1068. MARSHALL,B., SEDGLEY,R.H. and VISCOE,P.V. 1980
Effect of water-stress on the photosythesis and respiration of wheat ears.
Australian J.Agric.Res.(Australia), 31:857-871.

1069. MIAYOUKUO,J.F. and ALBERTINI,L. 1975
The cytotoxic action of methoxyethylmercury silicate on roots of T. durum Desf.
C.R.Hebd.Acad.Sci.(France), 281:1227-1230.

Methoxyethylmercury action is manifested by a mitoclassical effect and by cytodecresis inhibition at low concentrations, and by mitostatical and chromatoclassic effects at higher concentrations. Cystine and thioglycolic acid detoxicate, under certain condition, durum wheat roots treated with the fungicide.

1070. MONOTTI,M. 1976
Growth analysis of bread and durum

wheat. (It)
Ann.Fac.Agr.Univ.Perugia (Italy), 30:325-340.

Two bread (Marzotto and Irnerio) and a durum (Creso) wheat varieties fertilized with two rates of nitrogen were compared by the growth analysis technique, on the basis of total dry matter and ear dry weight determined at intervals between shooting and physiologic maturity. Total dry matter yield was higher in Irnerio, intermediate in Creso and lower in Marzotto. However the ear dry weight of Creso did not differ from that of Marzotto. Highest LAI value, 4.9 was reached by Irnerio, while maximum LAI of Marzotto and Creso was 4.2. However, the values of LAD calculated for the period between earing and physiologic maturity were as follows: Irnerio> Creso> Marzotto. G(grain/LAD) and Harvest Index (grain/total dry matter) were consistently higher in the bread varieties. Nitrogen increased significantly total dry matter production, grain yield, LAI and LAD, but decreased consistently the G values.

1071. MURTAS,A., DEIDDA,M. and MILIA,M. 1982
Seasonal changes in water, osmotic and turgor leaf potentials in Durum wheat. (It)
Ann.Fac.Agr.Studi Sassaresi (Italy), 29:101-113.

In 1982 the seasonal changes of leaf of five durum wheat cultivars grown under field conditions was monitored using a psycrometric apparatus. There was found to be a general increase in pressure during the floral differentiation-earing period. No particular differences were observed either between the tall and dwarf varieties or between those with bloom or not. The relation between the values taken from the earing period to the initial stage of leaf sensenece does not follow a linear regression in all the varieties. According to an analysis of the differing values it seems that the varieties 'Tibula' and 'Creso' are more resistant to water stress than the other varieties, although these findings require further proof.

1072. Mac GREGOR,A.W. and MATSUO,R.R. 1982
Starch degradation in endosperms of barley and wheat kernels during initial stages of germination.
Cereal Chem.(USA), 59:210-216.

During initial stages of germination, patterns of starch degradation in kernels of barley and durum wheat appeard to be similar as assessed by scanning electron microscopy. Degradation started at the ventral crease edge of the endosperm-embryo junction and moved along this junction to the dorsal edge. This suggests that the site of initial amylase synthesis germinating cereal grains is the embryo and not the aleurone layer.

1073. NARDI,S. and BRUNORI,A. 1980
Protein accumulation and total RNA content in the endosperm of developing grain of T. durum in response to nitrogen fertilization.
Genetica Agraria (Italy), 34:113-121.

400 kg of nitrogen per hectare, given in split doses from sowing up to the boot stage, markedly influenced the accumulation of protein and the variation of total RNA content in the endosperm of developing grain of durum wheat. In the endosperm of fertilized plants the accumulation of protein proceeded at higher rates from the beginning of seed development and lasted a few day longer This resulted in about 38% more protein than in the control. The RNA content increased at the same rate but its accumulation continued for a few more days in the endosperm of nitrogen fertilized plants which showed 16% more total RNA than the control.

1074. NOWAKOWSKI,W., KONOPKO,E. and LUBANSKA,G. 1975
The utilization of solar energy in the photosynthetic process during four vegetative phases in different varieties of T. durum. (Fr)
Acta Agrobotanica (France), 28:197-204.

The percentage of the incident solar energy utilized in photosynthesis was calculated in 20 varieties which represented twelve distinct botanical forms of T. durum. Efficiency was usually greatest during the shooting-to-earing or the early-to-full-ripeness stage. Termes Preto was the most efficient during the earliest stage, Pabellon 67 between tillering and shooting, Wells between

shooting and earing and Midum in the final stage. The greatest efficiency over the whole cycle was found in Medoah X Kahla, with a mean of 3.8 per cent, but because this variety had a small assimilation area it was not among the most productive, either in grain or total dry matter. Wells, which ranked fourth in order of mean photosythetic efficiency, with 3.65 per cent, gave the highest grain yield per plant.

1075. PASSERA,C. 1978
Effect of salinity on photosynthesis and photorespiration of two wheat species (T.durum cv. PEPE 2122 and T.aestivum cv.Marzotto).
Can.J.Bot.(Canada), 56:121-126.

Effects of NaCl toxicity were examined in two wheat species (Triticum durum L. cv. PEPE 2122 and Triticum aestivum L. cv. Marzotto). At NaCl concentration up to 50mM growth, dry weight, succulence, and O2 evolution decreased while chlorophyll and protein content increased. 14CO2 fixation increased at 25 mM and decreased at 50mM NaCl; also , carboxylaine and photorespiratory enzyme activities were differently affected by increased salinity. The ratio between ribulose 1,5-diphosphate carboxylase and phosphoenolpyruvate carboxylase activities decreased, photorespiration rate was stimulated, and the O2 evolving mechanism was inhibited.

1076. PERCHOROWICZ,J.T. and JENSEN,R.G. 1983
Photosynthesis and activation of ribulose bisphosphate carboxylase in wheat seedlings. Regulation by CO2 and O2.
Plant Physiol. (USA), 71:955-960.

1077. PLANCHON,C. 1979
Photosynthesis, transpiration, resistance to CO2 transfer and water efficiency of flag leaf of bread wheat, durum wheat and triticale.
Euphytica. (Netherlands), 28:403-408.

Net photosynthesis, transpiration and resistances to CO2 and water vapour transfer of 2 cv. of each of durum wheat, wheat, hexaploid triticale and octaploid triticale were analysed. Water efficiency was defined by the CO2 exchange rate (CER): transpiration ratio measured under saturating irradiance corresponding to full stomatal opening. Wheat cv. Capitole and Champlein and durum wheat cv. Bidi 17 were characterized by a low CER associated with a large flag leaf area and a high mesophyll resistance. There was a close correlation between CER, flag leaf area, mesophyll resistance and total chlorophyll content.

1078. POGNA,N.E. and BELIN PERUFFO,A. 1981
Differential analysis of the durum wheat varieties Capeiti 8 and Patrizio 6 by electrophoretic methods. (It)
Sementi Elette (Italy), 27:11-13.

1079. POGNA,N.E., BELIN PERUFFO,A. and BOVO,G. 1981
Gliadin pattern heterogeneity in basic foundation seed samples of Italian durum wheat varieties.(It)
Genetica Agraria (Italy), 35:191-194.

1080. PRESTON,K.R., DEXTER,J.E. and KRUGER,J.E. 1978
Relationship of exoproteolytic and endoproteolysis activity to storage protein hydrolysis in germinating durum and hard red spring wheat.
Cereal Chem.(USA), 55:877-888.

Changes in exoproteolytic and endoproteolytic activities, endosperm protein solubility fractions, and sulfosalicylic acid-soluble amino acids and peptides were determined during the germination of durum and hard red spring (HRS) wheats. Only small increases in exoproteolytic activity occurred in the varieties tested. Significant increases in endoproteolytic activity, however, were found during germination. Comparison between proteolytic activities and changes in endosperm protein solubility fractions of selected varieties indicated that enhancement of endoproteolytic activity during germination was required for extensive storage protein hydrolysis. Increases in amino nitrogen were found to be due almost entirely to amino acids, with little change in peptide levels, indicating that sufficient levels of exoproteolytic enzyme were present in the ungerminated wheats to hydrolyze peptides produced by increasing levels of endoproteolytic activity.

1081. ROSSI,L. 1978
Potential of utilizing reductase activity as a means of increasing

protein and yield of cereals. In technology for increasing food production.
Publ: FAO.Rome, Italy.1978, 319-323.

Seedlings of Triticum aestivum, T. turgidum, T. spelta, T. compactum. T. macha, T. sphaerococcum, T. vavilovi, Aegilops speltoides, triticale and rye were analysed for nitrate reductase activity (NRA). Tissue nitrate and reduced-N content and NRA were negatively correlated with plant wt. whereas reduced-N content/plant was positively correlated. Nitrate and reduced-N content and NRA all increased with increasing the exteranl N supply but indicated that NRA was limiting. In 10 durum wheat cv. grain yield was correlated with total NRA and NRA at anthesis, and grain protein content was significantly correlated with NRA and protease activity at the wax-ripe stage. Durum wheat cv. Creso had a high capacity for assimilating nitrate during the reproductive phase and a high NRA activity during late ripening. Increasing applied N increased NRA in all plant parts in Creso.

1082. ROSSI,L., BRUNETTI,N. and FERRANDI,P. 1973
Seasonal patterns of nitrate-reductase activity in leaves and ears of two durum wheat varieties. (Abstract).
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 537.

Data are reported concerning nitrate-reductase activity (NRA) in 1st, 2nd, 3rd leaves, peduncles, flag sheaths and ears of durum wheat varieties Creso and B 80/57. NRA was measured at intervals from boot to ripening stage by in vivo method. NRA was found in all the green parts of the plant; it was higher in Creso than in Ba 80/57 during all the season. The flag leaf blades, among the leaves, maintained longer its NRA. In flag sheaths and peduncles, NRA was lower but more persistent than in flag leaf blades. The high values of NRA was found in the awns.

1083. RUDRAMUNIYAPPA,C.K. and PANCHAKSHARAPPA,M.G. 1980
Pollen development in Triticum durum Desf. a histochemical study.
J.South Indian Bot.(India), 46:33-43.

Pollen formation in the anther of T. durum was studied histochemically. The substances localized were DNA, RNA, proteins and ascorbic acid in the tissue sections and the contents were determined in different tissues.

1084. SCHRADER,L.E. 1970
Critique of factors influencing nitrate acquisition by plants: assimilation and fate of reduced nitrogen uptake, accumulation, assimilation, and transport of nitrogen in higher plants In nitrogen in the environment. Volume 2. Soil-plant-nitrogen relationships.
Acad.Press.Inc. (London) Ltd., 101-141.

This critical analysis of the original paper includes supplementary data and discussion and identifies some areas that need further investigation. Several aspects of the genetic, physiological, biochemical and environmental regulation of NO3 assimilation in plants are reviewed. Both interspecific and intraspecific differences in NO3 uptake are discussed. NO3 assimilation in shoots including regulation, diurnal fluctuations, liability of nitrate reductase activity and localization of the enzyme involved in NO3 assimilation is reviewed. A discussion of transport of nitrogenous metabolites is included. Finally, the role of light in the induction of nitrate reductase and in providing reductant for NO3 assimilation, and the effect of CO2 on NO3 uptake and assimilation, are discussed.

1085. SKIBA,T., BRUNETTI,N., FERRANDI,L. and BOZZINI,A. 1978
Evaluation of nitrate assimilation efficiency in durum wheat (Triticum durum). (Pl)
Pamietnik Pulawski (Poland), 119-131.

Data are presented on the efficiency of nitrate assimilation in the durum wheat cv. Creso, Tito, Castelporziano, Valgerardo, Valsacco, FG 161 and GVZ 385 estimated from nitrate reductase activity. In cv. Creso and Tito a similar value for nitrate assimilation efficiency was obtained when im values were compared with the percentage of N derived from fertilizer using 15N.

1086. SOJKA,R.E., STOLZY,L.H. and FISCHER,R.A. 1981
Seasonal drought response of selected

wheat cultivars.
Agron.J. (USA), 73:838-845.

In a 2-year field experiment, plant water status measurements were used to compare the drought response of selected wheat cultivars. Yields, xylem pressure potential (Nx), adaxial leaf diffusive resistance (Rs), and soil water content (O) were monitored. Twelve cultivars of Triticum aestivum L. em Thell and T. durum Desf., and two of Tritosecal Wittmack were used. Genotypes with lower seasonal (Nx) generally had higher percent yield reduction, when yield was expressed as a percent of irrigated controls. Water use during the observation period in the second season was similar for all droughted treatments and cultivars which was less than half that of the irrigated controls. Late in the second season, (Nx) decreased to as low as -47 bars in some treatments. Correlation between midday (Nx) and yield (absolute or percent of control) for individual cultivars were highly significant. The importance of full night (Nx) recovery to near zero was apparent for three cultivars studied intensively. Observations of Rs proved relatively insensitive to cultivar differences in these severely arid conditions.

1087. STAMP,P., RAVE,G., DIEPENBROCK,W., HERZOG,H. and KRIPPGANS,P. 1982
Comparative analysis of dry matter accumulation in caryopses and seeds of aestivum wheat, durum wheat rye, triticale, rape seed and pea by means of a growth function.
Z.Acker.Pflanz.(F.R.G), 151:224-234.

Under controlled temp. and light conditions, no definite relation existed between growth duration and max. grain or seed wt. of wheat, rye, triticale, rape and pea. The relation between max. growth rate and max. wt. was also relatively uniform for all spp. However, durum wheat attained max. wt. before 50% of the growing time had elapsed.

1088. TANZARELLA,O.A. and BLANCO,A. 1980
Stomatal frequency and size in durum wheat (Triticum durum). (It)
Genetica Agraria (Italy), 34:190-191.

In the context of a research on drought resistance, a preliminary study on the variability of some leaf characters (flag leaf area, number of stomata and trichomes, stomatal size) in 10 varieties of durum wheat was made. Stomatal frequency was significantly different in the studied cultivars. Differences in the frequency of trichomes were also observed. The data are discussed in relation to some characteristics of adaptation of the studied varieties to the southern Italy conditions.

1089. TOMARCHIO,L., TRIOLO,L. and DI MARCO,G. 1983
Photosynthesis, ribulose-1, 5-bisphosphate carboxylase, electron transport, and ribulose-1, 5-bisphosphate of virescent and normal green wheat leaves.
Plant Physiol. (USA), 73:192-194.

All the parameters, expressed on a leaf area basis, were similar in both a yellow-green mutant and the normal green wild type of Triticum durum 'Cappelli', except electron transport, which was more than twice as much in the wild type as in the mutant.

1090. TRIOLO,L. and BASSANELLI,C. 1976
Carbonic anhydrase net photosynthesis and photorespiration in Zn-deficient leaves of T. durum anhydrase function.
Agrochimica (Italy), 20:457-465.

1091. TRIOLO,L., CERVIGNI,T. and GIACOMELLI,N. 1982
Photosynthetic characteristics of a yellow green mutant of durum wheat.
Agrochimica (Italy), 26:192-203.

Photosynthetic variable in 11-day-old plants of (a) a yellow-green mutant and (b) a wild type of wheat cv. Capelli were compared in growth chambers. The chlorophyll a + b content of (b) was 2.5 to 3 times that of (a) and the a:b ratio was higher in (b). The carotenoids content of (a) was 50% that of (b). Photosynthetic rates were compared at different light intensities and CO2 concentrations.

1092. URAN,L. 1980
The photoperiodic behaviour of wheat varieties from different geographical latitudes. 1: The effect of light as a climatic factor on morphological components of yield in Triticum

durum Desf. (De)
Bodenkultur (Austria), 31:54-69.

Two Algerian varieties and one Austrian variety were subjected to different photoperiods and light intensities in controlled environments. Polonicum X Zenati Bouteille, a hybrid Algerian variety, flowered irrespective of treatment. Critical photoperiods for Hebda, also from Algeria, and the Austrian cultivar Pandur varied between 13 and 16 h and were negatively related to light intensity. The number of days to flowering differed among varieties and responded differently to the treatments within each variety.

1093. WARCHALEWSKI,J.R. 1976
Preliminary investigation on purification of native alpha-amylase inhibitors from durum wheat.
Bull.Polonian Acad.Sci.Biol.Sci.(Poland) 24:559-563.

1094. WITTMER,G., IANNUCCI,A., De SANTIS,G. and BALDELLI,G. 1982
Old and new durum wheat varieties: Preliminary data on physiological factors limiting yield [Abstract]
Ist.Agr.Gen.Coltiv.Erbacee,Univ.Bologna, 41.

The growth characteristics of 4 durum wheat cv. grown at Tavoliere della Pulga were studied in 1979-80. It appeared that leaf width and leaf area duration as measured from heading to maturation were the 2 factors having the greatest influence on yield variations.

1095. ZUNIGA,G.E., ARGANDONA,V.H., NIEMEYER,H.M. and CORCUERA,L.J. 1983
Hydroxamic acid content in wild and cultivated Gramineae.
Phytochemistry. (Chile), 22:2665-2668.

The content of 2 hydroxyamic acids, in cultivated and wild spp. of Gramineae was determined. Maize and Triticum durum contained both. In annual plants such as wheat, while neither acid was found in the fruits, their levels in coleoptiles and leaves increased rapidly reaching a max. 4 days after germination and decreased gradually afterwards.

Plant Taxonomy and Distribution

1096. AKHMEDOV,A.Sh. 1981
New botanical variety of T. durum Desf.
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 106:85.

A description and Latin diagnosis are given for var. tetraaristatum, which has long awns.

1097. BOGYO,P. and PORCEDDU,E. 1973
The use of discriminant function in the numerical taxonomy of durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 225-244.

During 1971 durum wheat varieties were grown at Ferrandina and 18 varieties of the same species at Santeramo. Twenty-two different variables pertaining to awns, spikes, spikelets, glumes and seed were measured or graded at each of the locations. A given number of variables measured in a particular set of varieties seem to create a closed group. The removal of variety or the addition of a new one as well as any change in the number of variables included in the analysis changes the discriminant functions so drastically that no unique classification seems to be possible using this technique. Moreover, for the same set of varieties, the discriminant functions seem to change with different environments. Thus results in any given environment do not seem to hold for any other environment.

1098. MUSTAFAEV,I.D. and ALI-ZADE,A.V. 1978
New botanical variety of T. durum. (Ru)
Byul.Vses.L.Inst.Rast.N.I.Vavilova(USSR) 75-76.

A description and Latin diagnosis are given of T. durum var. ramosoleucurum, which differs from var. Leucurum in having branched ears.

1099. PATIL,V.P. and DEODIKAR,G.B. 1983
Relationship of T. timopheevii with T. durum and T. dicoccum based on chromosome behaviour and fertility.
Biovigyanam.(India), 9:13-18.

Crosses and backcrosses of T. durum x T. timopheevii were completely sterile but crosses of F1 hybrids of T. durum x T. timopheevii with T. dicoccum were partially fertile. The fertility

increased over three or four successive crosses with T. dicoccum. Chromosome pairing studies indicated that T. durum is more closely related to T. timopheevii than to T. dicoccum but observations of fertility indicated that T. durum is more closely related to T. dicoccum.

1100. PERRINO,P. and HAMMER,K. 1983
Sicilian wheat varieties.
Kulturpflanze(F.R.G), 31:227-279.

Among 120 samples, 72 morphological variants were recognized, these 72 were further classified into 32 cultivars and 17 botancial varieties (of which one is new and not yet classified). The 32 cultivars are illustrated and described in detail, with particular emphasis on ear morphology. The material comprises Triticum durum, T. turgidum and T. aestivum.

1101. SEHNALOVA,J. 1979
Contribution to the taxonomy of T. turgidum L. and T. durum Desf. and a study of their morphological variability (review). (Cs)
Studi.Inf.Zak.Vedy Zem (Czechoslovakia), 36.

The classification of T. turgidum and T. durum and all their described varieties is reviewed. Keys to distinguish the varieties are given and 37 morphological characters which were used to classify 216 cv. are described.

1102. SMITH,J.S.C. and LESTER,R.N. 1980
Biochemical systematics and evolution of Zea, Tripsacum and related genera.
Economic Bot. (USA), 34:201-218.

Serological studies of maize, Euchlaena mexicana, Zea perennis, Triticum durum and spp. of Tripsacum, Coix, Andropogon, Borthriochloa. Elyonurus, Manisuris and Dichanthium were undertaken. The Zea antibody systems, the antigen systems were ranked for the different species.

Seed Technology and Production

1103. ANON. 1978
Particular problems in durum wheat purification. (De)
Deutsche Muller-Zeitung (F.R.G), 76:29-31.

Five specific points of durum wheat cleaning as well as the equipment used are discussed:1) stones separation, 2) separation of grains contaminated with Claviceps purpurea; separation of impurities; intensive humidification; separation of broken grains.

1104. INNAMORATI,M., GODI,A.B. and GULISANO,L. 1981
Interaction between seeds and replication of germination experiments. (It)
G.Bot.Italiano.(Italy), 115:211-225.

Seeds of 2 durum wheat cv. were placed to germinate at 5, 10, 15, 20 or 25 seeds/germinator with a total of 500 seeds/treatment from 3 to 5 months after harvest. With increase in number of seeds/germinators, germination capacity increased in 6-month-old seed and decreased in 11-month-old seed. It is assumed that each seed releases a susbstance which has a linear effect on all within the same germinator. The significant heterogeneity between replicates was interpreted as caused by heterogeneity of the substance distribution on the substrate.

1105. PETRUZZELLI,L. and CARELLA,G. 1983
The effect of ageing conditions on loss of viability in wheat (T. durum).
J.Exper.Botany. (Italy), 34:221-225.

The effect of fusicoccin, K and Na on artificially aged wheat seeds was investigated. Contrary to the results found in naturally aged wheat the treatments did not stimulate germination when the embryos isolated from the artificially aged seeds were germinated, they grew very poorly and showed a marked decrease in proton extrusion in comparison with unaged and the naturally aged seeds. Moreover, fusicoccin and K did not stimulate germinability in artificially aged embryos unlike the naturally aged embryos. The changes are interpreted in terms of the effects of different aging conditions on seed performance and particularly on cell membrane state.

1106. TOURKMANI,M., KHOUYA,A. and AAMEUR,F.B. 1979
Production and control of seeds of wheat.(hard and soft),barley and oats. (Fr)
Hommes,Terre et Eaux. (France), 9:35-39.

Progress in the efforts to improve seed quality and production is compared with initial expectations in 1973. First generations sowings of durum and bread wheats were very successful but in barley and maize production was very poor. Durum wheat cv. Hadj Mouline, Cocrit and Jori outyielded cv. 2777. Best bread wheat cv. were 149, Siete Cerros and Potam.

Insects and Insect Control

1107. ANON. 1983
Feasibility and results of population dynamics studies on stored grains insects in small scale bins with simulated climatic conditions (Sitophilus granarius , Sitophilus oryzea , Rhyzopertha dominica , soft wheat, sorghum, durum wheat).
Con.Int.trav.Entomol,Prod.Stocks.France, 23-34.

1108. CARDONA,C., HARIRI,G., JABY EL-HARAMEIN,F., RASHWANI,A. and WILLIAMS,P.C. 1983
Infestation of wheat by Suni bug (Eurygaster spp.) in Syria.
RACHIS (ICARDA,Aleppo,Syria), 2:3-5.

A study was made to determine the damage done by Suni bug to durum wheat and bread wheat. Three samples were studied: 1) samples from local farms, 2) samples from flour mills in nothern Syria, 3) laboratory samples. Results show the effect of Suni bug infestation in terms of percentage protein, kernel weight and wheat meal fermentation.

1109. FARJAN,M.E. 1983
Laboratory biodynamics of two durum wheat insect pests, the rice weevil: Sitophilus oryzea L. (Coleoptera : Curculionidea) and the lesser grain borer: Rhizopertha dominica (F.) (Coleoptera : Botrychidae) with application to conservation conditions in North Africa. (Fr)
These-Docteur Ingenicur(Entomol).France, 111.

1110. FLEURAT-LESSARD,F. 1980
Physical control of grain insects and cereal products by means of hot-air and high frequancy. (Fr)
Tech.Bull.(France), 345-352.

Legislation doesn't authorize insecticide application treatments for cereal products; but insect attacks may occur at any time in the cereal production line. Thermic shocks followed by cooking as well as non-ionizing rays constitute an effective and hygienic means to fight insects. Insect control with hot air is done by forcing hot air on the grain samples and semolina infested with rice weevil larvae. With high frequency waves wheat samples need to be exposed for about 1 minute at a 800 W irradiation to achieve insect destruction. Semolina samples need longer exposure times.

1111. PORTER,K.B., PETERSON,G.L. and VISE,O. 1982
A new greenbug biotype.
Crop Sci. (USA), 22:847-850.

Amigo, a wheat germplasm line resistant to Schizaphis graminum and selections from crosses and backcrosses of wheat to Amigo were evaluated for resistance to collections of the insect made each year from 1977 to 1980. Amigo, its derivatives and the rye variety Insave were resistant to field collections of biotype C until January 1980 when Amigo and its derivatives failed to survive an infestation of progeny from a November 1979 collection at Bushland, Texas. A series of 11 laboratory tests of biotype C-resistant and susceptible wheat, rye, barley and sorghum lines showed the new collection to be other than the A, B and C biotypes; it was designated E. Resistance to biotype E was found in rye, barley, oats, amphiploid Triticum durum X T. tauschii (Aegilops squarrosa) and sorghum.

1112. RASHWANI,A. 1983
Resistance to wheat stem sawfly (Cephus pygmaeus L.) related species in cereals.
RACHIS (ICARDA,Aleppo,Syria), 2:15-16.

A summary is made of research done from 1978-83 to identify sources of resistance to Cephus spp. in approximately 1000 genotypes of durum, bread wheat, barley and triticale. Sources of resistance were found in all crops; in general the most resistant genotypes were found among the durum cultivars.

1113. RASHWANI,A. 1983
Effect of durum and bread wheat Stem solidness on the percentage of infestation by wheat stem sawfly (Cephus spp.)
RACHIS (ICARDA,Aleppo,Syria), 2:22-23.

Studies were carried out at ICARDA to determine mechanisms of resistance in durum and bread wheat lines to wheat stem Sawfly infestation. In general, infestation decreased as stem solidness increased.

1114. RASHWANI,A. and CARDONA,C. 1984
Effect of suni bug (Eurygaster integriceps Put.) damage on the yield of Hammari and Gezira-17 durum wheat
RACHIS (ICARDA,Aleppo,Syria), 3:21-23.

A survey conducted in 1983 determines the relationship between percentage of seed infestation and yield losses. The significant positive relationship between Suni bug damage and losses in grain weight suggest that the Suni bug is an economically important pest of durum in Syria.

1115. RASHWANI,A. and CARDONA,C. 1984
The incidence of Suni bug (Eurygaster integriceps Put.) in Syria.
RACHIS (ICARDA,Aleppo,Syria), 3:27-28.

A survey was made in summer of 1983 to determine the geographical distribution and levels of infestation by the Suni bug of durum wheat and bread wheat in Syria.

1116. SMITH,L.B. 1978
History of an insect infestation in durum wheat during transport and storage in an inland terminal elevator in Canada.
J.Stored Products Res. (U.K), 14:169-180.

A bulk of 242 tonnes of infested durum wheat from a primary elevator was sampled when it was loaded into four boxcars in August 1974. when it was unloaded at the inland terminal elevator and when it was turned in the terminal elevator. During a storage period of 1 year, the wheat was cleaned once and turned 4 times. Grain temperature was recorded each time samples were taken. Adults and larvae of Cryptolestes ferrugineus (Stephens) and of Triboliun castaneum (Herbst) were found, with larvae of the former species being most prevalent. Cleaning the grain during storage was ineffective as a means of disinfestation. The number of insects in the samples decreased as the duration of storage increased and as grain temperature decreased.

1117. STEBBINS,N.B., PATTERSON,F.L. and GALLUN,R.L. 1982
Interrelationships among wheat genes H3, H9, and of hessian fly resistance.
Crop Sci.(USA), 22:1029-1032.

Test cross analysis at the tetraploid level showed that Triticum durum 'Elvas' (CI17714) has two independent dominant genes for resistance to Mayetiola destructor biotype D. Resistant F4 T. aestivum selections 812-24 (Stella), 817-2 and 822-34 (Ella) were selected from a cross involving Purdue 5517, Monon and Elva. Previous work showed that Stella and 817-2 have two linked, partially dominant genes lying 36 map units apart, designated H9 and H10. Ella , which has H9H9, was used in crosses to distinguish lines derived from Stella and from 817-1 that had H9H9 or H10H10. Repulsion phase F3 line analysis showed that H9 and H10 were independent. Linkage analysis showed that H6 in Caldwell is 2.02 plus or minus 2.01 map units from H9 in Ella.

1118. STEBBINS,N.B., PATTERSON,F.L. and GALLUN,R.L. 1983
Inheritance of resistance of PI94587 wheat to biotypes B and D of hessian fly.
Crop Sci.(USA), 23:251-253.

Resistance of Triticum turgidum (T. durum) 'PI94587' to biotype D of Mayetiola destructor was studied in backcrosses and testcrosses with other tetraploid and hexaploid wheats. Resistance to biotype B was examined in crosses with other tetraploids. Test cross analysis of the resistance of PI94587 to biotype D strongly suggested the presence of two independent dominant genes. Test cross plant progenies susceptible to biotype D were tested for resistance to biotype B using reserve grain. The data suggested that it was probable that two genes (one in addition to H6) or three were segregating in the cross progenies for resistance to biotype B. Thus, PI94 may have four or five independent genes for resistance to M.destructor.

Diseases and Disease Control

1119. AMAND de MENDIETA,J. 1980
Effect of the control of fungal diseases on the aerial biomass production and distribution of T. durum Desf. (It)
Balcarce,Bs.As.(Argentina), 39.

1120. ANON. 1979
Prone to disease durum wheat varieties. (Fr)
Perspectives Agricoles (France), 32.

1121. ARJONA,M.C.O. and FUENTES,S. 1977
Study on Septoria tritici Rob-et Desm. causal agent of brown spot in wheat leaves in Mexico and Guatemala (T. durum) (Es)
Agrociencia (Mexico). 22:71-83.

Twenty two Septoria tritici isolates were obtained from wheat leaves showing typical leaf symptoms of brown spot. The method of isolation on PDA consisted in transferring cirri emerging from pycnidia present in the diseased tissue, under high humidity conditions. Highest conidial production was obtained in wheat isolate SD-12 from Triticum durum grown in Fries liquid medium. Maximum conidial concentration was 2.88 X 106/cc. The most effective inoculation method for S. tritici was by spraying wheat plants, with a conidial water suspension at 2 X 106/cc conidial con entration. Plants were kept in a mois. chamber 24 hours previous to inoculation and 72 hours after such inoculation. Guttation water stimulated both conidial germination as well as conidial production of S. tritici. A higher production of pycnidia on the lesions was also observed when guttation water was used for inoculation. Pathogenicity on resistant and susceptible wheat cultivars indicated that all isolates under study belong to the same pathogenic race.

1122. C.N.R.BARI 1976
Cereal diseases in southern Italy,[2]. Fusarium roseum f.sp. cerealis on durum wheat. (It)
Ric.Sci.C.N.R (Italy), 46:382-383.

Fusarium roseum f. sp. cerealis: "Avenaceum", and "Graminearum" are important pathogens of cereals. Observations conducted on material from different locations showed that "Culmorum" is largely present in southern Italy.

1123. CARRANZA,J.M. and GONI,L. 1976
Pathogens affecting the seeds of T. durum Desf. (Es)
Rev.Fac.Agron.Univ.Nac.Plata (Argentina) 50:129-134.

In this work the phytopathogenic agents which affect durum wheat in Argentina are given. The following fungi have been isolated and identified: Alternaria, A. tenuis, Cephalosporium, Cladosporium herbarum, Helminthosporium ssp., Pleospora ssp. The effects of diseases on grain quality, and the effect of climatic factors on the diseases are described.

1124. CARRANZA,M.R. 1979
Agents causing alterations in the seeds of durum wheat (T. durum in Argentina). (Es)
San Miguel de Tucuman (Argentina), 2:527-540.

1125. CARRANZA,M.R. 1979
Drechslera cynodontis (Marig) Subram. & Jain, Curvularia inaequalis (Shear) Boedij and C. protuberata Nelson & Hodges, pathogens of candeal wheat (T. durum Desf.) seeds in Argentina. (Es)
Rev.Fac.Agron.Univ.Nac.Plata (Argentina) 55:73-77.

Morphological characters of D. (Cochliobolus) cynodontis, Curvularia inaequalis and C. protuberata, newly recorded in Argentina, are described.

1126. CARRASCO,E.L. and APABLAZAH,G.E. 1980
The effect of temperature on the susceptibility of wheat (T. aestivum L. and T. durum Desf.) to stem rust (Puccinia graminis f.sp. tritici) (Es)
Cienc. Invest.Agr. (Chile), 7:95-107.

Resistance decreased in all varieties with rise in pretreatment temperature. Under the water treatment, which was the more effective, the maximum effect occurred at different temperatures in different varieties. The bread wheat Sonka-INIA was the most resistant variety and the least sensitive to treatment. Menflo intermediate in resistance, was most sensitive to

treatment. T. durum 'Quilafen' was the least resistant. The pustule type which characterizes severe attacks was more common after high pretreatment temperatures than after lower ones.

1127. CASULLI,F., SINSCALCO,A., TOMMASI,F. and PARADIES,M. 1982
Physiological races of P. recondita Rob.ex Desm.f.sp. tritici Eriks.et Henn. Identified in 1979 and 1981 in various localities of Italy. (It)
Phytop.Mediterranea (Italy), 21:66-74.

1128. CHUMAKOV,A.E. and SHCHEKOCHIKHINA,R. 1983
Characteristics of fungus diseases of spring durum wheat. (Ru)
Mikol.fitopatol.(USSR), 17:157-160.

Intensity of semi-saprotrophic fungus infections was greater than infections by obligate biotrophic fungi. Losses due to relatively weak infections generally equalled those due to more severe infections.

1129. CIRILLI,G. 1976
Fungus contamination of durum wheat. (Es)
Molineria Y Panaderia (Spain), 71:17.

1130. COOK,R. and YORK,P.A. 1982
Resistance of cereals to Heterodera avenae: Methods of investigation, sources and inheritance of resistance.
EPPO.Bull.(France), 12:423-434.

1131. DEDRYVER,C.A. 1977
Development of Rhopalosiphum padi L. and Macrosiphum (Sitobion) avenae F. [Homoptera Aphidae] in 1975, on durum wheat [T. durum] in Gironde (south-weast of France). Regulative effect of Entomophthora. Effect on yield.
Agric.Pathol.Veg.(France), 76:50-92.

1132. DI VITO,M. and INSERRA,R.N. 1978
Reaction of T. durum accessions to a puglian population of Heterodera avenae. (It)
Nematol. Mediterranea (Italy), 6:197-204.

All of 110 accessions of Triticum durum were susceptible to a puglian population of Heterodera avenae in glasshouse trials.

1133. FERRARESI,A., MARENGHI,A. and TODERI,G. 1978
Response of bread wheat and durum wheat varieties to a treatment to control late diseases. In Reports on Work done in the Subproject "Plant Protection in Wheat, Maize and Sorghum" Part 2. Rome. (It)
Consiglio Nazionali Dell Ricerche(Italy) 391-408.

Of 10 durum wheat varieties, studied at four localities, treatment with a combination of thiophonate methyl and maneb generally increased grain yields. Ranger, Sansone, Tito and Kid showed the greatest increase.

1134. FRISULLO,S. 1982
Phytopathogenic fungi in southern Italy. 1: Alternaria triticina pras. et prab. on durum wheat (T. durum). (It)
Phytop.Mediterranea (Italy), 21:113-115.

A study was conducted to assess the occurrence of A. triticina on durum wheat in southern Italy.

1135. FRISULLO,S. 1983
Fungal parasites of plants in southern Italy. 2. Wojnowicia graminis (Mc Alpine) A.P. and Saccardo on durum wheat. (It)
Phytop.Mediterranea.(Italy), 22:89-91.

Light browning of the stem base and leaf chlorosis was noted. The fungus is described.

1136. FRISULLO,S. 1983
Fungal parasites of plants in southern Italy. 3: Phaeosphaeria nodorum (Mull.) Hed. on durum wheat. (It)
Phytop.Mediterranea. (Italy), 22:194-198.

Perithecia of P. (Leptosphaeria) nodorum were newly recorded on durum wheat in S. Italy. The fungus is widespread in some wheat growing areas in Apulia, Basilicata and Calabria.

1137. INSERRA,R.N., VOVLAS,N. and BRANDONISIO,A. 1978
Endoparasitic nematodes associated with cereals in southern Italy. (It)
Nematol.Mediterranea.(Italy), 6:163-174.

A survey of parasitic nematodes on cereals showed Pratylenchus neglectus

and Heterodera avenae to be the most common, being found on 53 and 37% respectively, of Triticum durum samples. Meloidogyne naasi, P. penetrans, P. thornei, Radopholus ritteri and Zygotylenchus guevarai were found in smaller amounts. P. neglectus retarded the growth of T. durum in glasshouse tests.

1138. IONESCU-CONJOCARU,M. 1978
A new physiologic race of brown rust with specific virulence on durum wheat detected in Romania in 1977. (Ro)
Prob.Prot.Plantelor (Romania), 6:1-7.

The new race of Puccinia recondita f.sp. tritici, responsible for 30% infection of the wheat line DF 14-71, is designated R 58-77D. The use of genes Lr 9,Lr 19, Lr 24 and Lr 25, effective against all Romanian brown rust races, is recommended for increasing resistance of durum wheat to the disease.

1139. JAN,P., COCHET,J.C. and ADOR,J. 1979
Susceptibility of different spring crops to herbicides applied on cereals in autumn. (Fr)
COLUMA.Paris (France), 1:315-327.

1140. LEONORI OSSICINI,A. 1974
Varietal differences in resistance to P. graminis and P. recondita in durum and aestivum wheat. (It)
Ann.Ist.Sper.cerealicoltura (Italy), 4:145-157.

1141. MARTENS,J.W. 1984
Incidence and virulence of P. graminis on wheat and barley in Canada in 1983.
Canadian J.Plant Pathol.(Canada), 6:243-248.

Heavy infection occurred on wild barley and on susceptible cultivated barley and wheat throughout Manitoba and eastern Saskatoon by mid Aug., but there was no damage due to stem rust on recommended bread and durum wheat cultivars. 14 virulence combinations, including 4 new ones, were identified, but none of these constitutes a threat to commercial cultivars. No virulence was identified on lines with Sr6, Sr13, Sr22, Sr24, Sr26, Sr27, Sr29, Sr30 and Sr37. Virulence on lines with Sr9b was rare.

1142. MIELE,S. and VANNOZZI,G.P. 1977
Control of the main cryptogames diseases of T. durum and T. vulgare in spring time in Italy. (It)
Fac.Land Bouwettens Chappen,Gent, 29:1151-1157.

1143. MULLANEY,E.J., SCHAREN,A.L. and BRYAN,M.D. 1983
Resistance to Septoria nodorum in a durum wheat cultivar as determined by stage of host development.
Canadian J.Bot.(Canada), 61:2248-2250.

Seedlings of the spring durum wheat cv. Giorgio 396(CI 15111), show a high level of resistance to S.nodorum while the mature plants are very susceptible. Tests under greenhouse conditions showed seedlings of the cultivar to have a significantly higher level of resistance to isolates of S.nodorum than seedlings of a susceptible cultivar in its seedling stage; but field and greenhouse inoculations of the mature plant showed it to be susceptible in terms of both disease symptoms expressed and reduction in weight of the kernels produced. This seedling resistance may be of potential value if it can be incorporated into cultivars grown in environments where seedling resistance is essential, or incorporated along with other genes for resistance to produce cultivars with a high level of resistance to S.nodorum over several growth stages.

1144. PARADIES,M. 1981
Standard races and variants (biotypes) of P. recondita f. sp. tritici were identified in Italy 1977. Effectivenes of some resistance genes and greenhouse tests of varieties of durum wheat (T. durum Desf.) and bread wheat (T. aestivum L.)
Cereal Rust Bull.(Italy), 8:3-9.

Among the 16 standard races identified from 112 samples, 77 and 220 were the most common. One biotype each of race 21 and 220, and 3 biotypes of 77, were identified. Gene Lr 1 from Malakof was ineffective against 39.3% of the isolates, Lr 2c from Brevit against 46.6% and Lr 2b from Carina 53.3%. Lr 2d from loros was 100% ineffective, and Lr 3 from Mediterranean (85.3%) and Lr 11 from Hussar (74%) were only slightly more effective. The near-isogenic line (Transfer x Tc6) RL 6010, carrying Lr 9, was resistant to all isolates. Agatha,

with Lr 19, was also very resistant, being susceptible to only 2%. Durum wheats were much more resistant to the 4 races tested than bread wheats.

1145. PARADIES,M., CASULLI,F. and CARIELLO,G. 1977
Notes on the physiological races of Puccinia recondita f. sp. tritici identified in Italy 1976 and on the response of durum wheat (T.durum Desf.) to them in the greenhouse. (It)
Ann.Fac.Agr.Univ.Bari (Italy), 29:139-152.

Data are provided on the reactions of eight differential durum varieties to 104 isolates, representing 15 physiological races, and of varieties to four of those races. Hussar, with Lr11, was the least attacked.

1146. PASQUINI,M. 1980
Disease resistance in wheat: 2. Behaviour of Aegilops species with response to Puccinia recondita f. sp. tritici, P. graminis f. sp. tritici, and Erysiphe graminis f. sp. tritici.
Genetica Agraria (Italy), 34:133-148.

To increase the spectrum of resistance genes present in Italian durum wheat varieties of 'Val' group, the behaviour of different Aegilops species with respect to Puccinia recondita tritici, Puccinia graminis tritici and Erysiphe graminis tritici has been analyzed. The results indicate the presence of a wide spectrum of resistance to P. recondita in several Aegilops species. In particular the most resistant species appear to be Ae. speltoides and Ae. caudata, in which different strains have shown a combined resistance also to stem rust and mildew. A variable behaviour has been observed in: Ae. squarrosa = Ae. tauschii, Ae. ventricosa, Ae. ovata, Ae. triaristata, Ae. trincials, etc. A high virulence degree against the different species examined has been shown by P. graminis. Only Ae. unieristata and Ae. caudata have demonstrated resistance to stem rust.

1147. PASQUINI,M., GRAS,M.A. and ZITELLI,G. 1978
Virulence genes present in the pathogen population of P. recondita var. tritici and Puccinia graminis var. tritici in Italy during 1977/78.
Ann.Inst.Sper.Cerealicoltura.Rome(Italy) 4.

The results obtained indicate that, during the last two years, in the pathogen populations of P.recondita a strong variation has not occurred. It has been found that the physiologic races 12 and 61 were the most prevalent, while biotypes from race 77 were only sporadically present. On the contrary a more evident variation in the pathogen populations of P.graminis occurred, both because of the deep differentiation among the various biotypes identified and because of the drastic change of racial composition during the last 20 years. The appearance of new virulence genes able to attack Valgerardo and its derivatives shows the necessity of searching for new resistance gene.

1148. PASQUINI,M., GRAS,M.A. and ZITELLI,G. 1980
Durum wheat face to face with the widespread parasitic diseases in Italy. (It)
Infor.Agr.(Italy), 36:8927-8935.

Field and glasshouse reactions of 28 vars. to 7 biotypes of Puccinia recondita, 4 biotypes of P. graminis and Erysiphe in 1974-79 are tabulated.

1149. PASQUINI,M. and ZITELLI,G. 1983
Virulence changes in P. recondita tritici and P. graminis tritici in Italy from 1960 to 1983.
Colloques de L'INRA, (France), 175-180.

Italian data concerning Puccinia recondita tritici and Puccina graminis tritici for the period 1960-1983 have been examined in order to determine if the virulence spectrum of wheat rust populations has changed. The best behaviour with respect to both rusts over a period of 20 years, has been shown by genes coming from wild species (Aegilops spp. Agropyron and Secale) which have maintained a long-term resistance. Changes in the virulence composition of Italian population of stem rust and, to a lesser extent, of leaf rust, and the unexpected appearance of new and rare virulent biotypes may have important future implications for breeding purposes.

1150. PASQUINI,M., ZITELLI,G. and GRAS,M.A. 1980

Reactions of durum wheat (T . durum) varieties to the most widespread fungal diseases in Italy. (It)
Ann.Ist.Sper.Cerealicoltura,Rome(Italy), 11:199-200.

1151. PATIL,L.K., WANI,P.V. and MORE,B.B. 1979
Chromatographic studies on the amino-acid metabolism of healthy and diseased leaves of durum wheat incited by Alternaria triticola .
J.Maharashtra Agric.Univ.(India), 4:268-270.

Glutamic acid, glycine, lysine and leucine were found in diseased but not in healthy leaves whereas the reverse was true of cysteine and methionine.

1152. PRESCOTT,J.M. and SAARI,E.E. 1975
Major disease problems of durum wheat and their distribution within the region.
Proc.3rd Reg.Wheat Workshop,Tunisia, 104-114.

There are a number of pathogens attacking wheat but little distinction of those attacking durum or bread wheat has been made. There is a real need to widen the genetic base of the durum wheats, particularly with respect to disease resistance. Increased efforts are needed to identify, test, and release adapted, high yielding durum varieties for this region.

1153. RASHID,G., QUICK,J.S. and STATLER,G.D. 1976
Inheritance of leaf rust [P . recondita] resistance in three durum wheats.
EPPO Bull. (France), 5:335-351.

1154. ROELFS,A.P. 1977
The 1977 stem rust situation - wheat, durum and oats.
Crop Qual.C. (USA), 56-62.

1155. SISTO,D. 1980
Short notes on the behaviour of durum wheats tested with four isolates of powdery mildew. (It)
Ann.Fac.Agr.Univ.Bari (Italy), 31:733-738.

Infection trials were carried out under controlled conditions with four Italian isolates of powdery mildew, in order to study the behaviour of cultivated Italian durum wheats along with wheats carrying known resistance factors. Among 100 lines and varieties tested only 7 Italian cultivated wheats were resistant to the 4 isolates of Erysiphe graminis tritici, i.e., 'Belfuggito', 'Valgerardo', 'Valsalva', 'Valnova', 'Sansone 201 P', 'Matarrese', and 'Minutola'. A differential behaviour was found in the varieties' Raineri', 'Lambro', 'Belvedere' and 'Pepe 64'.

1156. SOUTHWELL,R.J., BROWN,J.F. and WONG,P.T.W. 1980
Effect of inoculum density, stage of plant growth and dew period on the incidence of black point caused by Alternaria alternata in durum wheat.
Ann.Appl.Biol. (Australia), 96:29-35.

Glasshouse experiments show that incidence was positively correlated with both inoculum density and growth stage of the wheat plants at the time of inoculation. Incidence was linearly related to the stage of plant growth between anthesis and the late milk stages of development at the time of inoculation. A threshold dew period of 3-6 h was required for black point symptoms to develop. Disease incidence increased with increasing duration of the dew period to a max, after exposure for 48 h.

1157. STATLER,G.D. 1982
Inheritance of virulence of P . recondita f. sp. tritici on durum and spring wheat cultivars.
Phytopathology. (USA), 72:210-213.

1158. STATLER,G.D., NORDGAARD,J.T. and WATKINS,J.E. 1977
Slow leaf rust development on durum wheat.
Can.J.Bot. (Canada), 55:1539-1543.

Four Triticum durum varieties exhibiting susceptible or moderately susceptible reactions to Puccinia recondita were evaluated for slow rusting and compared with T. aestivum 'Thatcher' (susceptible) and 'Waldron' (resistant). The durum varieties showed consistently low infections in the field that were of a lower order than infection on Thatcher. Data presented shows that (1) final rust severity may be used as an indication of infection rate and (2) infection of either of the top two leaves gives an accurate evaluation of

the resistance of a variety. While yields of Thatcher were increased by controlling the rust, those of the durum varieties were not. The slow rusting shown by the durum varieties apparently provided adequate protection against leaf rust under conditions prevailing in north Dakota.

1159. TROCCOLI,C. and PACUCCI,G. 1978
Influence of a treatment to control late diseases in bread wheat and durum wheat cultivars. (It) In Reports on Work Done in the Subproject "Plant Protection in Wheat, Maize and Sorghum". Part 2. Rome.
Consiglio Nazionali Dell Ricerche(Italy) 377-390.

The study dealt with 17 durum wheat varieties and 13 bread wheat varieties. Treatment with a combination of benomyl and mancozed resulted in an increased yield of 8-10 per cent in Trinakria and Hymera and a decreased yield of 13-25 per cent in Kid, Gabbiano, Valnova, Valfiora and Creso (Croesus) in the durum wheats. In the durum wheats, those with a high incidence of mealy endosperm showed a higher incidence after treatment.

1160. VALLEGA,J. and ZITELLI,G. 1973
A case of horizontal resistance of leaf rust in durum wheat. (Abstract)
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 509.

1161. VARVARO,L. 1983
A bacterial disease of durum wheat (T . durum Desf.) caused by Pseudomonas syringae pv. atrofaciens (Mc Culloch) Young et al in Italy. (It)
Infor.Fitopatol. (Italy), 33:49-51.

The bacterium was newly isolated from lesions on durum wheat leaves and identified on the basis of morphological, cultural, biochemical and physiological characters and pathogenicity. Yield was not significantly reduced.

1162. VITO,M.DI. and INSERRA,R.N. 1978
Reaction of T . durum accessions to a puglian population of Heterodera avenae . (It)
Nematologia Mediterranea (Italy), 6:197-204.

Some tolerance was shown to the population by 16% of 110 accessions tested; of two varieties tested, Patrizio was more tolerant than Psathias.

1163. VITO,M.DI. and VIVAR FLORES,H.E. 1974
Inheritance of resistance to P . recondita rob.desm. in Triticum durum . (Es)
Agr.Univ.Autonoma-Chapingo (Mexico), 92.

1164. VOVLAS,N. and INSERRA,R.N. 1978
The systematic position of Pratylenchoides retterisher [Nematode] with observations on its embryogenic development [collected from wheat (T . durum Desf.) roots] Italy.
Nematologia Mediterranea (Italy), 6:49-56.

1165. ZITELLI,G. 1974
Introduction to genetic improvement of durum wheat for disease resistance.
Proc.4th FAO/Rockefeller.Found.W.S.Iran, 309-318.

1166. ZITELLI,G. 1976
Genetic improvement of durum wheat for disease resistance.
Ann.Ist.Sper.Cerealicoltura,Rome(Italy), 6:212-213.

1167. ZITELLI,G., PASQUINI,M. and VALLEGA,V. 1983
Field behaviour of wheat with regard to rusts in Italy during 1981.
Cereal Rusts Bulletin (Italy), 11:29-32.

Weeds and Weed Control

1168. ALLAYA,S. 1975
Weed control methods and policies in Tunisia. (Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 205-210.

1169. ANON. 1981
Weed control of spring cereal. (Fr)
Cultivar (France), 135:28-33.

1170. CAUDERON,Y., TEMPE,J. and GAY,G. 1978
Creation and cytogenetic analysis of a new hybrid Hordeum vulgare ,ssp. distichon X T . timopheevii . (Fr)
C.R.Acad.Sci.Paris,Ser D.(France), 1687-1690.

The factors that regulate the reaction of various wheat to herbicides are examined. In this outline the most significant results obtained from research carried out by various authors in order to further knowledge concerning the varietal tolerance mechanism of cereal crops in relation to herbicides are reviewed. The information available up to now concerning varietal sensitivity of hard wheat is briefly summarized.

1171. COCHET,J.C., PLOUY,B. and MAYNADIER,M.H. 1979
Susceptibility of different spring cereal species and varieties to herbicides. (Fr)
COLUMA,Paris (France), 1:305-313.

1172. COVARELLI,G. 1974
The principal herbicides for control of grasses or some bread and durum cultivars. (It)
Ann.Fac.Agr.Univ.Perugia,(Italy), 29:557-573.

In two durum wheat varieties treated over two years with five herbicides at two doses, grain yield was lowest with both treatments of benzoylprop-ethyl. Methabenzthiazuron gave higher yields than this in all except Castelporziano, though it gave lower yields than the other three herbicides used.

1173. DEKOV,D., SIMEONOVA,I. and ALVARES,M.de LOS A. 1979
Effect of herbicides 2,4-D and 2M-4X on weed infestation yield and quality of durum wheat. (Bg)
Rasteniev'd Nauki,(Bulgaria), 16:107-113.

Application of 1.2 kg 2.4 -D a.i. or 2M-4X (MCPA) a.i. with 10 kg ammonium nitrate/ha to durum wheat at the late tillering stage was effective against weeds and increased grain yields from 3.24-3.32 to 3.53-3.68 t/ha. Herbicides had no significant effect on physical qualities and chemical composition of grains.

1174. DUWAYRI,M. and SAGHIR,A.R. 1983
Effect of herbicides on weeds and winter cereals in Jordan .
Dirasat.(Jordan), 10:115-122.

Several herbicides were applied to wheat and barley in Irbid and Jubeiha in the year 1976-77 to evaluate their effectiveness against wild oats and common broad leaf weeds and to test the tolerance of several wheat varieties to those herbicides. Triallate at 2.0 kg/ha (a.i), sprayed as pre-emergence incorporated application increased the yield of wheat and reduced the number of wild oat panicles per m2 when the weed infestation was high. The two herbicides bromoxynil at 1.5 L/ha and bromoxynil + MCPA at 2.0 L/ha controlled effectively the broad leaf weeds and increased significantly the grain yield of wheat. The response of wheat to the herbicides was different among varieties tested. The variety ''D Dwarf'' responded vigorously when bromoxynil + MCPA was applied: whereas the variety ''Arz'' was the best yielder using bromofenoxim = terbuthylazine which was phytotoxic to many varieties. Furthermore differences existed among the varieties in their ability to compete with weeds.

1175. GIORGIO,D.De. and RIZZO,V. 1980
Chemical weed control in durum wheat. Four years of research on the Apulina tableland. (It)
Ann.Ist.Sper.Agron.(Italy), 11:121-147.

Avena sterilis and Phalaris brachystachys constituted 53-70% of all weed spp. present. Other weeds present were Adonis vernalis, Fumaria officinalis, Galium aparine, Papaver rhoeas and Veronica hederifolia. None of the single herbicides used controlled all the weeds. Isoxynil + MCPA were effective against most spp. except the commonest ones.

1176. HAGEMAN,L.H. and BEHRENS,R.L. 1980
The effect of DPX-4189 on oats, barley, spring and durum wheat. In Proceedings North Central Weed Control Conference.1979.
Dep.Agron.Univ.Minnesota (USA), 34:9.

In a glasshouse study, DPX-4189 at 0.5, 0.75 and 1 kg/ha post-em. caused intervenal chlorosis and stunted growth in wheat, barley and oats. DPX-4189 at 0.25 kg/ha was tolerated by all three species. In a field trial no differential yield responses were observed between 7 spring wheat, 4 barley, 3 oat and 3 durum wheat cultivars to DPX-4189 at 0.125 and 0.25 kg/ha.

1177. HAGEMAN,L.N. and BEHRENS,R.L. 1981
Response of small-grain cultivars to chlorsulfuron.
Weed Sci.(USA), 29:414-420.

In field experiments spring wheat, barley, and oats showed adequate tolerance to chlorsulfuron at 0.125 and 0.25 kg/ha with no differential responses among cvs. However, the yield of durum wheat was reduced by chlorsulfuron at 0.25 kg/ha at one location.

1178. HARTLEY,M.J. and MITCHEL,W.J.P. 1982
The tolerance of som bread wheats, durum wheats and triticales to herbicides for wild oat control.
Proc.35th Weed & Pest Cont.Conf.Waibato, 230-232.

1179. HENSON,J.F. and JORDAN,L.S. 1982
Wild oat (Avena fatua) competition with wheat (T. aestivum and T. turgidum durum) for nitrate.
Weed Sci.(USA), 30:297-300.

Lath-house experiments were conducted to compare the effect of wild oat (Avena fatua L.) competition on two wheat (Triticum aestivum L. 'Anza' and T. turgidum durum group 'Mexicali') genotypes at three nitrate concentrations. Plants were grown to maturity in pots containing 10 wheat or wild oat plants, or mixtures of 10 wheat and 10, 25, or 50 wild oat plants. When grown without competition, Anza had more above-ground plant weight and grain yield and less whole-plant percent nitrogen than Mexicali. Wild oat competition caused larger reductions in plant weight and grain yield, and smaller reductions in percent nitrogen for Anza than for Mexicali. Wild oat competition reduced the effectiveness of nitrate in increasing plant weight, grain yield, and whole-plant percent nitrogen of wheat.

1180. LEMELE,D., HINKLEY,R.B. and FISHER,J.A. 1981
Tolerance of durum wheat varieties to postemergence wild oat herbicides.
Proc.6th Australian Weed Conference, 1:123-126.

Five durum wheat vars. and two bread wheat vars. were treated with difenzoquat, flamprop-methyl and dicofop-methyl in weed-free conditions. The durum wheat varieties showed differential varietal response to the wild oat (Avena sp.) herbicides. D31014 had the greatest tolerance to difenzoquat, flamprop-methyl and dicofop-methyl and D31085 was the most susceptible. D30633 and D30561 were susceptible to difenzoquat but were less susceptible to flamprop-methyl and diclofop-methyl. Durati was susceptible to difenzoquat and diclofop-methyl and tolerant to flamprop-methyl. Egret and Songlen were generally more tolerant to all the herbicides.

1181. MAYLAND P.G. and FRAZIER,R.M. 1978
Diclofop results with the experimental use permit in wheat and barley. In Proceedings of the North Central Weed Control Conference.
Dep.Agron.Univ.Minnesota. (USA), 33:56.

Diclofob-methyl at 0.75-1 lb/acre was well tolerated by all cvs. of spring wheat, durum and barley tested. It provided good to excellent control of wild oats (Avena sp.) and foxtail (Setaria sp.) at the 1- to 4- leaf stage. Average yield increases ranged from 2.3 to 10.99 bu/acre.

1182. MILLER,S.D., MALEWAJA,J.D. and OLSON,W.A. 1979
Wild oat (Avena fatua) with flamprop-methyl.
Weed Sci.(USA), 27:91-95.

1183. MILLER,S.D., MALEWAJA,J.D., PUDELKO,J. and ADAMCZEWSKI,K.A. 1978
Defenzoquat for wild oat (Avena fatua) control.
Weed Sci.(USA), 26:571-576.

Postemergence difenzoquat for wild oat control in spring wheat and durum wheat, was evaluated in the field, greenhouse, and controlled environmental chamber. Wild oat control with difenzoquat was greater at the five- than at the three and one-half or two-leaf stages of growth. Barley tolerance to difenzoquat was excellent; however, spring wheat tolerance was influenced by cultivar. Durum wheat generally was more tolerant of difenzoquat than spring wheat. Tank mix combinations of broadleaf herbicides with difenzoquat had no effect on crop injury or wild oat control. Wild oat control with difenzoquat was greatest with adequate soil moisture, adequate

fertility, warm air temperatures and high relative humidity.

1184. ROSSI,L., MOSCONI,C. and MAROCCHI,G. 1977
Varietal resistance to some herbicides in T. durum and T. aestivum.
Genetica Agraria (Italy), 31:259-260.

Marked varietal differences were seen in susceptibility to benzoylprop-ethyl (a) and difenzoquat (b) in trial of 44 durum and bread wheat lines sprayed with 1.5 and 3 times the recommended dose; durum wheats were more susceptible than bread wheats. In a second experiment, all five bread-wheats used had fairly good resistance to these herbicides at the higher dose, losses in yield and 1000 grain weight were 10 per cent and 5 per cent respectively with (a) and 5 per cent and 2 per cent respectively with (b). The 16 durum varieties responded similarly to the bread wheats treated with (a) but mean losses in yield and 1000-grain weight were 43 per cent and 15 per cent respectively at the higher dose of (b). Maristella, Montanare Valsacco and FE2063 were highly resistant.

1185. SYLLAMI,A. 1975
Weed control research and demonstration in Tunisia. (Fr)
Proc.3rd Reg.Wheat Workshop,Tunisia, 193-203.

1186. SHAKER,D.L., ISOM,W.H., LYON,J.L. and VILCHEZ,M. 1979
Effects of nitrogen on fourteen wheat cultivars. In Proceedings of the Western Society of Weed Science.
Dep.Bot.Plant Sci.Univ.California (USA), 32:50-55.

Nitrogen at 3.36 and 6.72 kg/ha was applied to the soil surface immediately after sowing 11 wheat cvs, and incorporated by sprinkler irrigation. Crop injury due to nitrogen varied according to climatic and other environmental conditions. However, wheat cvs. MP 54 (Triticum aestivum) and Mexicalli (Triticum durum) were consistently more sensitive than the other cvs. tested with yield losses increasing with increasing rate of nitrogen.

1187. SINGH,H.G. 1973
An evaluation of herbicidal efficacy of terbutryn for weed control in dwarf aestivum and durum wheat.
Plant Protection Bull. (India), 24:1-6.

Harvest and Post Harvest Operations

1188. DEIDDA,M., DEMONTIS,F. and BROTZU,V. 1976
Test of pre-emergence weeding on durum wheat.
Pavia (Italy)1975, 75-88.

1189. LETO,C. and POMA,I. 1978
The importance of systematic soil tillage for a rational cultivation of durum wheat (in Sicily) (It)
Sviluppo Agricolo.(Italy), 12:29-30.

1190 SNOBAR,B., DUMAYRI,M., HADDAD,N. and TELL,A.M. 1982
Harvesting and threshing losses in cereal and legume crops in Jordan.
Amman Jordan Univ., 1-29.

Straw Utilization

1191. ANON. 1982
Straw cereals. Varieties. A choice. (Fr)
Producteur Agricole Francais (France), 58:41-47.

1192. CIANCI,D., MUSCIO,A., PALERMO,D., MARSICO,G. and CENTODUCATI,P. 1982
The utilization of straw treated with sodium hydroxide as animal feed. 1-Results of in vivo digestibility trials. (It)
Zootec.Nutriz.Animale (Italy), 7:23-39.

Straw from durum wheat cv. Appulo (a) untreated or (b) treated with 150 l of 30% sodium hydroxide sol./t straw was fed to 3.5-yr-old rams as 40% of the diet in the 1st, 60% in the 2nd and 90% in the 3rd feeding cycle. The nutritive value of the straw was 225.8 and 244.7 FU/t DM using theoretical digestibility values and 288.7 and 439.3 using actual data with (a) and (b), resp. Live weights were 80.2 and 81.7 kg initially, 71.9 and 68.9 kg after cycle 1. 73.4 and 70.1 kg after cycle 2 and 72.5 and 68.1 kg after cycle 3 with (b) and (a), resp.

1193. CORDESSE,R. 1982
Improvement of the straw nutritive value by chemical treatments. A review of treatment of hard wheat straw with anhydrous ammonia. (Fr)

These Dr.Ingen.Zootech.INRA-(France)1982 11.

1194. CORDESSE,R. and TABAI,M.T. 1981
Feeding of lambs with ammonia treated straw. 1. Nutritive value,growth and carcass quality of animals. (Fr)
Ann.Zootech. (France), 30:137-149.

Straw of durum wheat cv. Tomclair was treated with 5% ammonia. Digestibility was determined with adult rams before feeding straw as 70% of the diet of 75-day-old male lambs. N content of the straw was increased from 0.48 to 1.52%. CP content from 3 to 9.5% and energy content from 0.41 to 0.68 FU by ammonia treatment. Addition of 30% concentrates did not significantly increase energy content of the diet and daily growth rates of 91 g were possible with no evidence of toxicity.

1195. GARAMBOIS,X. 1982
Use of durum wheat in lamb fattening. Preliminary results. (Fr)
Bull.Techn.Rec.Zootechn.Veter.(France), 15-18.

1196. INRA FRANCE. 1982
Use of hard wheat in lamb fattening. Preliminary results. (Fr)
Patre (France) No.290, 17-19.

Grain Quality and Technology

1197. ABDEL-RAHMAN,A.H. 1983
Amino acid composition of two Italian durum wheat varieties and their semolina.
Food Chemistry.(U.K), 10:155-158.

Cvs. Capeiti and Creso had glutamic acid 30.0 and 34.0, valine 4.80 and 3.20, arginine 4.70 and 3.90 and glycine 4.01 and 5.01% of protein, 12.4 and 6% of DM, resp. There were slight differences between varieties in some other amino acids. Wheat and semolina had different values.

1198. ABECASSIS,J. 1981
Marketing pasta: quality of durum wheat, semolina and pasta. (Fr)
S.O.I.C.Q. Marseille (France), 42-55.

Under quality or industrial value or technological value are grouped durum wheat characteristics which are responsible for semolina yield and semolina quality.

1199. ABECASSIS,J. and ALARY,R. 1977
Evaluation of the culinary quality of durum wheat varieties by means of an viscoelastograph.
Bull.Inform.Liaison Synprodur(France), 2:21-24.

Selection of durum wheats according to their culinary quality is described at its main stages: fabrication of pasta, cooking and over cooking of the pasta. The cooked products characteristics are determined by means of the viscoelastograph. The interpretation of some results is given.

1200. ABECASSIS,J. and ALAUSE,J. 1979
Colour indices and cooking quality of milling products from durum wheat cultivars. (De)
Getreide, Mehl Und Brot (F.R.G), 33:71-76.

Hectolitre wt., 1000-grain wt., percentage of non-vitreous and dark-stained grain and contents of ash and protein of durum wheat cv. Agathe, Durtal, Lakota, Povinville, Tomclair and Valdur harvested in 1977 are given. The cooking quality of semolina, groats and meal obtained from them are also given.

1201. ADRIAN,J. and BOISSELOT,L.J. 1977
Vitamins in cereals. (Fr)
Bull.ENSMIC (France), 280:197-203.

The quantity and distribution of vitamins in durum wheat grain and other cereals are given.

1202. ADRIAN,J., RABACHE,M. and FRANGNE,R. 1982
The presence of pesticides in food. (Fr)
Industries des Cereales (France), 18:23-30.

Changes in insecticides during storage and processing were studied. For durum wheat the analysis of the different milling products reveals presence of insecticides in the edible fraction.

1203. ALARY,R., ABECASSIS,J. and FEILLET,P. 1978
Evolution of durum wheat cooking quality by means of the viscoelastograph. (De)
Getreide, Mehl Und Brot (F.R.G), 32:276-280.

A new evaluation method for culinary quality of durum wheats is proposed.

Its principle is the following: about 45% of semolina is extracted from the durum wheat grain by means of milling and screening. Pellets are produced out of it,and the quality of pellets cooked in boiling water for 16, 24 and 32 minutes is determined with a viscoelastograph. The analysis of 28 durum wheat lots show the results are correlated with the quality of spaghetti produced with these wheats.

1204. ALAUSE,J. and ABECASSIS,J. 1978
Quality of new French durum wheat cultivars. (De)
Getreide, Mehl Und Brot (F.E.G), 32:197-204.

Data on grain quality characteristics, including 1000-grain wt. and CP content of 6 winter and 9 spring durum wheat cv. grown in 1-4 yr in France, are given.

1205. ANON. 1978
Agronomical research combined with a quality analysis of durum wheat-Aude, Grad, Inder, Rhone Delt. Results 1976. (Fr)
Serv.C.Enq.Etude Stat. (France) No.13.

The agronomical survey on durum wheat is conducted together with the durum wheat quality. Survey is aimed at studying the existing relations between quality criteria and agronomical ones, so as to try to explain some technological results observed in durum wheat.

1206. ANON. 1978
Durum Wheat. (Fr)
Le Petit Meunier(France), 3.

The spring durum wheat harvest was of excellent quality with very little fermature dissection. In 1978 in France, there were large price differences depending on quality. There was the necessity to put an effort in selecting good quality as had been done in USA.

1207. ANON. 1979
Separation of hard wheat grain into fractions prior to milling.
Mukom-Elevat.Kombikorm.Pron.No.12, 28.

Fractions are separated according to grain size using 3, 2.5 and 2 mm. Quality of milling products is established according to yield and ash content of the products resulting from their first grindings. Results show the advantages of separation of grains in three independent categories. This also allows a differential conditioning and drying of three kinds of fractions.

1208. ANON. 1980
Durum milling.
Bull.Ass.Operative Millers,Mar-1980, 3808-3813.

1209. ANON. 1980
Durum wheat quality. (Fr)
Brochure ITCF.ONIC.(France).

Physical and technological characteristics of the durum wheat varieties are presented. Durum wheat production is given for 1979 and 1980 (predicted as of November 1).

1210. ANON. 1981
Evolution of varieties. (Fr)
Cultivar (France), 145:52-61.

1211. ANON. 1982
A durum wheat club charged with the defence of pasta quality. (Fr)
Bull.Infor.Ministere.Agric.(France), 7.

Aiming to harmonize durum wheat of different qualities, so as to have precise criteria for pasta manufacture, the European operators (producers and manufacturers) of the "durum wheat" branch have just instituted at Rome a Durum Wheat Club. France, a confounder, will participate through three delegates of the concerned parties (wheat producers, semolina producers and pasta manufacturers).

1212. ANON. 1982
Good quality results of French durum wheat and soft wheat. (Fr)
Le Petit Meunier (France)., 1-2.

Durum wheat quality according to ONIC-ITCF harvest survey is good. Culinary quality is very good and uniform in the south for traditional varieties (Agathe, Bidi 17, Montferrier) and new ones (Creso, Mondur); only Kindur has a much lower culinary quality. In the north this quality is considerably better than last year's with three prominent varieties: Cavinor, Mondur and Valdur. Pasta color and physical characteristics are satisfactory.

1213. ANON. 1983
Durum wheat: nitrogen supply and quality. (Fr)
Cultivar (France), 166:35.

According to the results of 1982 trials for a given variety parameter desiccation rate is higher when protein content decrease. Culinary quality also decreases. A good nitrogen nutrition results in a better protein content of the grain. A bad nitrogen nutrition may be the result of an insufficient nitrogen fertilization, bad nitrogen utilization by the plant or a shortage of nitrogen during the period of growth.

1214. AUTRAN,J.C. 1980
New breeding possibilities for high cooking quality through durum wheat gliadin and glutenin protein electrophoregrams.
Cereal Foods World. (USA), 25:532-533.

Varieties could be classified on the basis of their electrophoretic patterns for both gliadin and glutenin. Two different electrophoretic mobility classes were established for the gamma components of gliadin. Varieties belonging to one of these groups had better gluten quality than those in the other.

1215. AUTRAN,J.C. 1981
Recent data on the biochemical basis of durum wheat quality [T . durum].
Technology. New York. (USA), 257-274.

1216. AUTRAN,J.C., BERRIER,R. and JEANJEAN,M.F. 1981
New data on the chemical and genetic composition of durum wheat gluten proteins.
Cereal Foods World (USA), 26:499.

Electrophoretic analysis of aneuploid lines indicated that synthesis of most of the gliadin bands or subunits associated with cooking quality was controlled by chromosome 1B. Segregation of several bands in the F2 of some crosses indicated that, generally, codominant alleles and closely linked genes were involved. Linkage between some HMW subunits and gliadin bands suggested that a cluster of genes controls both.

1217. AUTRAN,J.C., DAMIDAUX,R. and JEANJEAN,M.F. 1982
Evaluation of the genetically determined culinary potential of the durum wheat varieties by electrophoregrams of gluten proteins. (De)
Getreide, Mehl Und Brot (F.R.G), 36:29-33.

Gliadin's bands 42 and 45 seem to be closely associated to intrinsic culinary quality. So it seems possible for the breeder to use gel polyacrylamide electrophoresis to carry on selection starting from the F3, for the presence of gliadin band 45. Those F3 lines containing the 45 band, could be screened for the character high elastic covering of gluten and confirmation at the end of the test by means of cooking microtests.

1218. BANASIK,O.J. 1981
Pasta processing [durum wheat].
Cereal Foods World (USA), 26:166-169.

Text of a speech presented at the AACC Central State Station 22nd Annual Symposium "Processing Methods of Cereal Based Products" in St Louis, MO, 30 January 1981. Gives a general overview of the processes involved in producing pasta.

1219. BANASIK,O.J., SEYAM,A.A. and HABER,T.A. 1976
Studies on the structure of durum wheat, pasta and spaghetti.
Macaroni J.(USA), 58:18-26.

1220. BARBERO,L. and CAVALLI,G. 1977
Lead and copper determination in soft and durum wheat. (It)
Tecnica Molitoria (Italy), 28:105-108.

1221. BAROCCIO,A. and ALESSANDRONI,A. 1978
Variations in aminoacid content of the protein in grains of T . durum at different stages of maturity. (It)
Ann.Ist.Sper.Cerealicoltura (Italy), 9:137-150.

The changing aminoacid composition of six varieties was studied. The protein fractions of the grain stabilized 3-4 weeks after the mature grain could be determined in the early stages of development. In general, the application of nitrogen fertilizer did not affect the aminoacid composition.

1222. BAROCCIO,A., ALESSANDRONI,A. and DOTTRI,A. 1980
Variations in amino acid protein composition of maturing grains from T. durum varieties. (It)
Genetica Agraria (Italy), 34:153-154.

Analyses were carried out on the amino acid composition of grains at various stages of maturity in six Triticum durum varieties grown at two levels of nitrogen fertilizer. In all, data changes occurred during the first 3-4 weeks after flowering in the amino acid percent of the total protein: after this stage stabilization of various protein fractions content takes place, and consequently during the later stages of maturity no significant variations in amino acid composition of grains were confirmed. The results suggest that the various protein fractions in mature grains of each variety can be evaluated from the early stages of maturity.

1223. BEBYAKIN,V.M. and KUMAKOVA,A.V. 1981
Gliadin composition in T. durum varieties and F1 hybrids. (Ru)
Tsitol.Genet.(USSR), 15:39-42.

Gliadin banding patterns contained 17-25 components in the 23 varieties analysed. Varietal differences were least marked in the gamma zone. The banding patterns of the hybrids contained the components of both parents; no components disappeared and no new components appeared.

1224. BEKBOLET,M. 1979
The influence of gluten proteins on the pasta quality of Turkish T. durum wheat cultivars.
Thesis.Food Fac.Ege.Univ.Izmir.Turkey.

Climatic conditions in Turkey are favorable for durum wheat production. Improvement programs take into account yield and disease resistance, but not pasta quality criteria. The influence on pasta quality was studied for 6 Turkish durum wheat cultivars, as well as the influence of protein composition on culinary quality. Results obtained with the use of a viscoelastograph show that all Turkish wheat samples are suitable for pasta production.

1225. BOGGINI,G. 1984
Durum wheat in the north: a reality. (It)
Informatore Agrario (Italy), 40:21-22.

Tabulated assessments are given of the milling and pasta qualities of a total of 15 cultivars in trials in 1982 and 1983. Vezio and Produra had the best milling quality and Creso and Valforte the best pasta quality.

1226. BOGGINI,G. and BORGHI,B. 1977
Inheritability of the ash-content in the cariopsis of Triticum durum [durum wheat].
Sementi Elette (Italy), 23:15-21.

Samples of 13 varieties, harvested in 8 northern Italian trials and seeds coming from F1 generation of a diallelic crossing, were examined. The varieties Tito and Creso showed lower mineral contents in the grain; Sansone, Belfuggito and Lambro had higher. Mineral contents are negatively correlated with specific weight and grain hardness. The positive correlation between ash content and dominance degree is a source of difficulty found in bringing to homozygosity the types with low ash content from the first generation onwards.

1227. BOGYO,P. and PORCEDDU,E. 1975
The use of discriminant function in the numerical taxonomy of Durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 225-246.

1228. BOLLING,H. and ZWINGELBERG,H. 1976
Importance of vitreousenss for durum wheat processing. (De)
Getreide, Mehl Und Brot (F.R.G), 3:146-148.

A number of studies were made to investigate the relationship between vitreousness and kernel hardness in durum wheat. Kernels with over 75% vitreousness gave 53-57% semolina. Low vitreousness is related to low semolina content. The results on hardness show that the kernel hardness in durum wheat is difficult to relate to other quality parameters bread wheat. The variability for hardness in durum wheat is low.

1229. BOURDET,A. and AUTRAN,J.C. 1976
Electrophoretic determination of the gliadins for identification of wheat

blends. (De)
Getreide, Mehl Und Brot (F.R.G), 30:203-207.

Several methods are discussed which are not able to distinguish between one wheat from another. However the electrophoretic separation of certain enzymes has been successful (peroxidase, B-amylase).

1230. BOUTRIF,E. and MORSE,R.E. 1976
Aflatoxin production on couscous.
Candian Inst.Food Sci.Technol.J.(Canada) 9:186-188.

1231. BOZZINI,A., CANTAGALLI,P., PIAZZI,S.E. and SORDI,S. 1973
Immunochemical characterization of tetraploid and hexaploid wheats.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 59-68.

By the preparation of antisera, applying the technique of immunoprecipitation in agarose gel and of immunoelectrophoresis, it was possible to characterize two specific soluble proteins, the first one with cathodic mobility (PCS) and the other one with anodic mobility (Mb 0,19), which are present in bread wheats and absent in durum wheats. Immunoprecipitation analysis gives therefore the possibility to reveal the presence of illegal mixtures of bread wheat products in durum wheat semolina and macaroni.

1232. BRACCIALI,A., CANTAGALLI,P., POMPUCCI,G. and TARLI,P. 1980
Note on the identical immunological behavior of a protein fraction from durum wheat germ and a purified lectin from soft wheat germ.
Cereal Chem. (USA), 57:367-368.

This study investigated the immunological pattern developed by the antiserum against DWG fraction, assayed by double immunodiffusion in agarose gel with purified SWG lectin, soybean lectin and protein extracts from soft wheat and durum wheat semolina, both free from wheat germ. The objectives were: 1) to demonstrate the immunological identity between SWG lectin and the DWG fraction and 2) to determine whether the antibody against the DWG fraction reacts with soybean lectin or with durum or soft wheat protein other than lectin.

1233. BREEN,M.D., BANASIK,O.J. and WALSH,D.E. 1977
Use of various protein sources in pasta.
Macaroni.J. (USA), 58:26-32.

1234. BUHLER-MIAG,Inc. 1979
"High temperature" drying of pasta products.
Macaroni J.(USA), 60:30-32.

1235. BURE,J. 1980
Wheat symposium (Triticum) durum, pasta (Rome 30 and 31 May 1979). (Fr)
C.R.Seanc.Acad.Agric.(France), 66:54-65.

1236. BURINI,G. and DAMIANI,P. 1978
Analysis of natural triglycerides by consecutive chromatographic technique, [2]. The triglycerides of durum wheat, soft wheat and their milled products.
Tecnica Molitoria (Italy), 29:97-108.

Italy is a major consumer of macaroni products and a major producer of durum wheat, so the International Association of Cereal Chemistry together with the National Italian Institute of Nutrition organized an International "Durum Wheat Macaroni Products" Symposium in Rome.

1237. BURNOUF,T. and BIETZ,J.A. 1983
Determination of durum pasta quality by reversed-phase high-performance liquid chromatography of gliadins.
Cereal Food World (USA), 28:556.

Gliadins of durum wheat varieties of different pasta quality were analyzed by reversed-phase high-performance liquid chromatography (RP-HPLC). Gliadins were directly extracted from single ground kernels. After centrifugation, extracts were injected and proteins eluted with a linear 55-min gradient of acetonitrile. Gliadins from each variety were resolved into a unique chromatographic pattern. However, two distinct and mutually exclusive types of patterns-four chromatographic peaks of high hydrophobicity served to distinguish durum varieties on the basis of pasta quality. Aluminium lactate electrophoresis of two of these fractions, collected from a preparative RP-P column, revealed the presence of gliadin bands 43 and 42, which have previously been shown to be related to durum gluten strength and weakness, respectively. RP-HPLC can, therfore, be used to predict pasta quality of unknown samples. By modification of the

chromatographic conditions of analysis, a rapid, highly automated procedure that permits approximately 200 quality determinations per 24 hours has been developed. It has potential of being a valuable screening tool in early generations of durum wheat breeding.

1238. BURZYNSKA,H. and MACIEJSKA,K. 1978
Comparison of methods of some salmonella detection in pasta.
Rocz.Pantw.Zak.Higieny (Poland), 29:279-286.

1239. CHANG,C.R. and TSEN,C.C. 1981
Characterization and heat stability of trypsin inhibitors from rye, triticale and wheat samples.
Cereal Chem.(USA), 58:211-213.

Extinction coefficients were determined for the trypsin inhibitors (TI) isolated from rye, triticale, hard red winter wheat, and durum wheat. Except for TI from hard red winter wheat II all the inhibitors contained carbohydrate. No free sulfohydryl group was detected in any of inhibitors by the amperometric titration method. All inhibitors were heat stable. Triticale TI was the most heat resistant among the inhibitors tested. However, heating at 125oC altered the conformation of the inhibitors and permanently inactivated all of them.

1240. CHANG,C.R. and TSEN,C.C. 1981
Isolation of trypsin inhibitors from rye, triticale and wheat samples.
Cereal Chem.(USA), 58:207-210.

Trypsin inhibitors (TI) of rye, triticale, hard red winter wheat, and durum wheat were isolated by extraction, affinity chromatography, CM cellulose ion-exchange chromatography, and gel filtration chromatography. Affinity chromatography produced a poor yield (37 and 29%, respectively) for hard red winter wheat and durum wheats TI. The specific activity of the inhibitors was increased 100-200 times by this step. Affinity chromatography resolved predominantly and two durum wheat TI (mol wt 38.500 and 22.500). CM-cellulose ion-exchange and gel filtration steps further purified the inhibitors to increase their specific activities.

1241. COTTONET,M., FEILLET,P. and AUTRAN,J.C. 1984
Isolation and characterization of two low molecula weight gliadins from durum wheat: LMWG 45 and LMWG 42. Comparison with gamma gliadins 45 and 42.
C.R.Acad.Sci.(France), 299:11-16.

Two gliadins of low mol.wt., LMWG 45 and LMWG 42, were isolated from durum wheat cv. Agathe and Calvinor. Their electrophoretic mobilities in acid conditions were identical to those of gamma gliadins 45 and 42 but analysis of mol. wt., amino acids, theoretical hydrophobicity and tryptic peptides mapping demonstrated significant structural differences between the low mol. wt. gliadins and gamma gliadins.

1242. COVARELLI,G. 1974
Effect on soil and foliar late nitrogen application on quality of durum winter wheat. (It)
Concini E Concimazioni (Italy), 18:9-14.

The functional role of gamma-gliadins 45 and 42 in durum wheat gluten viscoelasticity is examined by studying the hydrophobicity of these proteins. Components 45 and 42 have a similar amino-acid composition, with the exception of proline. Surface hydrophobicity is measured by the solubilization of gliadins with sodium-myristate. One hypothesis is proposed and discussed to elucidate discrepant behaviours of gamma-gliadins 45 and 42 through hydrophobic interaction chromatography and reverse-phase high performance liquid chromatography, gamma-gliadin 45 seems to be less accessible to soap than gamma-gliadin 42. Gamma-gliadin 45 seems also to have interactions with other components weaker than those which appear in the prerence of soap. The functional role of gamma-gliadins 45 and 42 is finally discussed with regard to their accessibility and aggregation.

1243. D'APPOLONIA,B.L. and MacARTHUR,L.A. 1976
Comparison of bran and endosperm pentosans in immature and mature wheat.
Cereal Chem.(USA), 53:711-718.

Pentosans extracted from the bran and endosperm of two varieties of immature and mature hard red spring and durum wheat were examined. Crude pentosan

containing material was extracted from the various brans with 0.5N sodium hydroxide. The amount of crude or amylase treated pentosan containing material recovered from the bran of immature wheat samples was higher in all cases than that recovered from the bran of corresponding mature wheat samples. However, the protein content of the pentosan containing material extracted from mature wheat bran was higher than that extracted from immature wheat bran. A slightly higher amount of crude and amylase treated pentosans was recovered from the flour or semolina of immature wheat samples than from corresponding mature samples. The ratio of arabinose: xylose for the essentially pure bran pentosan fraction was similar for the immature and mature wheat samples, whereas the ratio for the same fraction for the flour or semolina pentosans was higher for the immature wheat samples than for the mature samples.

1244. D'EGIDIO,M.G., FORTINI,S., GALTERIO,G., SGRULLETTA,D. and VOLPI,M. 1976
Characteristics of the flour and semolina of durum wheat and technological properties of pasta. (It)
Genetica Agraria (Italy), 30:117-141.

Protein and gluten contents of flour and semolina, asn content of the flour and incidence of mealy endosperm varied according to variety and site, in six varieties studied in four localities. In cooking tests, the semolina from the Cagliari and Gravina trials produced the best pasta; the varieties Trinakria and Raineri had the best-quality products.

1245. D'EGIDIO,M.G., FORTINI,S., GALTERIO,G., MARIANI,B.M. and SGRULLETTA,D. 1979
Protein content and composition of Italian durum wheat flour: Its quality related to spaghetti cooking.(It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 10:207.

1246. D'EGIDIO,M.G., STEFANIS,E.De., FORTINI,S., NARDI,S. and SGRULLETTA,D. 1982
Interaction between starch and protein fraction extracted from T. durum semolina. (En,It)
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 13:121.

1247. D'EGIDIO,M.G., STEFANIS,E.De., FORTINI,S., GALTERIO,G. and NARDI,S. 1982
Standardization of cooking quality analysis in macaroni and pasta products.
Cereal Foods World (USA), 27:367-368.

1248. D'YACHENKO,N.I., CHILIKINA,L.A. and BUYUKLI,P.I. 1981
Grain protein content in various genotypes of durum wheat in Moldavia. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 2:181.

About 300 forms of winter durum wheat were evaluated for grain protein content, 1000 grain weight, lodging resistance and height. The forms studied fell into four groups according to straw length: dwarf (trigenic), semidwarf (digenic), short-strawed (monogenic) and tall-strawed. The first two groups had good lodging resistance; the best of them gave a 15- 20% higher yield than the standard. Grain protein content tended to be highest in forms belonging to the dwarf (trigenic) group.

1249. DAL BELIN,P.A. and POGNA,N.E. 1981
Differential analysis of the durum wheat cultivars Capeiti 8 and Patrizio 6 using electrophoretic techniques. (It)
Sementi Elette (Italy), 27:11-13.

Gliadin contents of the seeds of the 2 cultivars were extracted and compared using polyacrylamide and SDS gels.

1250. DALBON,G. and DEHLER,W. 1982
Influence of the quality of raw material and dehydration on the quality of pasta.
Getreide, Mehl Und Brot (F.R.G), 36:298-302.

Nine spaghetti types differing in their egg and salt content are prepared from 3 mixtures of bread wheat and durum wheat (100-0, 80-20 and 20-80). The spaghetti was dried either at standard or high temperature. Data on their formulation, water content and cooking quality are given in several tables.

1251. DALBON,G., PAGANI,M.A. and RESMINI,P. 1981
Characteristics of durum wheat (T. durum) amides and cooking qualities of pasta: some preliminary considerations.
Macaroni J. (USA), 63:22-26.

1252. DALGATOVA,B.I. 1976
Grain quality of durum wheat in Azerbaijan. (Ru)
Azerbaijan SSR,Elm. (USSR), 211-216.

Tests were carried out during 1974-75 on six varieties, at the Karabakhskaya Experimental Station of the Azerbaijan Institute of Genetics and Breeding. Vitreousness of the grain was the trait most subject to variation. All the varieties had a fairly high 1000-grain weight. Protein content varied between 11.80 and 15.88 per cent in the grain and 11.57 and 15.53 per cent in the flour. All the varieties had good grain quality, especially Kara-Kylcik.

1253. DAMIDAUX,R., AUTRAN,J.C., GRIGNAC,P. and FEILLET,P. 1978
Relationship between the gliadin electrophoretic patterns and the viscoelastic properties of T. durum Desf. gluten as an aid in breeding [Wheat].
C.R.Hebd.Acad.Sci.Ser D (France), 287:701-704.

Analysis of seventy four Triticum durum varieties reveals a very consistent relationship between the presence of the components 45 or 42 in the polyacrylamide gel electrophoretic patterns of gliadins and the viscoelastic properties of the gluten. Such results provide a new means of evaluation of breeding material for cooking quality through electrophoretic methods.

1254. DAMIDAUX,R. and FEILLET,P. 1978
Relationship between the viscoelastic properties of cooked gluten, the protein content and the cooking quality of durum wheat. (Fr)
Ann.Technol.Agr.(France), 27:799-808.

Firmness and absolute recovery of durum wheat (T. durum) gluten have been determined from a strain-time curve(creep recovery curve) recorded on a viscoelastograph (load: 500 g); before measurement, the gluten ball was cast into special cylindrical cell which was dipped into boiling water. Gluten viscoelastrogram was determined for different dipping times (0 to 7 min.). Linear regression analysis has shown that durum wheat cooking quality (y) is related to wheat protein content (P) and absolute recovery of 90 sec heated gluten ball (G) according to the equation: y=1.17 P + 3.68 G-16.5 (r = 0.91). From these preliminary results (24 durum wheat samples analysed), there is evidence that determination of G could be a promising breeding tool for determining the intrinsic cooking value of durum wheat varieties.

1255. DARKANBAEV,T.B., FURSOV,O.V., KHAIDAROVA,Zh.S., ANIKEEVA,L.A. and MARICHEVA,E.K. 1980
Isoenzymes of alpha-amylase in grains of some cereals. (Ru)
Fiziol.Biokhim.Kul't.Rast.(USSR), 12:258-262.

There were specific, cv. and generic differences in electrophoretic spectra of alpha -amylase of grains of soft and durum wheats and some Aegilops spp. The spectra of isoenzymes of alpha -amylase, depending on electrophoretic mobility, were divided into 3 groups (A, B and C). The least mobile component of group C, which can differentiate the spectrum of soft wheat from that of durum wheat, was present in A. squarrosa subsp. strangulata.

1256. DAVIS,K.R., PETERS,L.J. and LETOURNEAU,D. 1984
Variability of the vitamin content in wheat.
Cereal Foods World (Japan), 29:346-370.

Vitamins covered are niacin, thiamine, riboflavin, pyridoxine, pantothenic acid, folic acid and the tocopherols. It is concluded that vitamin contents vary considerably and that it should be possible to select for higher vitamin content. Significant differences between varieties and/or classes of bread wheat and durum wheat are reported for niacin, thiamine, riboflavin, pantothenic acid, folic acid and alpha-tocopherol contents.

1257. DEKOV,D. 1973
Studying the suitability of some bread and durum wheat varieties for macaroni production. (Bg)
Rasteniev'd Nauki,(Bulgaria), 10:67-74.

Studies of physical, chemical and technological properties of the grain and flour for the preparation of macaroni in five varieties showed that all had good physical and chemical properties. The durum varieties 233,

788 and Hordeiforme 122, had good technological properties and their macaroni had a good flavour. The macaroni quality of 233 was slightly inferior to that of 788 and Hordeiforme 122, probably because 233 has T.turgidum in its parentage.

1258. DEKOV,D., KONOV,V. and SIMEONOVA,I. 1978
Chemical and technological qualities of new introduced durum wheat varieties. (Bg)
Rasteniev'd Nauki,(Bulgaria), 15:32-37.

Data on chemical composition and tecnological qualities of grains of 11 durum wheat cv. grown in Bulgaria are given. All cv., except Rainery and Carlo juci, can be used as raw material in the macaroni industry.

1259. DELLA GATTA,C., BLANCO,A., PORCEDDU,E., VENEZIAN,M.E.S. and SCARASCIA,M.G.T. 1979
Quality requirements of raw materials to be used in pasta manufacturing and characteristics shown by a set of Italian durum wheats.
Symp.Int.Chem.Cerealier,Rome (Italy), 1-30.

27 Italian varieties and lines, grown in 5 Italian sites, have been tested, and the kernel and semolina characters, as well as the spaghetti cooking quality, have been analysed. A large range of variation for all the observed characters, except for pigments, has been ascertained, due also to the environmental conditions; however, some varieties have shown more limited variability. From these experiments one can argue that a good cooking quality is related; 1) to a high protein content and a high gluten content even if of medium quality, or 2) to a moderate protein content in conjunction with a moderate gluten content of high quality.

1260. DEMIDOVA,E.G. and DAVYDOV,S.E. 1974
Some results of study of macaroni quality in varieties and hybrids of durum wheat in Tselinograd province.
Selektsiya, Semenovodstvo i agrotekhn. Polevykh Kul'tur.
Tskelinograd,Kazakh. (USSR)1974, 31-35.

In a study during 1969-71, the following hybrids gave a fairly high macaroni quality regardless of the weather conditions: Mutika 55/62-20 (Sololyunis X Khar'kov 46), Leucurum 21/51-64 (Hordeiforme 432 X Ak-molinka 5) X (Albidum VIR X Snegurka (Snow Maiden)), Hordeiforme 36/58-35 (Coerulescens 19/28 X Akmolina 2).

1261. DEMIR,I. and MARQUARD,R. 1978
Amino compounds in Triticum - Secale and Triticale originating from Turkey. (De)
Getreide,Mehl Und Brot (F.R.G), 32:58-60.

1262. DEXTER,J.E., DRONZEK,B.L. and MATSUO,R.R. 1978
Scanning electron microscopy of cooked spaghetti.
Cereal Chem.(USA), 55:23-30.

A scanning electron microscope was used to study changes in structure of spaghetti that occurred during cooking. The appearance of the spaghetti under different cooking regimes is described.

1263. DEXTER,J.E. and MATSUO,R.R. 1977
Influence of protein content on durum wheat quality parameters.
Can.J.Plant Sci.(Canada), 57:717-727.

The influence of protein content on some durum wheat (Triticum durum Desf.) quality parameters was investigated for two Canadian durum wheats of differing spaghetti making quality. A substantial increase in semolina yellow pigment content was observed for one of the two durum wheats as protein content increased. For both cultivars, a moderate increase in protein content was accompanied by a marked decrease in farinogram mixing time concomitant with an increase in maximum consistency and tolerance index. Cooking quality and tolerance to overcooking continued to improve as protein increased for both cultivars over the complete range of protein content examined. For both durum wheats, the proportion of non-gluten protein (the albumins and globulins) decreased significantly with increasing protein content.

1264. DEXTER,J.E. and MATSUO,R.R. 1977
The spaghetti-making quality of developing durum wheat. (En)
Can.J.Plant Sci.(Canada), 57:7-16.

The quality of spaghetti processed from

two Canadian durum wheats (Triticum durum Desf.) and one Argentine durum wheat was evaluated in terms of flour characteristics at four stages of kernel development. Rapid changes in the nature of the flour components within each cultivar resulted in substantial improvement of spaghetti quality during development. Flour pigment levels decreased during development for all three cultivars which resulted in decreased spaghetti pigment levels. Flour brownness, which was related to spaghetti brownness decreased during development for all three cultivars. The brownness of the Argentine durum flour and spaghetti was much greater than that of the Canadian durums at all stages of development. Spaghetti cooking quality improved during development for all three durum wheats until the 6-10 days preripe stage. The cooking quality of spaghetti processed from 6-10 days preripe durum was essentially equal to the cooking quality of spaghetti prepared from the corresponding ripe durum. Solubility distributions of the flour proteins established a relationship between improved spaghetti cooking and an increased proportion of glutenins.

1265. DEXTER,J.E. and MATSUO,R.R. 1977
The effect of gluten protein fractions on pasta dough rheology and spaghetti-making quality.
Cereal Chem.(USA), 55:44-57.

Gluten proteins from a durum wheat and a hard red spring wheat were fractionated by precipitation from 0.005 N lactic acid at various pH levels. As pH increased, the proportion of glutenins within each fraction was found to decrease concomitantly with an increase in gliadins. Reconstitution experiments demonstrated that a decrease in farinograph mixing time at pasta processing absorptions accompanied this decrease in glutenins and increase in gliadins. With the exception of the lactic acid insoluble fraction, addition of the gluten fractions had no detrimental effect on spaghetti color.

1266. DEXTER,J.E. and MATSUO,R.R. 1980
Relationship between durum wheat protein properties and pasta dough rheology and spaghetti cooking quality.
J.Agric.Food Chem.(USA), 28:899-92.

Results are presented from an evaluation of 30 durum lines for pasta dough farinograph properties. Protein characteristics and spaghetti cooking quality. Farinograph band width was a better indicator of spaghetti cooking quality than were mixing time and tolerance index.

1267. DEXTER,J.E. and MATSUO,R.R. 1981
Effect of starchy kernels, immaturity, and shrunken kernels on durum wheat quality.
Cereal Chem.(USA), 58:395-400.

The effect of starchy kernels, various degrees of immaturity, and shrunken kernels on durum wheat characteristics and end-use quality was investigated. As starchy kernel content increased, semolina granulation became finer and more flour was produced during milling. Protein content decreased with increased starchy kernel content, resulting in a deterioration in spaghetti cooking quality. The main effect of immature, grass green, and frosted green kernels was duller and browner spaghetti. The presence of shrunken kernels caused reduced test weight, high ash, reduced milling yield, higher speck count, and poorer spaghetti color quality.

1268. DEXTER,J.E. and MATSUO,R.R. 1982
Effect of smudge and blackpoint, mildewed kernels, and ergot on durum wheat quality.
Cereal Chem.(USA), 59:63-69.

Farm samples from the 1979 and 1980 Canadian durum wheat crops were handpicked to yield a series of controls and samples enriched by varying degrees in smudge and blackpoint, mildewed kernels, and ergot bodies. The most important effect of smudge and blackpoint and of mildewed kernels was an undesirable increase in semolina. Spaghetti color also deteriorated slightly, particularly from mildewed kernels. Levels of ergot bodies within the legally tolerated limits for Canadian durum wheat caused an increase in semolina speckiness. At higher levels of ergot, spaghetti color deteriorated rapidly and milling yield decreased. Spaghetti color quality did not appear to be affected by any of the degrading factors examined.

1269. DEXTER,J.E., MATSUO,R.R., PRESTON,K.R. and KILBORN,R.H. 1981
Comparison of gluten strength, mixing properties, baking quality and spaghetti quality of some Canadian durum and common wheats.
Can.Inst.Food Sci.Technol.J., 14:108-111.

The gluten strength, mixing properties, baking quality and spaghetti quality of 22 Canadian durum wheat cv. compared with those of 38 common wheats had generally weaker gluten and were poorer in baking quality and higher in spaghetti quality.

1270. DICK,J.W. 1982
Infuence of the germination of the North American wheats on the production and quality of pasta.(De)
Getreide, Mehl und Brot (F.R.G.), 36:187-189.

Apparently degradation in quality is higher for bread wheat than for durum wheat. For the latter one can still use a falling number of 200 seconds.

1271. DICK,J.W. and QUICK,J.S. 1983
A modified screening test for rapid estimation of gluten strength in early-generation durum wheat breeding lines
Cereal Chem. (USA), 60:315-318.

A sodium dodecyl sulphate microsedimentation test (MST) using 1 g of ground wheat was compared with an existing sedimentation procedures and cooked spaghetti firmness determined, for eight varieties grown at six localities. Statistical analyses showed that the MST was best for predicting cooked spaghetti firmness.

1272. DICK,J.W. and SHUEY,W.C. 1976
A computerized method for evaluating durum wheat quality.
Cereal Chem.(USA), 53:910-915.

The technique described includes eleven variables for quality evaluation. Percentage deviation from the mean of selected standard varieties is the determining factor for most of the variables in calculating the degree of variance from acceptable performance. The correlation coefficient between the calculated and the subjective evaluations was plus 0.92.

1273. DIMOPOULOS,J.S. 1979
Contribution of the researchers concerning the detection of soft wheat products into durum products. (Gr)
Proc.1st Greek Agr. Res. Symp. (Greece), 45-60.

Samples of soft (T. vulgare) and durum (T. durum) wheat varieties cultivated in different parts of Greece as well as semolinas and pasta products were analysed by the TLC method. Samples of 6 varieties of soft wheat cultivated in Cyprus were also included in the analyses. The intensity of the "sitosterol" palmitate band of the soft wheat varieties constitutes apparently a varietal characteristic. The Italian varieties Gallini, Generoso, Badia and Sparta behave practically as durum wheat (absence of the sitosterol palmitate band). None of the varieties examined contained sitosterol palmitate. Fresh semolinas behaved similarly but again was found to give rise to the sitosterol palmitate band. The process followed for the preparation of pasta products was found to produce the same effect. The ratio of the maximum heights of the densitogram peaks of sitosterol oleate and sitosterol palmitate (SO:SP) it is suggested as a criterion of purity of semolina and pasta products.

1274. DONNELLY,B.J. 1979
Potential impact of strong gluten cultivars on the future quality of North Dakota durum wheat. Matieres premieres et pates alimentaires. Symposium Association internationale de chimie cerealiere.
Inst.Nat.Nutr.Rome (Italy), 182.

1275. DONNELLY,B.J. and BANASIK,O.J. 1978
Quality report on production in north Dakota [durum wheat].
Molini d'Italia (Italy), 29:236-237.

1276. DOROFEEV,V.F. and YARINA,G.N. 1977
Technological properties of grain of durum wheat from Transcaucasia. (Ru)
Byull.Vses.L-Inst.Rast.Vavilova (USSR), 31-38.

Out of 115 varieties under irrigation at the Dagestan Experimental Station of the Institute of Plant Industry (VIR) during 1965-68, three winter and 19 spring varieties were selected as the best for macaroni production. They are listed and briefly described.

1277. DOTY,N.C. and BAKER,C.N. 1977
Microwave conditioning of durum wheat, 1: Effects of wide power range on semolina and spaghetti quality.
J.Agric.Food Chem.(USA), 25:815-819.

Crosby durum wheat was conditioned with microwave energy at 2450 MHz before experimental milling and processing. Physiochemically important semolina and spaghetti quality parameters were adversely affected after 360s of microwave conditioning. Milling behavior and physical dough characteristics were reduced after prolonged irradiation. Spaghetti color and cooked weight decreased, while cooking loss and firmness increased. In general, there were minimal effects on overall quality after 2240 s or less of microwave conditioning.

1278. DRONZEK,B.L., DEXTER,J.E. and MATSUO,R.R. 1980
A scanning electron microscopy study of wheat gluten.
Can.Inst.Food Sci.Technol.J.(Canada), 13:162-166.

The gluten structure of durum wheat cv. Wakooma and hard red spring wheat cv. Manitou was examined by scanning electron microscopy. Differences in the appearance of the 2 glutens under stress were consistent with differences in their functional properties. There were also differences in the structure of insoluble proteins isolated from the 2 glutens.

1279. DU CROS,D.L. and WRIGLEY,C.W. 1983
Analysis of proteins associated with quality in durum wheat.
Cereal Foods World (USA), 28:556.

1280. EL ASHWAH,T., EL SHIMI,N.M. and ISMAIL,F.A. 1981
Studies on mycelial production and utilization form Fungi imperfecti. 2: Chemical evaluation and macaroni enrichment with biomass.
Egyptian J.Microb.(Egypt), 16:97-105.

1281. FEILLET,P. 1977
Technical value of varieties. (Fr)
Bull.Inform.Ministere.Agr.(France), 14-15.

1282. FEILLET,P. and ABECASSIS,J. 1976
Applicability of durum wheat. (Fr)
Fac.Sci.Agron.Centre Res.Agron(Belgium), 551-560.

Durum wheat quality depends on milling value (semolina yield) and semolina quality for macaroni processing (specks, color, cooking quality). Factors of quality and methods of evaluation are examined.

1283. FEILLET,P. and ABECASSIS,J. 1976
Utilization value of durum wheats.
Tecnica Molitoria (Italy), 27:109-114.

This lecture, presented at the Journess Internationales de Cerealiculture held in Sept. 1976 in Gembloux (Belgium), deals with factors determining the quality of durum wheat, i.e. yield of semolina and its suitability for pasta manufacture (specks, color and processing characteristics). Milling and processing characteristics of 21 samples of durum wheat are tabulated, and a further tabulation presents results of evaluation by the pasta disk micromethod of processing quality of 4 durum cultivars grown in 6 districts of southern France.

1284. FEILLET,P., ABECASSIS,J. and ALARY,R. 1977
The viscoelastograph: its use in the evaluation of the cooking value of durum wheat.
Cereal Foods World (USA), 22:482-483.

This new method to evaluate durum wheat cooking value is suitable both for commercial and breeding purposes; simultaneously, data on yellow and brown index of wheat can be obtained. Semolina, extracted from 10 g wheat is purified; then semolina and water are kneaded in a mortar and sheeted. Disks are stamped out, pressed down, cut into smaller disks which are left to dry and cooked 16, 24 and 32 min in deionized boiling water. Swelling firmness, and cohesiveness of cooked disks are measured with a viscoelastograph.

1285. FORTINI,S., D'EGIDIO,M.G., GALTERIO,G., CANTONE,M. and VOLPI,M. 1979
Pasta making quality of some cultivars. (It)
Infor.Agr.(Italy), 35:7505-7507.

In field trials in 1977-78 at 13 locations in central and S. Italy and in Sardinia and Sicily, 13 wheat cv. were

grown. Av. CP content of the flour ranged from 10.7% for cv. Gabbino to 13% for cv. Trinakria and from 10.2% at a location near Rome to 14% at Villa Reia. Av. ash content of the flour ranged from 1.8% for cv. Produra to 2.04% for Vaselva.

1286. FORTINI,S., D'EGIDIO,M.G., STEFANIS,E.De., GALTERIO,G. and NARDI,S. 1980
Durum wheat special, chemical and technological results on durum wheat grain in the year 1978/79. (It)
Infor.Agr.(Italy), 36:12311-12313.

For the grain of 17 durum wheat cv. ash content, gluten content in the flour and beta-carotene conc. are given.

1287. FORTINI,S., D'EGIDIO,M.G., STEFANIS,E.De., GALTERIO,G. and NARDI,S. 1981
Chemical and technological results 1979-80. (It)
Infor.Agr. (Italy), 37:17466-17467.

Data are given of a number of quality factors including beta carotene content and gluten strength and content of grain from 16 durum wheat cv. grown at 6 sites in 1979-80.

1288. FORTINI,S., D'EGIDIO,M.G., STEFANIS,E.De., GALTERIO,G. and NARDI,S. 1982
Pasta quality, proteins and ash in the results of five years' experiments. (It)
Infor.Agr.(Italy), 38:22653-22654.

Tabulated data are given on the pasta quality and on the protein and ash content of the grain of up to 24 durum wheat varieties in 1976-1981 in two regions of Italy. The pasta quality and the ash content of the flour of 22 varieties at six localities in 1980-1981 are also presented.

1289. FORTINI,S., GALTERIO,G. and MANMANA,P.N. 1975
Protein fractions in vitreous and yellowberry grains of Triticum durum.
Genetica Agraria (Italy), 29:295-300.

Grains of twelve varieties of Triticum durum grown under different climatic and agronomic conditions were separated in vitreous and yellowberry types. Protein fractionation was performed by contraction with water, isopropanol, lactic acid and potassium hydroxide. In general protein content extracted by such solvents was always higher in vitreous grains. A significant difference in protein composition between vitreous and yellowberry grains is detected in water and alcohol soluble proteins; the other two fractions show no difference. Total protein content of vitreous grains is higher than that of yellowberry grains. In the two types of grains there is no difference in ash, and beta-carotene content, as well as in the weight of one thousand seed.

1290. FORTINI,S., SCRULLETTA,D., GALTERIO,G. and D'EGIDIO,M.G. 1974
Mineral elements in vitreous and mealy grains of Triticum durum. (It)
Ann.Ist.Sper.Cerealicoltura (Italy), 5:177-183.

Tables are presented showing sulphur, nitrogen, phosphorous, potassium, iron, zinc and ash contents for vitreous and mealy grains in each of eleven varieties. While contents of phosphorous, potassium and zinc in vitreous and mealy grain were not consistently different in eleven varieties, there was a tendency for iron content to be slightly higher in vitreous grains but this was not significant. Iron content was positively correlated with total nitrogen in vitreous grains. In mealy grains, nitrogen and total sulphur contents were about 20 per cent lower than in vitreous grains.

1291. GIACOMELLI,N. and DEKOV,D. 1973
The influence of protein composition on durum wheat quality. (Abstract)
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 573.

The influence on quality of protein composition and amino acid content was investigated in nine interspecific crosses of durum wheat. Proteins were separated into general classes (albumins, globulins, gliadins, and glutenins) by quantitative column extraction, while amino acids were analyzed by the method of Moore and Stein. The relationships between protein composition, amino acid content and quality factors were established from comparison with farinograms.

1292. GODON,B. and POPINEAU,Y. 1981
Differences in hydrophobicity of the gliadins of two durum wheat varieties of high and low quality. (Fr)
Agronomie (France), 1:77-82.

Hydrophobic interaction chromatography, using ethanol as the elution medium, separated the gliadins of Agathe (high quality) and of Duratal (low quality) into fractions according to the ethanol concentration (0-60%). Overall, the gliadins of Agathe were the more hydrophobic. It is suggested that gliadin quality in durum wheat may be associated functionally as well as genetically with its composition.

1293. GUENAULT,B. 1982
When does pasta not stick together any more? (Fr)
Les Sillon (France)No.69,16-17 Dec.1982.

1294. GUEZLANE,L. 1979
Comparative study of the technical quality of 5 durum wheat varieties cultivated in Algeria. (Fr)
These I.N.A.El Harrach,(France), 86.

1295. HOWARD,R.M. 1981
Milling of semolina.
Macaroni J.(USA), 62:14-17.

Durum wheat semolina processing is described and a simplified milling diagram is given.

1296. HSIEH,C.C., WATSON,C.A. and Mc DONALD,C.E. 1981
Direct gas chromatographic estimation of saturated steryl esters and acylglycerols in wheat endosperm.
Cereal Chem.(USA), 58:106-110.

A sensitive, convenient, and time-saving quantitative gas-chromatographic method for analyzing the saturated steryl esters and acylglycerols of wheat endosperm was developed. Semolina of U.S. durum wheat was found to be free from saturated steryl esters (palmitate of campesterol and sitosterol), except for the variety Produra, which contained a total of 2.4 mg/100 g. Approximately 24 mg/ 100 g of total saturated steryl esters was the lower limit and 37.0 mg/100 g the upper limit observed in flour from 24 cultivars of hard red spring bread wheat. Two diacyglycerol peaks and three triacyglycerol peaks were observed. The total average content of diacyglycerols was lower in durum semolina than in hard red spring bread wheat flour, whereas the total average triacyglycerol content showed no significant difference.

1297. INRA FRANCE. 1980
Report 1976-79[laboratory of cereal technology] Montpellier ,INRA, France, proteins and enzymes in cereals, technology and quality of durum wheat, quality of rice, processing of cereals. (Fr)
INRA France., 15.

Proteins and enzymes in cereals, technology and quality of durum wheat, quality of rice, processing of cereals.

1298. ISHINA,G.F. and BEBYAKIN,V.M. 1981
Improving methods of evaluating grain quality in durum wheat. (Ru)
Selekts.Semenov (USSR), 8-9.

In the four varieties studied, content of carotenoids in the milled grain fell with duration of storage, but to different extents in the different varieties. The carotenoid content of macaroni prepared from the grain also fell with increased length of storage of both ground grain and dry macaroni, the fall being greater in some varieties than others. The fall in carotenoid content was associated with a rise in macaroni quality which was reflected especially in the firmness of the macaroni.

1299. JEANJEAN,M.F., DAMIDAUX,R. and FEILLET,P. 1980
Effect of heat treatment on protein solubility and viscoelastic properties of wheat gluten.
Cereal Chem.(USA), 57:325-331.

Gluten was extracted from four common wheat and three durum wheat cultivars, viscoelasticity and protein solubility were examined. On heating, gluten compressibility decreased, gluten firmness increased, and some protiens soluble in 60% ethanol were insolubilized through the formation of new bonds, possibly disulfide. Viscoelastic properties correlated highly with the content of proteins that were soluble in 60% ethanol or in 1% mercaptoethanol/0 025 M borate buffer. Results of gel electrophoresis showed that some subunits of salt soluble and

gliadinlike proteins participate in the formation of insoluble protein networks and others do not. Differences between cultivars were significant. In common wheats with better baking quality and durum wheats with better pasta-cooking quality, the tendency of the ethanol soluble proteins to aggregate during heating was greater.

1300. KAMMAN,J.F., LABUZA,J.P. and WARITHESEN,J.J. 1981
Kinetics of thiamin and riboflavin loss in pasta as a function of constant and variable storage conditions.
J.Food Sci (USA), 46:1457-1461.

The stability of thiamin and riboflavin in enriched pasta humidified to different water activities was measured at 25, 35, 45, and 55 Co for period of up to 1 yr. Riboflavin was shown to be extremely stable (dark reaction) whereas thiamin losses were significant. Thiamin loss increased with temperature and water activity. Predictions of thiamin loss for a square wave temperature fluctuation steady state data were compared to actual losses found in storage for pasta held at equal alternating times at 25/45 and 25/55 Co. The hicks-Sechwimmer-Labuza model provided an adequate method for predicting both the amount of loss and the effective temperature from steady state data.

1301. KOMAROV,V.I., MEDVEDEV,A.M., SEMENOVA,L.V. and YARINA,G.N. 1974
Effect of irrigation on the technological properties of the grain in a number of varieties from the world collection of bread and durum wheat. (Ru)
Nauka (USSR), 299-303.

In a study of grain quality in the Kuibyshev province of the USSR, the irrigation of spring bread wheat tended to increase 1000-grain weight and reduce slightly crude-gluten content and the physical properties of the dough, but the baking quality remained unchanged. In durum wheat under irrigation, there was a slight reduction in the firmness of the macaroni. Some varieties were found which not only maintained their technological properties, but actually improved them under irrigation.

1302. KOMAROV,V.I., YARINA,G.N., NIKIFOROVA,N.F. and STEPANOVA,G.I. 1977
Initial material for breeding bread and durum wheat for quality. (Ru)
Genetike i Selektsii (USSR), 59:39-42.

List are given of the best durum wheats for macaroni production. The best durum wheats include Vera 63, Lakota and Leucurum 33.

1303. KONAREV,A.V. 1977
The identification of 0.19 in grain proteins of cereals.
Commu.62th Cong.Annu.AACC.San Francisco.

Albumin 0.19, which inhibits alpha-amylase of insects and human saliva and which has been considered specific for bread wheats (Triticum aestivum L.) on the basis of electrophoresis in starch and polyacrylamide gels, has been discovered in the tetraploid wheat T.durum by means of an antiserum to the isolated 0.19 component. Accordingly, this component does not appear specific for bread wheats. By means of rocket immunoelectrophoresis, it was shown that the albumin component specific to bread wheats is not identical to albumin 0.19. This specific component was found immunochemically in a different region of the electrophoretic pattern of the wheat albumins. It has an isoelectric point of about 4.6 whereas albumin 0.19 has an isoelectric point of 7.3. The presence of albumin 0.19 in the grain proteins of wheat, barley, rye, Aegilops, and Agropyron was studied.

1304. KONOV,V., DEKOV,D. and YARINA,G.N. 1977
Study of the suitability of some durum wheat varieties for macaroni production. (Bg)
Rasteniev'd Nauki (Bulgaria), 14:60-71.

Of eight Bulgarian, two Soviet and three Italian varieties tested, the best rheological properties were shown by the Bulgarian Simeonovka 1,1811, 1812 and by the Italian Patricio. The Bulgarian forms Simeonovka 1, 1522 and 1486 gave the best macaroni colour. The Bulgarian forms Simeonovsk 1, 1522 and 788, were the best for macaroni production.

1305. KONOV,V. and MATSOV,B. 1976
Study of agrobiological and technological properties of local forms

of durum wheat from a collection grown in Sadovo. (Bo)
Rastenievʼd Nauki (Bulgaria), 17:47-54.

A study was made of 1261 lines in Bulgaria during 1970. Data are presented on 1000-grain weight contents, vitreousness and the sedimentation index for the 36 lines with the highest values for these characters.

1306. KONZAK,C.F. 1973
Proposal for development of international standard test and scoring systems for quality and other evaluations in durum wheats. (Abstract)
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 561-562.

Methods for design of a standardized description manual are described. The need for review especially for quality tests, procedures for assigning genetic symbols and mechanism of a system to coordinate and organize useful data prior to input in data banks at genetic resource centers are discussed.

1307. KOSMOLAK,F.G., DEXTER,J.E., MATSUO,R.R., LEISLE,D. and MARCHYLO,B.A. 1980
A relationship between durum wheat quality and gliadin electrophoregrams.
Can.J.Plant Sci.(Canada), 60:427-432.

Gliadins from 30 durum wheat cv. were extracted and separated by polyacrylamide gel electrophoresis. Cv. can be classified as belonging to 1 of 2 groups based in their electrophoregrams. Cv. in group 1 were characterized by weak gluten properties and poor cooking quality compared with cv. in group 2.

1308. KRUGER,J.E. 1976
A note on the semiautomated determination of catalase in wheat.
Cereal Chem.(USA), 53:796-801.

Colorometric method for measuring catalase using the Technical Auto Analyzer and the suitability of the method for measuring the catalase activity in wheat are described.

1309. KRUGER,J.E. and MARCHYLO,B.A. 1982
High-performance aqueous gel permeation chromatography analysis of beta-limit dextrin hydrolysis by malted hard red spring wheat, malted durum wheat and fungal (Aspergillus oryzae) alpha-amylases.
Cereal Chem.(USA), 59:488-492.

High-performance aqueous gel permeation chromatography used to analyze the molecular weight distribution of products formed by alpha-amylase catalyzed hydrolysis of beta-limit dextrin. Products formated by alpha-amylase purified from malted hard red spring wheat, malted durum wheat and fungal (Aspergillus oryzae) sources were studied and compared. The breakdown of beta-limit dextrin proceeded in stages. Initially, the beta-limit dextrin solution exhibited a loss in turbidity concomitant with rapid production of high molecular weight dextrin products larger than 1.5 X 105 daltons and little production of low molecular weight dextrins and sugars. This was followed by formation of intermediate molecular weight products that slowly decreased in size concurrent with a progressive buildup of low molecular weight sugars and oligosaccharides. Malted hard red spring and durum wheat alpha-amylase hydrolysis appeared identical but differed from that effected by fungal alpha-amylase.

1310. LA FIANDRA,D., PORCEDDU,E. and COLAPRICO,G. 1979
Amino acid composition and species relationships in genus Triticum .
Wheat Information Service (Japan), 5.-55.

Thirty three samples of different species of Triticum (T.durum) were included in the analysis. Analysis of variance was performed for each amino acid; correlation coefficients and canonical analysis were determined on mean values in each species. Species did not show any difference for aspartic acid, isoleucine, tyrosine; differences among species were significant at 1% level for all other amino acids.

1311. LAIGNELET,B. 1979
Study on certain biochemical factors common in coloration and cooking quality of durum wheat pasta. (France)
These de Doctorat.Univ.Sci.Techn.France. 173.

1312. LAIGNELET,B. 1983
Oxidation during the mixing of durum wheat semolina.
Sciences des Aliments (France),

5:469-484.

Water-soluble fraction (WSF) of durum wheat semolina was able to modify the color and the cooking of pasta products. WSF presented a high lipoxygenase activity. The properties of WSF and its involvement in the oxidation of dough were studied during the mixing with a Brabender Farinograph. It was shown that WSF, particularly lipoxigenase, was a very effective system for the oxidation of carotenoid pigments in order to maintain the gluten at a unoxidized state unfavorable to the cooking quality by means of competition for available oxygen.

1313. LAIGNELET,B. 1983
Lipids in pasta and pasta processing.
Sciences Des Aliments (France), 269-286.

1314. LAMLKIN,W.M. and MILLER,B.S. 1980
Note on the use of sodium hydroxide to distinguish red wheats from white common, club, and durum cultivars [USA].
Cereal Chem.(USA), 57:293-294.

A color test employing sodium hydroxide was investigated as a method for distinguishing red wheats from white common and amber durum cultivars. A modified procedure was developed which required only 5 min and could be performed on a single kernel. Using the modified procedure, an untrained observer could correctly classify as red or nonred all 87 samples examined, which includes 60 American wheat cultivars representing all classes.

1315. LAW,D.P. and TKACHUK,R. 1977
Determination of moisture content in wheat by near infrared diffuse reflectance spectrophotometry.
Cereal Chem.(USA), 54:874-881.

A method is described for determining moisture in ground wheat by direct near-infrared reflectance spectrophotometry. Kubelka-Munk values, F(R'), were calculated from the spectra at 20 wavelengths. Multiple linear regression analysis showed that only two values were sufficient to predict the moisture accurately over a range of 2.8 to 16.5%. The method is applicable to different wheat types (durum, hard red spring and soft white winter) and is unaffected by a change in mean particle size.

1316. LAZZARI,L.B. 1984
Emilia-Romagna. (It)
Infor.Agr.(Italy), 40:31-36.

Tabulated assessments are given of the grain quality of 24 durum wheat varieties in trials at up to four localities in the Italian province of Emilia-Romagna in 1979, 1982. Only the Creso was consistently assessed as having good grain quality.

1317. LELIEVRE,F. 1978
Current improvements in field of durum dry grain quality appraisement. Consequences on varied selection in Morocco. (Fr)
Hommes, Terre et Eaux (Morocco), 8:21-28.

Durum wheat lots classification according to quality has been put into effect recently in Europe, so that wheat lot prices are according to their semolina and pasta quality. Lot classification raises big problems due to differences of opinion between producers and users. In France, the National Institute for Agronomical Research has developed the Laboratory of Durum Wheat Technology of Montpellier in order to carry out tests easy to run on numerous samples so as to estimate both technological and nutritional quality. The application of these tests evidently has consequences at the breeder's level. He has to produce varieties with the required qualities, so the tests have to be adapted to very small samples in order to be used in selection. Even though quality problems are different in Morocco because of the different utilizations of durum wheat, certain findings of the French experience may be of help.

1318. LETO,C. and POMA,I. 1979
Durum wheat seeds [agronomical and commercial characteristics]. (It)
Sviluppo Agricolo.(Italy), 13 44-46.

1319. LII,C.Y. and LINEBACK,D.R. 1977
Characterization and comparison of cereal starches.
Cereal Chem.(USA), 54:138-149.

Starches were isolated from hard wheat (two varieties), soft wheat, durum wheat triticale, rye, and Triticum dicoccum (Emmer). All starches lost birefringence within the range 50.0

centigrade to 64.5 centigrade. Scanning electron microscopy revealed similar granule sizes and shapes for all starches, except rye. Iodine affinities of the starches ranged from 4.36 to 4.91%. Brabender amylograms obtained for each starch were characteristic of normal cereal starches. When amylopectin fractions isolated from each starch were debranched with isoamylase and subjected to gel filtration, two chain populations of carbohydrate were obtained from each amylopectin. Average unit-chain lengths of the amylopectins ranged from 15 for triticale to 26 for rye. The ratio of A-chains to B-chains in each amylopectin, determined enzymatically, ranged from 1.21 to 2.11.

1320. LUTSISHINA,E.G., KOSTROMINA,N.A., VOROB'EVA,L.A. and TIKHONOVA,R.V. 1980
Study of gluten by the nuclear magnetic resonance (NMR-IH) method. (Ru)
Fiziol.biokhim.kull't.Rast.(USSR), 12:42-48.

Gluten extracted from three bread wheats and one durum wheat differing in rheological properties was analysed with an NMR-1H spectrometer and the proton magnetic resonance spectra were recorded.

1321. MALIANI,C. 1973
Proteins in wheat. New prospects for durum wheat. (It)
Sementi Elette. (Italy), 18:41-46.

Protein analysis of a large number of lines and varieties of hard and soft wheat from the breeding program at the Andea Plant Breeding Centre indicated that the protein content in soft lines was near the norm for Italian wheat (10-12 per cent), but the content in hard lines fluctuated from 9.6 per cent to 17.84 percent.

1322. MANSER,J. 1981
Optimal parameters for manufacturing pasta, demonstrated on long pasta. (De)
Getreide, Mehl Und Brot. (F.R.G), 35:75-83.

By studying 6 durum wheat and 5 bread wheat varieties, grain quality characteristics and processing methods for obtaining the best quality for pasta were determined.

1323. MANSOUR,S.M., TAWFIK,M.E. and MITKEES,R.A. 1981
Effect of varieties and localities on the cooking quality of macaroni produced from durum wheat. In International Conference of New Trends and Techniques Towards Food Supply. Cairo (Egypt).
Egyptian Acad.Sci.Res.Technol.(Egypt), 26.

1324. MATSUO,R.R. 1978
Note on a method for testing gluten strength [Durum wheat].
Cereal Chem. (USA), 55:259-262.

Gluten strengths of 12 durum wheat varieties, 1 hard red spring wheat variety, and 3 composite samples representing grades of other classes of wheat are given. Stewart 63, typical of varieties with weak, extensible glutens, shows a low breaking-strength value. The stronger gluten of Wakooma is reflected by a much higher value. Weak gluten varieties like Botno, Crosby, and DT416 are readily distinguished. Gluten strength of other classes of wheat are presented for comparison.

1325. MATSUO,R.R. and DEXTER,J.E. 1979
Some physical wheat characteristics and semolina milling yield.
Inst.Nat.Nutr.Rome (Italy), 182.

The milling flow of the Allis-Chalmers laboratory mill was modified to increase semolina yield up to 70% with granulation similar to that of Canadian commercial mills. The reproducibility of semolina yield is excellent. The relationship of some physical characteristics of wheat to semolina yield was investigated. Factors studied included test weight, 1000 kernel weight, protein content and vitreousness. Semolina yield is significantly correlated to both test weight and 1000 kernel weight.

1326. MATSUO,R.R. and DEXTER,J.E. 1980
Relationship between some durum wheat physical characteristics and semolina milling properties.
Can.J.Plant Sci. (Canada), 60:49-53.

Test weight, 1000-kernel weight, protein content and semolina milling yield were studied in 174 samples, from a breeding programme. All correlations, except that between protein content and 1000-kernel weight, were significant.

Samples giving the best milling yield had high test weight and 1000-kernel weight.

1327. MATSUO,R.R., DEXTER,J.E. and KOSMOLAK,F.G. 1982
Statistical evaluation of tests for assessing spaghetti-making quality of durum wheat.
Cereal Chem. (USA), 59:223-228.

Using data on 30 cultivars grown at two sites for two years, it appeared that specific absorbance of semolina protein in aqueous urea was the best predictor of cooking quality where only one or two variables can be tested. Protein content and quality were important in cooking quality but other factors were also involved. Cultivar affected rheological and gluten qualities more than cooking quality.

1328. MATSUO,R.R., DEXTER,J.E. and Mac GREGOR,A.W. 1982
Effect of sprout damage on durum wheat and spaghetti quality.
Cereal Chem. (USA), 59:468-472.

The falling number test is highly correlated to durum wheat alpha-amylase activity and is a good indicator of sprout damage in durum wheat. The critical factor affecting end-use quality is the level of alpa-amylase in the processed product. High amylolytic activity in spaghetti increase the amount of residue in the cooking water and the level of reducing sugars in both semolina and spaghetti and tends to give a slightly softer cooked spaghetti. Semolina proteins, semolina yields, and spaghetti color are not affected by field sprouting.

1329. MATSUO,R.R. and IRVINE,G.N. 1975
Rheology of durum wheat products.
Cereal Chem. (USA), 52:131-135.

The use of a farinograph for assessing the rheological properties of pasta doughs has proven useful for quality evaluation of durum semolinas. Characteristics measured are the dough development time, maximum consistency, and tolerance index but little attention has been given to the band width and "wideness" or irregular mixing patterns of some durum varieties. Farinograms have been analyzed taking into account the mixing action of the farinograph blades and the flow characteristics of doughs of varying quality. Rheology of extrusion is examined in terms of farinograms. Differences in mixing curves are related to spaghetti and gluten quality.

1330. MENGER,A. 1973
Problems concerning vitreousness and hardness of kernels as quality factors of durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 563-569.

The problems of evaluating the degree of vitreousness in durum wheat and steps taken towards standardizing the analytical procedure are explained. Experimental evidence for interrelations between vitreousness of durum wheat kernels and their technological properties under modern processing conditions are commented on. Hardness as another criterion of kernel structure, methodical principles for its determination and the feasibility to use it in durum wheat quality tests, are discussed.

1331. MENGER,A. 1979
Experiences with pasta not made exclusively of durum wheat. (T. durum). (De)
Getreide, Mehl und Brot.(F.R.G), 33:299-307.

An out look is given about the experimental experiences with pasta made from the semolina mixture of durum and aestivum wheats and with the effect of egg parts in relation to the durum + aestivum mixture to maize flour and to the dietitic pasta products.

1332. MENGER,A. and ZWINGELBERG,H. 1978
Quality of durum semolina with extraction. (De)
Getreide, Mehl und Brot.(F.R.G), 32:236-242.

The paragraph no.1 of the pasta products decree is the grade of milling for pasta production limited to max. 70%. But due to the improvement in the milling processing, the grade of milling for pasta is no more analytically controllable. Since new national laws for pasta and other alimentary products are going to be decreed, it is necessary to draw the attention to the possibility of elevating the grade of milling for

pasta (70-80%). However, the elevation of the milling grade for pasta need better kernel quality of durum wheat.

1333. MENGER,A. and ZWINGELBERG,H. 1979
Quality of durum wheat semolina in increased grinding up. (De)
Muh + Mischfuttertechnik. (F.R.G), 116:95-98.

Effects of increased extraction rates of durum wheat semolina beyond the usual 70% were studied in German, French, Canadian and Sicilian wheats. Results of grain analysis, yields, protein and ash content of milling products and pasta culinary quality are presented as graphs and tables. It is shown that the extraction rate may be increased over 70% without a great technical difficulty but the overall quality of the durum wheat flour will be reduced Under certain conditions an extraction rate of 80% is admittable for certain wheats. Good quality wheats are more suited for high extraction rate than lower quality ones.

1334. McDONALD,C.E. 1979
Lipoxygenase and lutein bleaching activity of durum wheat semolina.
Cereal Chem. (USA), 56:84-89.

The newer varieties Rugby, Wakooma and Leeds had the lowest bleaching and lipoxygenase activities, in a study of the milled grain of nine Triticum durum varieties. These varieties also had the highest content of lutein and were among the varieties with the least pigment loss on making spaghetti from their flours. Bleaching and lipoxygenease activities were highly correlated with pigment loss.

1335. NICASTRO,C. and MASSANTINI,F. 1977
Correlation between yellowberry of durum wheat and some weather factors.
Semente Elette (Italy), 23:15-18.

The most sensitive period as regards rain is between shooting and swelling of the caryopse. The ear set phase is the most sensitive to temperature effects. There is a positive correlation between yellow berry and rain amounts and a negative one between yellow berry and temperature, where nitrogen was given during the vegetative stage. In Bari the nitrogen was distributed in the reproductive period and the correlation between yellow berry and quantity of rain resulted inverted.

1336. O.N.I.C. FRANCE 1977
Quality of durum wheat varieties. French harvest in 1977.
I.T.C.F,C.N.I.C.Ministry.
Agric.(France).

1337. OPROIU,E. and CERNESCU,L. 1975
Rheological characteristics of some durum wheat varieties studied in Romania.(Fr)
Bull.Acad.Sci.Agr.Forestieres (France), 5:37-45.

Four winter and five spring varieties were studied in 1972-73 with four nitrogen fertilizer treatments. Odesskaya Yubileinaya gave the highest quality pasta. An increase in nitrogen fertilization produced an improvement in pasta quality only in varieties with strong gluten, such as Odesskaya Yubileinaya or Caracal 1138.

1338. PARODI,P.C., NEBRADA M.,I.M. and COSMELLIF,A.A. 1982
Yellowberry in the grains of the wheat cultivar Quilafen (T. durum) in response to nitrogen and population density. (Es)
Cienc.Invest.Agr.(Chile), 9:89-93.

In field trials at Pirque, 0 or 96 kg N/ha was applied (a) 100% at sowing, (b) 50% at sowing + 50% at tillering, (c) 33% at sowing, 33% at the 3-leaf stage and 33% at shooting or (d) 20% at each of these stages + 20% at heading + 20% after pollination to durum wheat grown at 3 sowing rates. Grain yellow berry content was 18.86% with no N, 5.10% in (a), 3.70% in (b), 3.83% in (c) and 3.16% in (d). At the 2 lower populations, grain yellow berry content was significantly higher without than with N but it was not significantly different at the highest population.

1339. POPINEAU,Y. 1981
Difference in surface hydrophobicity of gliadins in two T. durum wheat varieties according to cooking qualities.
Agronomie (France), 1:77-82.

Hydrophobic interaction chromatography was applied to the fractionation of gliadins of two varieties of Triticum durum wheats. It was shown that

gliadins of the good cooking quality wheat (variety Agathe) were more hydrophobic than those of the poor quality wheats (variety Durtal). Some gliadins of both varieties with the same electrophoretic mobility and other gliadins known as markers of the quality, have different surface hydrophobicity depending on the variety. The composition of the gliadins could then be related to the cooking quality of Triticum durum wheats, not only genetically but also through their functional properties.

1340. PORCEDDU,E., PACUCCI,G., PERRINO,P., DELLA GATTA,C. and MAELLARO,I. 1973
Protein content and seed characteristics in populations of T. durum grown at three different locations.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 217-223.

1341. PRABHAUTHI,C., HARIDAS RAO,P. and SHURPALEKAR,S.R. 1976
Bread and chapati making quality of Indian durum wheats.
J.Food Sci.Technol.(India), 13:313-317.

Twenty-eight varieties of Indian durum wheats and their blends with soft aestivum wheat- Chhoti lerma, have been studied for bread making and chapati making quality. Varieties Local red, Amir, A-206, A-1-1-2-3, HD-4530 as such had excellent bread making quality and may be categorised as bread type durums. Ten varieties when blended with Chhoti lerma even at 15% level, gave excellent bread. Chapati made from 93-95% extraction flour (atta) from 14 durum varieties as such, were of excellent quality; while most of the Chhoti lerma blends with different durums at 15-25% level gave excellent chapatis. Unlike for bread wheats, no correlation was observed between the Farinograph water absorption of the flour and the chapati making quality. Only HD-4530 and HD-4519, when used as such or in blend with Chhoti lerma, were unique in that they gave excellent bread as well as chapatis.

1342. PRADEL,J. 1979
Hard wheat: Qualities and market [in France]. (Fr)
France Agricole (France), 35:21-23.

Durum wheat is utilized only for human consumption, and in France 90% of semolina are meant for pasta production. The semolina industry's requirements for product quality are quite strict with high foreign competition, the durum wheat producer has to produce a quality product which requires well adapted technology.

1343. QUICK,J.S. and CRAWFORD,R.D. 1983
Bread baking potential of new durum wheat cultivar.
Proc.6th Int.Wheat Genet.Symp.Japan., 851-856.

New strong gluten durum wheat cultivars have been developed in United States and Canada to provide pasta products with improved cooking quality. These durums were evaluated for leavened pan bread quality from wheat samples grown at several locations in North Dakota in 1975 and 1976. The strong gluten durum wheats were superior to the hard red spring wheats (HRSW) in kernel weight and flour water absorption, equal to the HRSW in test weight, flour protein, dough mixing pattern, and inferior in flour extraction and dough handling characteristics. The strong gluten were much superior to the weak gluten durum and nearly equalled the HRSW in overall evaluation. The strong gluten durums have potential in a bread wheat blend and as genetic materials for future improvement of durum and triticale baking quality.

1344. RAHIM,A., PRABHAUTHI,C., HARIDAS RAO,P. and SHURPALEKAR,S.R. 1976
Suitability of Indian durum wheats for semolina milling and vermicelli preparation.
J.Food Sci.Technol.(India), 13:249-252.

Among several varieties of Indian durum wheats evaluated, NI-5759, A-11,A-1-8-1, MPO-159, HI-7597,HD-4519, HD-4530 and WL-1002 gave excellent semolina yields of more than 55% which were comparable to Canadian durums- Stewart 63, Wakooma and Hercules 72 used as control. Twenty-two Indian varieties and Canadian Hercules 72 and Wakooma were found to have good to excellent vermicelli making quality. The Indian variety, A-1-8-1 showed excellent semolina milling quality and vermicelli making quality.

1345. RANGA RAO,G., LEELAVATHI,K. and SHURPALEKAR,S.R. 1981

Studies on some quality aspects of semolina from different types of wheat. J.Food Sci.Technol.(India), 18:180-184.

Three particle size ranges -20, +28; -28, +36; -36, +46 mesh were selected for quality aspects of laboratory millied semolina from soft aestivum ('Pissi local'), medium hard aestivum (WG-357), durum ('Bijaga yellow') and dicoccum ('Jave') wheats. Total ash and protein content in semolina gradually decreased with decrease of particle size in all the types of wheats. Semolina from soft aestivum wheat was highly inferior in cooking quality compared to semolina from other wheats. Its water uptake rate, cooking tolerance and water uptake capacity were very low. Semolina from durum and dicoccum had high cooking tolerance. Roasting (I) improved the cooking quality of semolina from soft and medium hard aestivum and durum wheats, and (II) had a slight adverse effect on the cooking quality of dicoccum semolina.

1346. RAO,P.H., RAHIM,A., PRABHAUTHI,C. and SHURPALEKAR,S.R. 1976
Physico-chemical, rheological and milling characteristics of Indian durum wheats.
J.Food Sci.Technol.(India), 13:317-322.

Twenty-four Indian and three Canadian durum wheat varieties have been evaluated for physico-chemical characteristics, rheological properties using farinograph and extensograph and the flour milling quality. Of the quality characteristics evaluated, some of the Indian varieties were comparable to or even better than the Canadian durums. The data for varieties NI-5759, A-11, HI-7720, HD-4530, A-9-30-1 were indicative of their potential for the preparation of pasta foods; while quality characteristics of many other varieties showed their potential for bread making.

1347. RUDENKO,M.I., MEDVEDEV,A.M., YARINA,G.K., KOMAROV,V.I. and CHMELEVA,Z.V. 1978
Biochemical and technological properties of durum wheat under different cultivation conditions. (Ru)
Kuibysh.kniz.Izadet'stvo. (USSR), 40-44.

Under irrigation and under rainfed conditions, increasing the NPK dose led to increase in protein and gluten content, vitreousness and macaroni quality in tall varieties. The Sararov varieties were close to the Bezenchuk ones in protein content but superior in macaroni quality. The short-strawed variety USMP13 equalled the tall Kha'kov 46 in macaroni quality both with irrigation and also without irrigation and high NPK doses.

1348. SAGI,H. und SAGI,F. 1982
Alkylresorcinols in durum wheat. 1: Varietal and kernel quality effects.
Acta Alimentaria (Hungary), 11:39-45.

5-Alkylresorcinol (5-AR) content in kernels of fourteen durum wheat varieties was determined with special attention to kernel size, vitreousness and occurrence of blackpoints. An average 5-AR content of 0.075% dry weight was found with 0.108% and 0.046% as highest and lowest values, respectively. 5-AR content of vitreous and floury kernels did not differ significantly. Occurrence of blackpoints also did not influence the 5-AR level. However, the light, small kernels contained relatively more 5-AR than the heavier ones.

1349. SASEK,A. and CERNY,J. 1978
Electrophoretic characteristics of the albumin-globulin complex of triticale and parental species. (Cs)
Rostlinna Vyroba (Czechoslovakia), 24:633-640.

The grain albumin-globulin proteins of Triticum turgidum, T. durum, T. aestivum, rye, triticale and wheat X rye crosses were fractionated by starch gel electrophoresis. The spectra obtained are illustrated and zones suitable for distinguishing triticale and its parental origin are discussed.

1350. SASEK,A. and SEHNALOVA,J. 1980
The gliadin spectra of selected genotypes of the species Triticum durum Desf. (Cs)
Rostlinna Vyroba (Czechoslovakia), 26:173-180.

The grain contents of gliadin of 19 var. of T. durum and 15 cv. of the commonest var. hordeiforme were separated by starch gel electrophoresis. The spectra contained 37 zones and in most cases the differences in the spectra were such

that they could be used for identification of cv.

1351. SCARASCIA,V.M.E. 1973
A comparative study of rheological and biochemical characteristics of semolina obtained from durum wheat varieties with respect to their pasta making quality.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 575-584.

For eleven varieties of durum wheat grown in two different environments in southern Italy and showing a wide spectrum of pasta making qualities, certain rheological (absorption power, consistency, etc.) and biochemical characteristics (total nitrogen, gluten, pigments, lipoxidase, peroxidase, etc.) which affect the technological qualities of wheat were analyzed. Results of the analyses were subsequently analyzed statistically in order to bring out any existing relationships between the parameters considered.

1352. SCARASCIA,V.M.E. 1975
Investigation of the characteristics of durum wheat quality: By means of factor analysis (It)
Ann.Ist.Sper.Agron.Bari (Italy)., 6:329-346.

Twenty-one quality traits were analyzed on eleven lines and cvs. of durum wheat grown in two localities of southern Italy. Genotypic correlations and heritability were calculated. Furthermore, by means of Factor Analysis, it was possible to perform a good separation of the 21 variables into five common factors that accounted for 89% of total variability.

1353. SEMENOVA,M.V., SINITSYN,S.S. and ZELOVA,L.A. 1979
Analysis of protein content in the grain of durum wheat using Orange G dye. (Ru)
Sec.Jnl.Source: Referat.Zh. (USSR), 4:168.

A technique for analysis of protein content using weighed grain portions of 100 mg and 5 ml of dye with both dry and soaked grain is described. The technique can be used to evaluate breeding material at early stages.

1354. SOZZI,B. 1980
Research and dosage of soft wheat in durum wheat bread. (It)
Tecnica Molitoria.(Italy), 31:838-840.

The soft wheat research and dosage for the durum wheat bread is based on the identification and dosage of one of the sterilesters extracted from the bread with petroleum ether, that is sistosterol palmitate using as standard of comparison ether extracts from breads prepared with fine flours of a check source with known contents of soft wheat.

1355. SPICHER,G. 1978
Hygienic problems with pasta products-2: Microbiological count of durum semolina and their pasta products. (De)
Getreide,Mehl Und Brot. (F.R.G), 32:161-164.

In this paper studies were made on the effects of fungi and the occurrence of aflatoxin. The fungi can exceed the 7000 units/gr. The fungi mainly consisted of Aspergillus, but Penicillum, Mucor, Cladosporium and Rizopus also were found. The occurrence of aflatoxin was not found in the raw material and in traces in the pasta products (very significently lower than the accepted level of 5 ppb).

1356. SPICHER,G. and ZWINGELBERG,H. 1983
Studies on the reaction of microflora of the durum wheat during milling decortfication. (De)
Getreide, Mehl Und Brot. (F.R.G), 37:185-189.

The effect of a superficial treatment on durum wheat grain on the microflora of milling products was studied. Grain grinding decreases microbial contamination. By removing 4% of hulls semolina extraction rate is increased. If wheat is wet before hulling there is an even more significant decrease of germs.

1357. SZANIEL,I., PALVOLGYI,L. and AUTRAN,J.C. 1981
Quality of durum wheats at various sites. (Hu)
Novenytermeles (Hungary), 30:219-227.

Grain of durum wheat cv. GK Basa, GK Raineri and GK Aga, harvested at number of State Farms and Experimental Stations over 2 yr, was subjected to detailed quality tests. Site effects were most pronounced in protein content,

vitreousness and brown index and were significant in 100-grain wt., hl wt, and cooking values, but not significant in yellow index and hardness of seed. Cv. variations was measurable in coarse meal yield and hardness of seed with GK Bass being the superior cv.

1358. TABEKHIA,M.M. and DONNELLY,B.J. 1982
Phytic acid in durum wheat and its milled products.
Cereal Chem. (USA), 59:105-107.

1359. TROPEA,M. and FISICHELLA,G. 1979
Comparative study on the amino acid composition of the protein complex of the most commonly grown durum wheat cultivars. (It)
Tecnica Agricola (Italy), 31:179-185.

The amino acids contents were determined in the grain of 22 durum wheat cv. Total amino acid conc. ranged from 11.22% in cv. Ranieri to 16.5% in GE 529, lysine content from 369 mg/100 g DM in cv. Gabbiano to 613 mg/100 mg DM in cv. Tito and valine content from 476 mg/100 mg DM in Ranieri to 726 mg/100 mg DM in cv. Hymera.

1360. TSEN,C.C., BAUCK,L.J. and HOOVER,W.J. 1975
Using surfactants to improve the quality of cookies made from hard flours.
Cereal Chem. (USA), 52:629-637.

1361. ULLRICH,I. 1982
The nutritional and physiological value of wheats of different varieties and at different stages of germination, determined in animal feeding tests. (De)
Thesis,Giessen Univ.(F.R.G) 1982,167pp.

Six Triticum aestivum varieties and one T. durum variety were placed into high, medium or low-protein groups, in order to assess the relationships of protein content and protein composition. The main differences between varieties, even within a given group, were seen in the protein fractions. It was established that a high grain protein content need not necessarily be related to a low biological value. In feeding tests the highest differences between ungerminated and pregerminated grain were seen in Disponent. Despite the notable increase in lysine content of germinating grain, especiallly in Disponent, lysine-enriched ungerminated rations produced better results in rats, indicating that they are not able fully to utilize for protein synthesis lysine newly produced during germination.

1362. VALLEGA,J. 1973
Durum wheat varieties cultivated in Argentina and their pastificable quality related with the Italian (macaroni) industry.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 599-613.

The Candeal type from the Mediterranean Basin was for a long period the most popular but later it has been largely replaced by the Taganrog type. Up to now, six varieties have been officially approved and released commercially. All of these six varieties have similar agronomic behaviour and almost the same commercial and industrial characteristics and they can be considered responsible for the quality of the total production of which more than 80% is exported. The Argentinian durum wheat is now in the international market as Candeal/ Taganrog. From the industrial point of view, it is very much appreciated because of its quantity and quality of gluten and mainly because it gives to the "pasta" the capacity to resist overcooking. In this respect Candeal/Taganrog can be considered as a "corrector" in blends. Italy needs to import the Argentinian Candeal/Taganrog which is used in blends in different proportions according to the quality of the national product used, mainly to make spaghetti.

1363. VENEZIAN,M.E.S. and OMBARDI,M. 1975
Contribution to the study of some factors affecting the quality of the semolina in durum wheat. (It)
Ann.Ist.Sper.Agron. (Italy), 6:263-274.

Tabulated data are presented on the chemical characteristics of the semolina and the cooking quality of the pasta obtained from it in twelve varieties. There was a significant negative correlation between SH groups in the semolina and degree of disintegration of the pasta during cooking and between urea-soluable protein content of the semolina and increase in volume of the pasta after cooking.

1364. WALLE,M. and TRENTESAUX,E. 1980
Study of a practical method using a Chopin alveograph for the evaluation of the macaroni making capacity of durum and semolina. (It)
Tecnica Molitoria (Italy), 31:917-922.

In order to evaluate the fitness of durum wheat to give good pasta, a method is presented. The semolina is mixed with water in the kneading-trough of Chopin Alveograph, and laminated; small samples of dough are cut and cooked; then the resistance of these samples are evaluated by the Alveograph, by measuring the average area of 4 graphs. This method, after some complementary studies, should allow the evaluation in the factory of the technological quality of durum wheat.

1365. WARCHALEWSKI,J.R. and TKACHUK,R. 1978
Durum wheat alpha-amylase: Isolation and purification.
Cereal Chem.(USA), 55:146-156.

Alpha-amylase was isolated in approximately 7% yields from germinated durum wheat.The chromatography indicated that seven amylases were present. Polyacrylamide gel electrophoresis showed that germinated durum wheat has eight amylase components. The eight amylases that were found by electrophoresis in both germinated hard red spring wheat had similar mobilities.

1366. WASIK,R.J. 1978
International collaborative study on durum wheat quality.
Cereal Foods World. (USA), 23:501.

The International Collaborative Study on Durum Wheat Quality was begun in 1973 when agreement was reached among a total of eleven laboratories in Canada, the United States and Europe. The study attempts to assess the inter-relationships between those tests routinely performed to evaluate durum wheat for pasta manufacture and chemical, physical and sensory properties of pasta.

1367. WASIK,R.J. 1978
Relationship of protein composition of durum wheat with pasta quality and the effects of processing and cooking on these proteins.
J.Inst.Can.Sci.Technol.Aliment.(France), 11:129-133.

The protein components of semolina from 12 durum wheat varieties differing widely in pasta quality were studied by solubility fractionation. Simple correlations between some pasta-quality parameters and the proportion of each protein fraction showed that the proportion of residue protein appeared to have a direct relationship with specific dough and gluten properties. The effects of processing (wet extrusion and drying), and of cooking, on the proteins from five varieties of durum wheat were investigated by protein solubility distribution, gel filtration chromatography electrophoresis. Although processing changed both the protein solubility distribution and gel filtration properties, no significant changes occurred in the electrophoresis patterns of the fractions obtained by solubility fractionation. Cooking brought about insolubilization of the proteins in pasta. The electrophoretic patterns of the protein fractions obtained from the cooked sample only remotely resembled those from corresponding semolina and uncooked pasta fractions. The proportion of insoluble protein in cooked pasta appears to be related to cooked pasta tenderness index, suggesting that the greater the proportion of insoluble protein the firmer the product and the better the cooked quality.

1368. WASIK,R.J. and BUSHUK,W. 1975
Sodium dodecyl sulfate-polyacrilamide gel electrophoresis of reduced glutenin of durum wheat of different spaghetti-making quality.
Cereal Chem.(USA), 52:328-334.

Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) of reduced durum wheat glutenins that have been purified by fractional salt precipitation of the AUC soluble flour proteins revealed distinct varietal differences in the molecular-weight distribution and relative concentration of the six largest subunits. These differences appeared to be related to the spaghetti-making quality of the variety from which the glutenin had been isolated. The glutenin of those varieties with excellent spaghetti-making quality had more of subunit 6 than subunit 5.

1369. WILLIAMS,P.C. and SIGURDSON,J.T. 1978
Implication of moisture loss in grain incurred during sample preparation.
Cereal Chem.(USA), 55:214-229.

Moisture loss incurred during the grinding process of sample preparation has been studied, using four different grinder models that are currently in operation in the Canadian Grain Commission's Grain Research Laboratory. The grains that were studied included three types of hard red spring wheat, soft red spring wheat, durum wheat, and two types of barley. Moisture levels ranged from 8 to 18%. All grains were found to lose significant amounts of moisture at initial levels as low as 10%. Such losses may constitute a continuing source of error in the second stage air oven moisture testing in which grains have been ground at equilibrium moisture levels of 10% or more.

1370. WILLIAMS,P.C., SRIVASTAVA,J.P., NACHIT,M and EL-HARAMEIN,F.J. 1984
Durum wheat-quality evaluation at ICARDA.
RACHIS (ICARDA,Aleppo,Syria), 3:30-36.

Description of grain quality factors important for the preparation of the diverse foods made from durum in the Middle East (2-layered flat breads, single layer flat breads, pasta, cous-cous, burghul).

1371. YARINA,G.N. 1973
Physical and chemical properties of the grain in Transcaucasian durum wheat. (Ru)
Genetike i Selektsii. (USSR), 50:178-186.

Little variation was found in grain colour or vitreousness in a study of 115 varieties, but under irrigation winter varieties formed bigger grains than spring ones. The best for grain weight were K46812 and K46809. The least variation in protein content was found in the spring wheats K46852 and K46772 and the winter wheats K46699, K 46704 and K46685. Considerable variation was found in the crude-gluten content of both spring and winter varieties.

1372. YOUNGS,V.L., MILLER,J.D., Mc MULLEN,M.R. and STACK,R.W. 1982
Effect of pink and yellow kernels in durum wheat.
Cereal Foods World (USA), 27:447.

While yellow kernels (yellow berries) are common in durum wheat, pink kernels are not. Some samples collected in 1980 contained 1% pink kernels, and in 1981 up to 6%. The color extended into the endosperm and color was readily visible in semolina milled from handpicked kernels. The pink kernels appeared to be evenly distributed within the wheat heads. Less than half of the pink kernels germinated, and those that did had pink rootlets. Preliminary evidence suggests that the source of the pink color may be a bacterium. In the greenhouse, plants grown from pink seeds produced normal seeds. Protein, kernels size, test wt. and 1000-kernel weight, were not affected. Other quality parameters of the semolina and spaghetti produced from pink kernels are being tested. Plants grown from yellow seeds also produced both normal and yellow seeds, but no more than the controls. When yellow seeds were handpicked and separated by degree of yellowness, protein percent decreased as yellowness increased. Effect of yellow color on quality of semolina and spaghetti is under investigation.

Food Technology

1373. ABDEL-RAHMAN,A.H. 1982
Effect of cooking time on the quality,minerals and vitamins of spaghetti produced from two Italian durum wheat varieties.
Journal of Food Technology.(USA), 17:349-353.

Spaghetti was made from two Italian durum wheat varieties and cooked for 10, 15 and 20 min. Percentages of water absorption and cooking loss were determined. Measurable amounts of soluble nitrogen, starch, minerals and vitamins were found in the water used for cooking. Minerals and vitamins were determined in cooked spaghetti. The percentage reduction of minerals increased with increasing cooking time, but trace elements decreased after 10 min of cooking and then became stable at the longer times. It is preferable to cook spaghetti for 15 min.

1374. ABECASSIS,J., ALARY,R. and KOBREHEL,K. 1980
Characteristics of cooked pasta influenced by the PH-value of cooking water. (De)
Bulletin de l'ENSMIC-No.293, 255-262.

1375. ABECASSIS,J., ALARY,R. and KOBREHEL,K. 1981
Cooked spaghetti: relations between surface conditions and quality of residual proteins. (Fr)
Cereal Industries (France), 11:13-14.

1376. ABECASSIS,J., ALARY,R., MICHEL,J., ALAUSE,J. and BRILLOT,P. 1981
Technological characteristics of durum wheat varieties examined in 1980 (semolina value, aspect and color of raw pasta, culinary quality of cooked pasta, France. (Fr)
INRA.Montpellier (France), 60.

1377. ABECASSIS,J. and ALAUSE,J. 1978
Technological characteristics of hard wheat cultivarr observed in 1978. (Fr)
INRA.Montpellier (France), 58.

1378. ABRAHAM,G. 1979
Influence of mechanical treatment on several characteristics of durum wheat semolina. (Fr)
Univ.Sci.Techn.Lang.Montpellier(france), 134.

1379. ANG,K.P., KWIK,W.L. and MOK,K.F. 1981
Determination of monosodium glutamate in "instant noodles" and "snack foods" by fluorometric method.
J.Singapore Nat.Acad.Sci(Singapore), 8:72-75.

1380. ANON. 1976
Procedure to produce boilable, elastic pasta and simultaneously maintain and intensify the natural yellow pigments of wheat and eggs. (De)
Food Science and Technology Abstracts, 3:367.

In a process for producing macaroni and similar products having improved properties, the loss of natural yellow pigments by oxidation is prevented by the simultaneous use of a monoglyceride hydrate and reducing agent which is acceptable for use in food, such as ascorbic acid, vitamin E and their compounds such as their anhydrides and esters. The addition of 0.4-0.5% of the monoglyceride was found to considerably improve the quality of the cooked product and make it more tolerant to overcooking. In addition to the presence of the reducing agent, the whitening effect of the monoglyceride is further compensated for by the presence of natural colouring compounds such as beta-carotene.

1381. ANON. 1978
Problems of manufacturing semolina. (Fr)
La Depeche Commercial,Agricole(France), 78.

1382. ANON. 1979
Standard for pasta products, macaroni, spaghetti, vermicelli, lasagna, noodles.
CGSB 32-GP-16M.(Canada), 5.

1383. ANON. 1979
Solar energy for macaroni drying.
Macaroni Journal (USA), 91:42.

1384. ANON. 1981
Methods to determine applicability of durum wheat pasta manufacturing. (Fr)
Commission of the EEC. D.Ge.A.(France), 401.

1385. ANON. 1981
Boosts pasta production 400%.
Food Engineering International, 6:48-51.

Golden grain, an American pasta and packed meals firm, has recently modernized its 3 factories equipments. Details of this expansion are given for their factory at Bridgeview (Illinois, USA).

1386. ANON. 1982
Durum wheat and pasta products.
Macaroni Journal (USA), 64:12.

1387. ANTOLINI,P. 1982
Milling for Italian pasta.
Macaroni Journal (USA), 64:35-36.

1388. BAKER,C.W. and DOTY,N.C. 1977
Microwave conditioning of durum wheat, 2: Optimization of semolina yield and spaghetti quality.
J.Agric.Food Chem.(USA), 25:819-822.

Crosby durum wheat was conditioned with microwave energy at 2450 MHz before experimental macromilling to increase semolina yield and spaghetti quality. Randomly selected duplicate samples were irradiated at 625 W up to 90 s, in 15-s

increments. Conditioning parameters were selected on the basis of quality data and grain temperatures observed during application of wide ranges of microwave power and the results of a micromilling study. In the micromilling study, microwave conditioning was performed at 390 W in 2-s increments up to maximum grain temperature of 65oC. Semolina and spaghetti quality parameters of the micromilled samples were not influenced by conditioning time but selectively influenced by level of tempered moisture. Microwave for 60s was optimum in the macromilling study. Semolina and semolina plus flour yield was increased 1.8 and 2.5 percentage points, respectively. Spaghetti color, cooked weight, and cooking loss were not altered by this conditioning treatment, while spaghetti firmness was increased significantly.

1389. BANASIK,O.J. and DICK,J.W. 1981
High protein extruded foods from durum wheat.
Cereal Foods World (USA), 26:498.

1390. BANASIK,O.J. and DICK,J.W. 1982
Extruded products from durum wheat.
Cereal Foods World (USA), 27:553-557.

Few studies have been reviewed on the use of durum wheat in extrusion-cooked foods. Durum wheat semolina, when made into an expanded product, is appealing in appearance and good tasting.

1391. BARNES,P.J., DAY,K.W. and SCHOFIELD,I.D. 1981
Commercial pasta manufacture: Changes in lipid binding during processing of durum wheat semolina.
Z.Lebensmittel-Unter.Forschung (F.R.G), 172:373-376.

Free and bonded lipid-acyls present in semolina and durum wheat pasta are determined during the different processing stages. Semolina contains about the same amount of free and bonded lipids, but about 90% of the free lipids become bonded during processing, particularly during drying. Triacylglycerides undergoes a similar transformation and certainly this lipidic fraction is the main reason for the observed phenomenon of lipid binding.

1392. BARUNI,G.S. 1976
Factors that influence microspaghetti processing and quality measurement factors.
Cereal Foods World (USA), 21:450.

Four factors (absorption, mixing time, kneading time and resisting time) were varied to determine their influence on the quality of spaghetti produced by a micro procedure. The physical characteristics of the spaghetti (diameter, texture, color, and appearance) were observed. The cooking quality (cooking loss, cooking time, cooked weight, and firmness) were determined. The absorption and rest time appeared to be the most influential factors.

1393. BAUMANN,G. 1976
Pre-cooked pasta and their industrial fabrication. (Fr)
Fr.Pat. (France)2 282 813-1976.

New food products of the macaroni type have their starch content gelled, a water content of <12.5% and are unaffected by boiling in water for <5 min. Wheat semolina incorporating an edible surface active agent, such as soya lecithin, is passed through a mincer-blender at a temp. of 80-110 centigrade to gel the starch, extruded to the required shape, cooled and dried.

1394. BESLAGIC,S. 1981
Replacement of egg and milk with soya protein in pasta.
J.Am.Oil Chem.Soc.(USA). 58:535-538.

Over 200 dwarf durum lines obtained by crossing the Mexican spring variety Oviachik 65 with Soviet tall winter varieties, were studied during 1978-80. Those with dominant genes conditioning red or black ear, black awns and red grain were better adapted to local conditions than those with the corresponding recessive alleles (white ear, white awns and yellow-white grain). Many of the short forms had high winter hardiness, profuse tillering and early stem extention (beginning of May).

1395. BOHRMANN,H., HERBIG,G., ULMER,R. and SPETH,G. 1980
Procedures for manufacturing instant cupped pasta. (De)
Food Sci.Technol.Abstr.(U.K) 4M, 377.

1396. BRAIBANTI,E. 1981
Process for the preparation of instant cooking alimentary pasta, and pasta so obtained.
UK Pat. 2071479A-1981.

1397. BRANDLE,R. 1978
Pasta and production method (De)
Food Sci.Technol.Abst.(U.K), 10:983.

Procedures are given for pasta production of the kind ready to use by cooling and then freezing of the base pasta. The principal elements in this are : eggs, salt, seasonings, semolina, flour, olive oil. The obtained food behaves well in storage and their preparation doesn't take more than 2 minutes.

1398. BREEN,M.D., SEYAM,A.A. and BANASIK,O.J. 1977
Durum wheat air classified flours and their effect on spaghetti quality.
Cereal Chem.(USA)., 54:737-746.

Samples of durum wheat, with different percentages of vitreous kernels (40 and 95%) were milled into flour. Each flour stream was pin milled and air-classified into a high-protein fine fraction and a medium-protein coarse fraction. A total of 7.3% of the fine flour with approximately 16% protein or over was obtained from air-classified flour fractions from 95% vitreous wheat sample, and 7.8% of the high-protein flour was produced from the 40% vitreous wheat sample. Ash contents averaged higher in the fine flour fractions. Spaghetti processed from the fine fractions showed lower color scores and had a higher cooking loss. Differences in vitreous kernel content did not affect spaghetti quality. The coarse fraction of air-classified flour was processed into high-quality spaghetti. The fine fraction could be used to increase the protein content of noodles and other pasta products.

1399. BUNNIES,H. and MIESEL,G. 1982
Pasta's importance as a food. (De)
Verbraucherdienst,(Consumers'Service), 27:59-66.

The aspects considered include: The different pasta types, pasta production, relative consumption per capita in Germany's different regions, prices and their tendencies, sensorial quality, nutrition value, general composition, amino-acids composition and mineral elements content.

1400. CAVENDER,J. 1982
Flour handling and blending systems for pasta production.
Macaroni J.(USA), 64:10-16.

1401. CORDONNIER,J.M. 1976
Cereals in the agricultural and food industries.
Semaine d'Etude-cerealiculture (France), 485-508.

1402. COTTEN,C.D. 1982
Microprocessors in the pasta industry.
Macaroni J.(USA), 64:22-23.

1403. CREMER,M.L. 1983
Sensory quality of spaghetti with meat sauce after varying holding treatments and heading in institutional microwave and convection ovens.
J.Food Sci (USA), 48:1579-1582.

Sensory quality of spaghetti was determined for a freshly prepared sample and after heating in institutional microwave and convection ovens following holding 1 hr chilled; 24 hr frozen;24 hr frozen, 24 hr chilled. Differences attributable to holding treatment occurred in moistness; in clumping, firmness and chewiness of pasta; and in overall ratings. Samples held 1 or 24 hr chilled had better scores than those held 24 hr frozen or 24 hr chilled. Spaghetti heated in the microwave compared to the convection oven had greater fat separation, clumping, greasiness, firmness, and chewiness.

1404. CUMMINGS,D.A. and OKOS,M.R. 1983
Viscoelastic behavior of extruded durum semolina as a function of temperature and moisture content.
Transaction of the ASAE,(USA), 26:1888-1893.

Uniaxial tension tests at constant rates of elongation were used to determine the relaxation for moisture and temperature equilibrated specimens of extruded durum semolina. Moisture contents ranged from 0.12 to 0.25 dry basis and temperatures 42 to 58 centigrade. Linear viscoelastic, thermo- and hydro-rheologically simple behavior were validated for experimental conditions. Data reduced for time-temperature and

time-moisture equivalence was fitted to Maxwell models and used to express behavior over extended time scale. Expressions determined for the temperature and moisture shift factors using constant strain rate data were used to reduce the failure stresses with good results. The scatter of failure points about the reduced line had a standard deviation of 0.3 logarithmic units.

1405. D'EGIDIO,M.G., STEFANIS,E.De., FORTINI,S., MARIANI,B.M. and NARDI,S. 1983
Analysis of pasta characteristics conditioned by their quality alternation in starch contents during manufacturing. (De)
Getreide,Mehl Und Brot (F.R.G), 37:55-60.

1406. DAL BELIN,P.A., PALLAVICINI,C., PINTON,R. and POGNA,N.E. 1982
Analysis of wheat varieties by gliadin electrophoregrams. 3: Catalogue of electrophoregram formula of 22 Italian durum wheat varieties. (Abstract).
Ann.Ist.Sper.Cerealicoltura,Rome (Italy) 13:118.

1407. DAOUD,A. 1979
Effect of tempering on the mechanical and milling properties of Syrian durum wheat grain.
Food Sci.Technol.(Poland), 25-38.

1408. DAUN,J.K. 1978
Mathematical method for estimating color of spaghetti and mustard flour.
Cereal Chem.(USA), 55:692-698.

A mathematical method has been developed that allows direct calculation of dominant wavelength (DW) and percentage of purity from trichromatic coefficients if the DW lies between 550 and 600 nm. Accuracy is about ±0.23 nm for DW and ±0.5% for percentage of purity. The procedure is used with a computer to demonstrate that spectrophotometric estimations of color values of spaghetti and of mustard flour rapidly provide information that is as accurate as visual rating and more comprehensive.

1409. DAVIS,A.B. and EUSTACE,W.D. 1981
Scanning electron microscopic views of various stages in the milling of hard, soft and durum wheat.
Cereal Chem.(USA), 61:182-186.

1410. DAVIS,A.B. and EUSTACE,W.D. 1984
Scanning electron microscope views of material from various stages in the milling of hard red winter, soft red winter, and durum wheat.
Cereal Chem.(USA), 61:182-186.

The scanning electron microscope provides an interesting perspective in the examination of wheat milling. Initial fracture patterns following passage of mill stock through the break rolls show which portions of the endosperm will become midding stocks. Continued attrition in the milling flow results in the removal of most of the endosperm until the final layer of endosperm cells often adheres to the aleurone layer and the remainder of the bran. Major differences in the attrition patterns of hard red winter, soft red winter, and durum wheats are verified by this method of observation.

1411. DEETHARDT,D.E. and JOHNSON,W.A. 1976
Noodles from whole grain flours.
Cereal Foods World (USA), 21:450.

Egg noodles made from stone ground hard red spring (HRS), hard red spring semi-dwarf (HRSD) and durum wheat flours were compared to one another and to whole grain triticale noodles for dough consistancy by penetration, cooked grain weight, cooking loss and acceptability by a taste panel (color, firmness, flavor). These studies indicate that noodles (and perhaps other pasta foods) with good nutritional and palatability qualities can be prepared from whole grain flours.

1412. DEXTER,J.E., BLACK,H.C. and MATSUO,R.R. 1982
An improved method for milling semolina in the Buhler laboratory mill and a comparison to the Allis-Chalmers laboratory mill.
Can.Inst.Food Sci.Technol.J.(Canada), 15:225-228.

A mill flow is described which produces a 70% extraction of granulars (65% extraction semolina) from a sound durum wheat in the Buhler laboratory mill when used in conjunction with a laboratory purifier. Compared to the Allis-Chalmers mill, the Buhler laboratory mill was equally sensitive to variations in wheat semolina milling

potential. A wide range of semolina and spaghetti quality tests revealed the Buhler laboratory mill to be an equally reliable predictor of semolina end use quality compared to the standard Allis-Chalmers laboratory mill.

1413. DEXTER,J.E., KILBORN,R.H. and MATSUO,R.R. 1983
Grain research laboratory compression tester: instrument measurement of cooked spaghetti stickiness.
Cereal Chem. (USA), 60:139-142.

The tester, designed for assessment of bread crumb texture, was modified to permit measurement of cooked spaghetti surface stickiness. Test results seemed to be in good agreement with subjective assessment of cooked spaghetti stickiness by an untrained taste panel. Preliminary investigations showed that cooking water quality and spaghetti drying procedure have a large influence on stickiness of cooked spaghetti. Spaghetti stickiness was also related to cooking time and elapsed time after cooking. Protein content did not appear to be strongly related to spaghetti stickiness.

1414. DEXTER.J.E. and MATSUO,R.R. 1977
Changes in semolina proteins during spaghetti processing.
Cereal Chem.(USA), 54:882-894.

Three durum wheats of widely differing spaghetti cooking quality and a hard red spring wheat were processed into spaghetti in a DeMaco laboratory extruder. Samples were taken at various stages throughout the spaghetti making process and were analyzed for sulfhydryl group and disulfide bond contents. For all four wheats, there was a substantial loss of sulfhydryl groups by the extrusion stage, although, by far, the greatest portion of the loss occurred during the first 6 hr of the 29-hr drying cycle. No relation could be established between cooking quality the extent of sulfhydryl group loss. Disulfide bond levels did not change significantly during processing of the wheats. Changes in protein solubility during spaghetti making followed a similar pattern for all four wheats. In each case, protein extractability in dilute acetic acid had decreased substantially by the time the dough entered the extruding auger. No further change in solubility occurred during the remainder of processing. Gel filtration elution profiles showed no significant change in the molecular weight distribution of the proteins during spaghetti processing. This, in conjunction with electrophoretic results, which revealed no qualitative changes in protein electrophoretic patterns during spaghetti processing, suggested that the loss of salt-soluble proteins may be due to binding by the insoluble components of the semolina rather than by polymerization.

1415. DEXTER,J.E. and MATSUO,R.R. 1978
Effect of semolina extraction rate on semolina characteristics and spaghetti quality.
Cereal Chem.(USA), 55:841-852.

Two durum semolina granulation of wheats decreases slightly with increasing extraction rate, resulting in slightly higher starch damage. Spaghetti processing absorption is not affected, however. Percent ash and protein content increase with extraction rate for both wheats. In each, the farinograph indicated a slight weakening of pasta dough characteristics as extraction rate increased, but spaghetti cooking quality was not affected. Pigment loss during processing increases significantly with increasing extraction rate, resulting in lower spaghetti pigment content. At high extraction, spaghetti also becomes browner and duller.

1416. DEXTER,J.E. and MATSUO,R.R. 1979
Changes in spaghetti protein solubility during cooking.
Cereal Chem.(USA), 56:394-398.

In three durum wheats and a hard red spring wheat spaghetti cooking quality decreased for all four wheats over the complete range of cooking times examined. For all four wheats, protein extractability in dilute acetic acid rapidly decreased during cooking up to about 12 min. At each cooking time examined the two poorer quality wheats exhibited significantly greater protein extractability than the two better quality wheats. The relationship between cooked spaghetti protein extractability and spaghetti cooking quality was confirmed for 18 durum wheat

lines of differing spaghetti cooking quality.

1417. DEXTER,J.E. and MATSUO,R.R. 1979
Effect of water content on changes in durum wheat semolina proteins during dough-mixing.
Cereal Chem.(USA), 56:15-19.

Semolina from a 1C Wamber durum wheat composite was mixed in the farinograph at 30 and 50 OC. At both 30 and 50 OC, farinograph mixing time reached a minimum value around 45% absorption and increased when absorption was increased further. Results from determinations of dough protein extractability in dilute acetic and Osborne protein solubility fractionations showed that gluten breakdown by increased gluten protein solubility, did not occur at absorptions below 45%. Gel filtration elution profiles of acetic acid extracts showed that at absorptions of 45% and above, the proportion of protein in the high molecular weight fraction increased significantly. These data suggest that gluten development during dough mixing at absorptions below 45% is limited. For a series of wheats representing a variety of gluten strengths, strong gluten wheats were found to achieve maximum gluten breakdown during mixing at higher dough water contents than were weak gluten wheats.

1418. DEXTER,J.E. and MATSUO,R.R. 1979
Effect of starch on pasta dough rheology and spaghetti cooking quality.
Cereal Chem.(USA), 56:190-195.

A collection of cereals comprising seven wheats, four barleys, three corns, rye, triticale, oats, and buckwheat served as a source of starches to investigate the effect of starch properties on pasta rheology and spaghetti cooking quality. The diverse nature of the starches was reflected by significant differences in their water absorption, amylose contents, microscopic structure, and amphylograph pasting properties. A wide range in mixing properties was obtained for starch and gluten blends when absorption was held constant at 36% (14% moisture basis). These differences appeared to be mainly attributable to variations in starch water absorptions. Waxy maize and waxy barley starches were detrimental to spaghetti cooking quality, but high-amylose corn starch appeared to impart a slight improvement in cooking quality of starches with more normal amylose content suggested that other starch properties may supercede amylose content as a spaghetti cooking quality criterion once a threshold level of amylose is attained.

1419. DEXTER,J.E., MATSUO,R.R., DANIEL,R.W. and Mac GREGOR,A.W. 1981
Pasta drying conditions. Effect on spaghetti properties.
Getreide, Mehl Und Brot. (F.R.G), 35:153-157.

The characteristics of spaghetti produced from three samples of semolina were affected by drying conditions in a very similar fashion. The 80 centigrade drying cycle used in this study appears to offer some advantages over the conventional 39 centigrade drying cycle. Duration of the 80 centigrade drying cycle could be greatly reduced compared to the conventional 39 centigrade drying cycle. Drying at 65 centigrade did not offer any advantage over the conventional drying scheme other than the potential for a shorter cycle.

1420. DEXTER,J.E., MATSUO,R.R., DANIEL,R.W. and Mac GREGOR,A.W. 1981
The influence of drying conditions on the quality of spaghetti. (De)
Getreide, Mehl Und Brot (F.R.G), 35:153-157.

1421. DEXTER,J.E., MATSUO,R.R. and DRONZEK,B.L. 1979
A scanning electron microscopy study of Japanese noodles.
Cereal Chem.(USA), 56:202-208.

A scanning microscope was used to study changes in dough structure during Japanese noodle preparation for a Japanese commercial soft wheat flour and a durum wheat flour of comparable protein content. The flour and sheeted dough from the Japanese flour had a more open structure than the durum sample. The starch granules of the Japanese flour were more conspicuous and more loosely held within the gluten protein matrix. For both flours, there was a progressive change in dough structure during noodle preparation up to the third sheeting. Examination of higher water content, however, demonstrated that full gluten development is not achieved at noodle dough absorptions.

The presence of 2% salt in the dough resulted in a smoother and more uniform gluten structure than that observed for unsalted doughs. When cooked, the internal structure of the better cooking quality product, Japanese noodles, exhibited less evidence of breakdown than the durum flour noodles.

1422. DEXTER,J.E., MATSUO,R.R. and MORGAN,B.C. 1981
High temperature drying: Effect on spaghetti properties.
J.Food Sci.(USA), 46:1741-1746.

The characteristics of spaghetti produced from two high temperature (HT) drying cycles, one featuring HT at the initial stages of drying (HT-A) and one featuring HT during the latter stages of drying (HT-B) were compared to spaghetti produced by low temperature (LT) drying. Both HT cycles had the advantage of greatly reduced drying time. In addition HT-A spaghetti exhibited much enhanced color intensity compared to LT spaghetti. Although HT-A spaghetti cooking properties were marginally inferior to LT spaghetti,cooking quality was still satisfactory. Spaghetti from HT-B was equal to or better than LT spaghetti in color quality while also exhibiting improved strand strength and superior cooking properties.

1423. DEXTER,J.E., MATSUO,R.R. and MORGAN,B.C. 1982
Effects of processing conditions and cooking time on riboflavin, thiamine and niacine levels in enriched spaghetti.
Cereal Chem.(USA), 59:328-332.

Durum wheat semolina was enriched to two levels with riboflavin, thiamine mononitrate, and niacin, and processed into spaghetti and was dried by a conventional low-temperature drying cycle and by two high-temperature drying cycles. Some riboflavin was lost during all three drying cycles, particularly during both high temperature cycles. In contrast, niacin and thiamine were stable throughout all three drying cycles. All three vitamins in spaghetti were rapidly lost during cooking. Although vitamin retention during cooking was significantly related to enrichment levels and drying cycle, cooking time was the predominant factor determining the proportion of each vitamin retained during cooking.

1424. DEXTER,J.E., MATSUO,R.R. and MORGAN,B.C. 1982
Effects of processing conditions and cooking time on riboflavin, thiamine, and niacin levels in enriched spaghetti.
Cereal Chem. (USA), 59:328-332.

Durum wheat semolina was enriched to two levels with a commercial vitamin enrichment mixture containing riboflavin, thiamine mononitrate, and niacin, and processed into spaghetti. Spaghetti processed at each enrichment level was dried by a conventional low-temperature drying cycle and by two high-temperature drying cycles. The enrichment mixture influenced spaghetti color properties but had no effect on cooking quality. Some riboflavin was lost during all three drying cycles, particularly during both high-temperature cycles. In contrast, niacin and thiamine were stable throughout all three drying cycles. All three vitamins in spaghetti were rapidly lost during cooking. Analysis of cooking water showed that loss of riboflavin and thiamine was from the combined effects of leaching into the cooking water and vitamin degradation. All niacin lost during cooking was recovered in the cooking water.

1425. DEXTER,J.E., MATSUO,R.R. and MORGAN,B.C. 1983
Spaghetti stickiness: Some factors influencing stickiness and relationship to other cooking quality characteristics.
J.Food Sci.(USA), 48:1545-1559.

Spaghetti was processed in a semi-commercial scale laboratory press from a range of raw materials, dried by a low temperature (LT) and a high temperature (HT) drying cycle, and assessed for stickiness and other important cooking quality attributes in cooking waters of varying hardness. Cooked HT spaghetti was generally less sticky, more resilient, firmer, and exhibited lower cooking loss than corresponding LT spaghetti. As cooking water hardness increased spaghetti became stickier and cooking loss increased. Stickiness was influenced by cultivar, wheat class, raw material granulation and protein content, but was

not related to sprout damage. Stickiness was significantly correlated to cooking loss, cooked weight, degree of swelling, compressibility, recovery, and firmness. However, even when all these factors were included in a step-up regression less than 50% of the variance in stickiness could be predicted.

1426. DEXTER,J.E., THACHUK,R. and MATSUO,R.R. 1983
Amino acid composition of spaghetti: effect of drying conditions on total available lysine.
J. Food Sci (USA), 49:225-228.

Drying conditions had a pronounced effect on the degree of loss of available lysine in spaghetti, but had no significant effect on the level of any other amino acid. Increasing the drying temperature and the duration of high temperature (HT) resulted in increasing loss of available lysine. Moisture content of the spaghetti at the onset of HT had no significant effect on the extent of available lysine loss. Relatively short term exposure of spaghetti to HT during drying resulted in improved spaghetti color and much reduced loss of available lysine compared to drying programs with longer exposure to HT, without sacrificing cooking quality. Cooking spaghetti had no effect on amino acid composition and available lysine levels.

1427. DINGES,H. 1982
Continuous dosage in the pasta industry. (De)
Getreide, Mehl und Brot (F.R.G.), 36:158-162.

The double screw mixing-machine with softner and admission pipe, and the belt feed regulation balance and their insertion in a production line are described.

1428. DONNELLY,B.J. 1979
Scanning electron microscopy and quality of pasta processed through teflon and non-teflon lined dies.
Cereal Foods World (USA), 24:459.

1429. DONNELLY,B.J. 1979
Pasta production: Raw material, technology, evaluation.
Macaroni J. (USA), 61:6-15.

1430. DONNELLY,B.J. 1980
Pasta regrinds: effect on spaghetti quality.
J.Agric.Food Chem.(USA), 28:806-809.

Blending commercial reground pasta at seven different levels with semolina was investigated to determine the effects on spaghetti color and cooking quality. In addition, the effect of cooking time on cooking quality of the blends was investigated. Cooking times of 10, 15, 20, and 25 min were used, with 15 min representing the standard cooking time used in our laboratory. On the basis of this study it would appear that blending regrinds with semolina to produce spaghetti is not advisable beyond the 15-20% level because of the deleterious effect on color and cooking loss.

1431. DONNELLY,B.J. 1982
Teflon and non teflon lined dies: effect on spaghetti quality.
J.Food Sci.(USA), 47:1055-1058.

Six samples of semolina, milled from durum wheat of varying quality, were extruded through Teflon and non-Teflon lined dies. Extruded spaghetti was evaluated for color and cooking quality. The effect of cooking time on cooking quality was also evaluated. Teflon extruded spaghetti had better appearance and cooking quality than its non-Teflon extruded counterpart. Strong gluten, whether in the Teflon or non-Teflon extruded products, improved cooking quality and tolerance to over-cooking. Scanning electron microscopy of the outer surface of dry cooked spaghetti elucidated, in part, the differences in appearance and cooking quality of the products extruded through both die forms.

1432. DOTZO,A. 1981
Pasta products supplemented with protein and prepared from unconventional raw materials.
Tecnol.Alimentari.(Italy), 4:12-14.

1433. EMSCHERMANN,G., SCHMITZ,G. and BIELIG,H.J. 1982
Correlation between instrumental and sensory registration of consistency of pasta. (De)
Gordian (F.R.G), 82:16-20.

1434. ERNST,R. 1982
Color measurement in raw material and

final products in the production of pasta. Part 1: instrumental measurement of chromaticity value and practical results. (De)
Geteride,Mehl Und Brot (F.R.G), 36:202-205.

The author points out the relations between the two systems known in colorimetry: trichromatic coordinator system and color differential measurement. Roch scale for egg yolks is also defined in the trichromatic system.

1435. ESPERICUETA,R.T. and ORITIZ,CERECERES,J. 1974
Studies on the industrial quality and genetic effect of the character named Panza blanca in T. durum. (Es)
Champingo (Mexico), 94-95.

1436. FABRIANI,G. 1973
Genetic improvement of the nutritive value and technological characteristics of durum wheat.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 519-524.

1437. FABRIANI,G. and QUAGLIA,G.B. 1975
Influence of the degree of nonvitreousness on durum wheat semolina characteristics. (It)
Riv.Sci.Technol.Alim.Nutrizione(Italy), 5.27-30.

The presence of nonvitreous kernels in durum wheat adversely influences milling yield, protein content and pasta manufacturing quality of semolina. From the results obtained, it was inferred that the proportion of these negative effects is related to the degree of nonvitreousness exhibited by the kernels. Consequently, to define nonvitreousness and to establish proper methods for its determination we have to take into consideration not only the percent of nonvitreous kernels but also the degree of nonvitreousness exhibited.

1438. FABRIANI,G., QUAGLIA,G.B. and MAFFEI,A. 1975
Effect of milling and pasta processing on the content of reactive and total-SH groups in pure varieties of durum wheat. (It)
Tecnica Molitoria (Italy), 26:81-85.

1439. FALCONI,S. 1982
Process for the production of cooked macaroni foods and plant with which to effect the said process.
US Pat.4311719-1982.

1440. FEILLET,P. and ABECASSIS,J. 1977
Description of a new measuring instrument for the viscoelastic characteristics of pasta. Applicability for evaluation of gluten quality of pasta and rice. (Fe)
Bull.An.E.L'Ecole Meun. ENSMIC (France), 97-101.

1441. FEILLET,P., FEVRE,E. and KOBREHEL,K. 1977
Modifications in durum wheat protein properties during pasta dough sheeting.
Cereal Chem.(USA), 54:580-587.

The effects of pasta dough sheeting on durum wheat protein properties were investigated. Dry gluten content was diminished (from 13 to 0%) by increasing the number of passes through sheeting rolls or by decreasing the roll clearance and the dough moisture content. Simultaneous changes in protein composition occurred: increases in the amount of gliadins and gel proteins, and decreases in the amount of 2-chloroethanol-soluble glutenins. A correlation between the rate of gluten recovery and the gel protein content was observed.

1442. FERNANDEZ,J.L.A., SHUEY,W.C. and MANEVAL,R.D. 1977
Quality of egg-spaghetti produced from bread and durum wheat granular mill streams.
Cereal Foods World (USA), 22:483.

1443. FIKS,H. 1982
The microbiological quality of pasta. (De)
Lebensmittle Industry (F.R.G), 29:119-122.

After studying egg pasta, pasta and raw materials employed in their production it was concluded that the samples studied were generally of good quality.

1444. FORTINI,S., D'EGIDIO,M.G., GALTERIO,G., CANTONE,M. and VOLPI,M. 1979
Cooking quality of some varieties (durum wheat) (It)
Ann.Ist.Sper.Cerealicoltura (Italy), 10:215.

1445. GAYTE SORBIER,A. and AUDIBERT,M. 1979
Influence of heat treatment and microwaves on the composition of amino acids in pasta, implication on their nutritive value. (Fr)
Ann.Nut.Food (FAO), 32:437-446.

1446. GEBRUEDER,B.AG. 1980
Method for drying pasta products and apparatus for bulk material treatment.
UK Pat.1560 545-1980.

1447. GORSKI,C.A. and GORSKI,S.B. 1983
Pasta gauge and container.
US Pat.4387 512-1983.

1448. GRANDIDIER,G. and RESIER,M. 1979
Exportation. Equipment for pasta packed in individual transparent bags. (De)
Ger.Pat (F.R.G) 2805 596 1979.

1449. GREEN,C. 1978
Have we reached spaghetti junction [production of durum wheat in U.K.].
Agritrade (U.K), 41-47.

1450. GREENAWAY,W.T. 1977
Dough volume test to evaluate hard red spring, hard red winter, white and durum wheats.
Baker's Digest.(USA), 51:36-38.

1451. GREGERSEN,J.A.M. 1978
Monoglyceride powder with good filterability: its use in products based on flour or starch. (Fr)
Ger.Pat.2719 580-1977.

1452. GRUENENFEDER,F. 1982
Mixing and extruding.
Macaroni J.(USA), 64:14-19.

1453. GRZYBOWSKI,R.A. and DONNELLY,B.J. 1977
Starch gelatinization in cooked spaghetti.
J.Food Sci.(USA), 42:1304-1315.

1454. GRZYBOWSKI,R.A. and DONNELLY,B.J. 1979
Cooking properties of spaghetti: factors affecting cooking quality.
J.Agric.Food Chem.(USA), 27:380-384.

The effects of analytical replication, cooking time, and protein quantity and quality on the cooking properties of spaghetti were investigated. Spaghetti cooking quality, as related to cooked weight, cooking loss, and cooked firmness, was determined at specified cooking time intervals. Results showed that replication did not affect analysis and that cooking time was the prime determinant of cooking quality. Protein quantity and quality were also significant factors affecting cooking quality particularly with respect to the maintainance of firmness and cooking stability.

1455. HAASE,W. 1976
Development of the durum-milling industry in the EC. (De)
Getriede, Mehl Und Brot (F.R.G), 30:142-145.

1456. HAKIM,C. 1975
The use of durum wheat flour in Lebanese baking. (Fr)
CIIA.Paris (France), 51-54.

1457. HANNA,H.A., SATTERLEE,L.D. and THAYER,K.W. 1978
Sensory and selected textural properties of pasta fortified with plant protein and whey.
J.Food Sci.(USA), 43:231-235.

1458. HERTEL,W. 1975
Residues in milled products of durum wheat. (De)
Getreide, Mehl Und Brot (F.R.G), 29:182-185.

The milling technical processing affects the residual in different processing phases. The small amount of residuals stick to different parts of the milling machines, thus the risk for contamination in the following products is enhanced. However, the research attempts to reduce the chemical residuals, especially malathion from the end product are promising. The results also show that through appropriate measures in technical milling, the parts contaminated to residuals can be separated without any negative effect on the durum wheat product and to the consumers. The technical methods were developed to reduce the chemical residuals, especially the malathion.

1459. HOSKINS,C.M. 1979
Industry echoes: Checking of pasta.
Macaroni J.(USA), 60:44.

1460. HOSKINS,C.M. 1979
Industry echoes: Thoughts on durum research.
Macaroni J.(USA), 61:8-10.

1461. HOSKINS,C.M. 1981
What's new? Macaroni drying and common sense.
Macaroni J.(USA), 63:22-32.

1462. HOULIAROPOULOS,E., ABECASSIS,J. and AUTRAN,J.C. 1981
Products of durum wheat grits: coloration and culinary qualities. (Fr)
Industries des Cereales.(France), 12:3-13.

Milling streams of three durum wheat varieties (Agathe, Durtal, Valdur) were analyzed for color and cooking characteristics. As far as color was concerned, brown index was strongly influenced by histological origin whereas yellow index turned out to be essentially a varietal characteristic. Cooking characteristics were quite dependant on the type of milling stream. Semolinas gave pasta with good viscoelastic properties but with a tendency to surface disintegration when overcooked. Conversely, pasta from flours lacked elasticity but kept a remarkable aspect of surface. However, these differences could not be related to differences in the particle size of products. Incorporating flours in semolina seemed to improve both rheological properties and resistance to disintegration of cooked pasta. In spite of higher protein content of flours compared to semolina, gluten extractibility decreased during milling progression. Gluten from flour was also firmer and less elastic than gluten from semolina. The overall analysis confirmed that surface disintegration and rheological properties of a cooked pasta are two factors that do not cover the same viewpoint of quality and that may involve different physicochemical mechanisms.

1463. HSIEH,C.C. 1983
Durum wheat lipoxygenase isoenzymes: isolation, properties and carotene bleaching.
Diss.Abstr.Int.B(USA), 43:3571-3572.

Three lipoxygenase isoenzymes from flour of durum wheat endosperm were isolated and purified by means of ammonium sulfate fractionation, DEAE and CM-cellulose column chromatography and their properties and effects on carotene bleaching were studied.

1464. HUSSEIN,M.A., ABOU-BAYA,M., DOMAH,M. and EL-KADY,S. 1981
Study on chemical and organoleptic properties of macaroni made from some wheat flour mixtures.
Cereal Foods World (USA), 26:506-507.

This study was carried out to determine the possibility of partial substitution of wheat flour meant for pasta production by some local cereals. Mixed flours used in this study include maize flour or sorghum flour enriched with skimmed powdered milk, or soya flour. Results lead to the following conclusions: the best pasta quality is obtained with a mixture of 5% soyaflour or skimmed powdered milk with 65% wheat flour and 30% maize flour. Soya flour or skimmed powdered milk contribute to improve pasta's color, aspect and culinary quality. Maize flour improves culinary quality, while sorghum flour decreases it.

1465. IBRAHIM,R.H. 1982
High temperature drying of pasta: Effect on quality and biochemical components.
Diss.Abstr.Int.(USA), 43:162.

High temperature drying was investigated on pasta made from 6 varieties of durum wheat. Since some of the durum wheat samples suffered sprout damage, the study also provided information on the effects of sprouting. Overall quality of the high-temperature dried spaghetti samples was better than the control dried at 40 centigrade. The spaghetti from sprouted wheat was a little lower in cooked firmness and cooked weight and a little higher in cooking loss than spaghetti from unsprouted wheat but the quality was still at an acceptable level.

1466. IBRAHIM,R.H., Mc DONALD,C.E. and DONNELLY,B.J. 1981
Experimental high-temperature drying of spaghetti.
Cereal Foods World (USA), 26:507.

Experimental drying methods at 60,70 and 80 OC for spaghetti have been developed. Drying lasts from 18 hours at 40 oC to 6 hours 30 minutes at 80 OC. The general quality of high temperature dried spaghetti is better than that of check samples dried at 40 OC. Details of the quality differences at high temperatures are given.

1467. IRVINE,G.N. 1978
Effect of water content on changes in semolina protein during dough mixing.
Can.Grain Com.(Canada)1978 Report:8p.

1468. JODLBAUER,M.D. 1976
The quantitative determination of monoglycirdes in pasta. (De)
Getreide, Mehl Und Brot.(F.R.G), 30:181-187.

1469. JODLBAUER,M.D. 1981
Contribution to the quantitative analysis of emulsifiers in pastries and pasta. (De)
Getreide, Mehl Und Brot.(F.R.G), 35:274-277.

This work describes methods to determinate mono and diglycerides in pasta and their esters in the bakery. For pasta gaseous chromatography and thin layer chromatography are employed. The ester of diacetyl tartaric acid is better put into evidence with thin layer chromatography following Seher Janssen's method.

1470. JOHNSTON,R.A., QUICK,J.S. and DONNELLY,B.J. 1980
Note on comparison of pigment extraction and reflectance colorimeter methods for evaluating semolina color.
Cereal Chem.(USA), 57:447-448.

1471. KAISER,E.M. and WARITHESEN,J.J. 1982
Packaging effect on riboflavin degradation in pasta products.
Cereal Foods World (USA), 27:447.

Riboflavin, a light sensitive vitamin, is rapidly degraded in the presence of visible light. The packaging material used for pasta products in retail distribution plays an essential role in the protection of this vitamin from light. Currently marketed products were evaluated for the protective effect of the packaging under controlled laboratory conditions which simulate actual retail conditions. Light chambers were used at several intensities to provide varied light levels. High pressure liquid chromatography with fluorescence detection was used to quantify the riboflavin content. The riboflavin retention was highest with packages completely impermeable to light. A loss of over 50% was observed in pasta products with transparent packaging material.

1472. KHATTAB,M. 1978
Study and description of the minipress piscaglia. Study on its use for the evaluation of durum wheat pasta-quality. (Fr)
I.N.A.Paris.September 1978.41pp.

Pasta quality of durum wheat is evaluated in laboratories with a viscoelastograph or an aleurograph on cooked pasta discs. The method to obtain these discs is quite different from the industrial one. The use of the Piscaglic mini-press to obtain these pasta discs allows close simulation of the industrial procedure.

1473. KIM,S.H. and Mc DONALD,C.E. 1980
High-temperature / short-time extrusion cooking of semolina.
Cereal Food World (USA), 25:520.

1474. KOBREHEL,K., ABECASSIS,J., ALARY,R. and FEILLET,P. 1982
Protein components of semolina and qualitative characteristics of pasta-making products. (Fr)
Int.Symp.Durum Wheat."Ind.Sci.Res."Italy 11-23.

Proteins have a leading role in determining the cooking quality of alimentary pastas. The concept of quality includes a large number of characteristics. The two most important are: the viscoelasticity and the condition of the pasta surface. The viscoelasticity is chiefly influenced by quantity of protein, but protein quality also exerts not negligible effect. The surface conditions of alimentary cooked pasta depend both on quality and quantity of protein presents in semolina; nevertheless the chief factor is the ability of such proteins to be insolubilized during the cooking process.

1475. KOCH,W., MERKENICH,K., UHLMANN,G. and ZAPLINSKI,W. 1982
Means to improve noodles. (De)
Ger.Pat.3014773-1981.

Pasta culinary quality may be improved by addition of a small amount of bread wheat and a mixture of phosphates. This allows noodles to stand higher temperature drying sterilization.

1476. KORDONOWY,R.K. 1982
Utiliztion of durum mill feed streams for increasing dietary fiber in durum pasta.
Macaroni J. (USA), 63:27-30.

Pulverised bran and/or remillings are incorporated to durum wheat semolina so as to improve nutritional quality, specially pasta fiber content. Losses at cooking are higher in the enriched samples than in pure semolina ones. Samples enriched only with bran don't have any difference with pure semolina samples. Firmness of enriched pasta is higher than semolina pasta, up to rates of 15% for bran and 20% for remilling. Enriched pasta drying is not a problem at all. Bran enriched pasta flavour is considered agreable and better than that of pasta enriched with remilling or even 100% semolina pasta.

1477. KORDONOWY,R.K. 1983
Durum wheat studies on fiber and its effect on pasta.
Macaroni J. (USA), 64:10.

1478. KOWALEZUK,M. and KRASNOWOKA,B. 1978
Potential use of Amber durum wheat flour.
Food Sci.Technol.Abstr.(U.K), 11:1-9.

1479. LABEL,F.M. 1981
Food application work integrates texture and flavors.
Food Development (USA), 15:21-25.

1480. LAIGNELET,B. 1976
Changes in coloration and other quality factors of pasta in the course of dehydration. (De)
Getreide,Mehl Und Brot.(F.R.G), 30:277-280.

1481. LALLEMAND,J. 1980
Pasta. Techniques-quality-expenses. I-Reflexions on pasta industry. (Fr)
Industries des Cereales (France), 17-21.

1482. LINSTROTH,J. 1981
What's new? Color in semolina and macaroni.
Macaroni J. (USA), 63:16-17.

Semolina color is a result of durum wheat yellow pigments; their quantity varies from one variety to the other, one farming site to the other and even sometimes, from one year to the next. During pasta manufacture there are important losses in color. Destruction takes place principally during kneading, then to a lower extent during extrusion. These two phases may be carried out under vacuum so as to avoid oxidation which is harmful to color. However, the higher the lypoxidase content, the higher the loss in color, even using a vacuum.

1483. LIPPUNNER,Ch. 1976
Special problems in cleaning durum wheat. (De)
Getreide,Mehl Und Brot.(F.R.G), 30:237-240.

The molina content is related to clean seed , particularly to high kernel color, yellow-berry and to the reduction of stones, claviceps and broken kernels.

1484. LORENZ,K. 1976
Physico-chemical properties of free-lipid cereal starches.
J.Food Sci. (USA), 41:1357-1359.

1485. LOTT,G. 1976
Experience concerning cleaning and disinfection in pasta factories in Switzerland. (De)
Getreide,Mehl Und Brot. (F.R.G), 30:280-282.

1486. LU,C.Y., CHEN,C.Y. and WANG,H.H. 1980
Studies on the processings and qualities of starch noodles from various starches.
Abstr.Papers,Am.Chem.Soc.(USA), 177:87.

1487. LUCHTER,K. and BELL,B. 1981
Quality control of pasta products including determination of egg in pasta via NIR analysis.
Cereal Foods World. (USA), 26:506.

A unique and inventive application for measuring the number of eggs in pasta. By using the correlation transform we can determine the number of eggs in semolina by measuring the fat and sterol content.

1488. MACLEAN JR,W.C., DE ROMANA,G.L., KLEIN,G.L., MASSA,E. and MELLITS,E.D. 1979
Digestibility and utilization of the energy and protein of wheat by infants.
J.Nutr. (USA), 109:1290-1296.

1489. MANEEPUN,S. 1978
Functional and nutritional studies on spaghetti samples prepared from durum semolina hard wheat farina blends supplemented with soy or fibrous products.
Diss.Abstr.Inter.B (USA), 39:148.

Various spaghetti samples were prepared with different proportions of soy products, hard wheat farina and durum wheat semolina. The functionality of these ingredients for making spaghetti was evaluated.

1490. MANEEPUN,S. and TSEN,C.C. 1976
Effects of hard wheat farina and soy protein on the functionality and nutritive value of pasta product.
Cereal Foods World.(USA), 21:450.

1491. MANSER,J. 1976
Influence of drying pasta on their bacteria contents. (De)
Getreide,Mehl Und Brot. (F.R.G), 30:155-159.

1492. MANSER,J. 1980
Drying pasta at high temperatures.What is meant by drying at high temperatures and how does it influence pasta? (De)
Diagramme - Buhler. (F.R.G), 11-12.

1493. MANSER,J. 1982
Process for the production of pasta products packed ready for sale in serving portions in packages.
US Pat. 4 323 585-1982.

Pasta is packed in ready for sale in serving portions. They are separated in individual portions before drying and packing. To avoid product breakage at the moment of separation, the equivalent to one pasta portion is kept on one of the elements used for two portions transported.

1494. MATSUO,R.R. and DEXTER,J.E. 1980
Comparison of experimentally milled durum wheat semolina to semolina produced by some Canadian commercial mills.
Cereal Chem.(USA), 57:117-122.

A milling scheme for producing 70% extraction durum wheat semolina in an Allis-Chalmers laboratory mill is described. The granulation, ash, starch damage, color, and spaghetti making quality of laboratory-produced semolina were compared to those qualities in semolina milled from the same wheat by three Canadian commercial mills. Results showed the laboratory product to be very similar to commercially produced semolina.

1495. MATSUO,R.R., DEXTER,J.E. and DRONZEK,B.L. 1978
Scanning electron microscopy study of spaghetti processing.
Cereal Chem. (USA), 55:744-753.

Structural changes in pasta dough during spaghetti processing in a laboratory scale continuous process press were studied by scanning electron microscopy. When water is added in the preliminary mixing stage before dough formation, the tight compact structure characteristic of semolina begins to change to a more open structure. Concomitant with dough formation in the extrusion auger, a jagged, discontinuous protein matrix becomes predominant. Starch granules definitely align along the direction of flow by the time dough reaches the end of the extrusion auger. The protein matrix becomes more ordered as processing continues, but does not appear to achieve a continuous network of protein sheets and fibrils, suggesting that full gluten development does not occur.

1496. MEISEL,N. 1976
The use of microwaves in the course of dehydration of pasta. (De)
Getreide,Mehl und Brot. (F.R.G), 30:187-189.

Following introductory sections, discussing basic principles relating to microwave energy and giving relevant mathematical formulae, the application of microwaves for drying pasta products is discussed. Tabulated data record the reduction in microbial counts achieved by microwave drying of 'elbow' macaroni. For pasta , a 3-stage drying process is recommended, involving hot-air drying to reduce the moisture content from 32 to approx. 20%, microwave drying to reduce the moisture content to 14%, and finally an 'equalization' stage involving hot-air drying to a moisture content of 12.5%. Drying time is 40 min vs. 10 h with conventional drying methods.

1497. MELLA,M. 1981
Pasta making machine.

US Pat. 4 269 582-1981.

Description of a pasta making machine; mainly of the parts involved in kneading and extrusion.

1498. MENGER,A. 1976
Influence of raw material and manufacturing conditions on the pasta quality. (De)
Getreide,Mehl und Brot. (F.R.G), 30:149-155.

Relations existing between pasta quality and raw material on one hand and processing factors on the other hand are obtained by using results of several years experimentation.

1499. MENGER,A. 1977
Experiences with electrophoretic methods for the determination of soft wheat in durum wheat products. (De)
Getreide,Mehl und Brot. (F.R.G), 31:312-315.

The advantages and disadvantages of methods to detect bread wheat. All of them are based on electrophoresis of protein and can only be applied to products which haven't been cooked or dried at high temperature since it denature wheat proteins.

1500. MENGER,A. 1978
Utilization of the pasta disc test to evaluate the influence of raw materials and productions on pasta quality.
Getreide,Mehl und Brot.(F.R.G), 32:291-295.

Two methods developed at the Laboratory of Durum Wheat and Rice Technology (INRA, Montepellier), viscoelastographic method and squashing of paste discs between two glass plates, are utilized to evaluate durum wheat and the effects of mechanical and thermic treatments on the culinary quality of pasta. Results demonstrate that the two methods are effective. The pasta discs methods has the advantage that it can be used on small samples.

1501. MENGER,A. 1980
Infuences of cooking-water on pasta of different qualities. (De)
Getreide,Mehl und Brot.(F.R.G), 34:336-340.

1502. MENGER,A. 1982
Color measurement in raw material for production of pasta. Part 2: Critical comments on the applicability of different apparatus and methods. (De)
Getreide,Mehl und Brot.(F.R.G), 36:205-207.

Measurement tables obtained with two tristimulus colorimeters, corresponding pigment and ash contents, and yellow and brown indexes are given. It is concluded that yellow pigment content provides the best and easiest estimate of the coloration potential of pasta raw materials.

1503. MENGER,A. 1983
Determination of industrial value of durum wheat. (It)
Tecnica Molitoria (Italy), 34:343-350.

1504. MENGER,A. and RABE,E. 1978
On nutritive quality and its specification in pasta. (De)
Getreide,Mehl und Brot.(F.R.G), 32:210-214.

1505. MEREDITH,P. and POMERANZ,Y. 1982
Inherent amylograph pasting ability of U.S. wheat flours and starches.
Cereal Chem. (USA), 59:355-360.

The starch-pasting abilities of flours of 68 wheats were compared. Flours from soft and club wheats and one sample of durum wheat had poor pasting ability. Part of the variation in pasting was explained by differences in protein contents and starch damage.

1506. MOLDOVEANU,G. 1980
Quality of pasta made of Triticum durum . (Ro)
Prod.Veg.Cereale Plante Tehnice(Romania) 34-36.

1507. MOLINA,M.R., GUDIEL,H., BATEN,M.A. and BRESSANI,R. 1982
Production of high protein pasta products using a semolina/corn/soy flour mixture. 3: Effect of cooking on the protein nutritive value of pasta.
Cereal Chem.(USA), 59:34-37.

Pasta products were prepared from semolina and from semolina replaced at the 20, 40, 60, and 75% levels by whole corn flour. From these mixtures, spaghetti was prepared with and without ether defatted soy flour. A test of

resistance to disintegration and organoleptic evaluation indicated that quality decreased significantly ($P<0.05$) when the semolina in the blend was lower than 40 and 32%, respectively. A significant ($P<0.05$) correlation ($r = -0.93$) was found between solids lost through cooking and organoleptic evaluation score. After cooking, all products showed increased nitrogen content. Cooking decreased significantly ($P<0.05$) the total and available lysine and the protein quality of the L-lysine-supplemented products, but it caused an increase in the percentage of available lysine in the soy-supplemented and unsupplemented products and therefore improved the protein nutritive value. A significant ($P<0.01$) positive correlation ($r = 0.98$) was found between the available lysine content and the protein nutritive value of the products.

1508. MOORE,L.F. 1976
Pasta cooking apparatus.
US Pat. 3 958 503-1976.

1509. MOUSAE,E.I. 1980
Influence of wheat classes and granular mill streams blends on pasta quality.
Diss.Abstr.Int.B(USA), 41:177.

1510. MOUSAE,E.I., SHUEY,W.C., MANEVAL,R.D. and BANASIK,O.J. 1983
Farina and semolina for pasta production. 1: Influence of wheat classes and granular mill streams on pasta quality.
Assoc.operative millers Bull.July.1983, 4083-4087.

1511. MURAKAMI,S., KOKEGGUCHI,S., TAKAHASHI,H. and OKADA,K. 1981
Instant-cooking dry macaroni and like dry foods and method of their manufacture.
US Pat. 4 243 690-1981.

Instant cooking dry macaroni are manufactured with a paste which contains at least 25% in weight wheat flour; the mixture is pressure dried until alpha-starch conversion reaches 60-80%. Then products are given different shapes and dried. These dry macaroni are not sticky and have a delicate porous texture. They are easy to cool by immersion in hot water for a short time. They are stable and keep well.

1512. MacARTHUR,L.A. and D'APPOLONIA,B.L. 1982
Microwave and gamma radiation of wheat.
Cereal Foods World (USA), 27:58-60.

The treatment of cereal grains with various types of radiation has been a topic of interest to scientists for several decades. Although initially used as a method of preventing losses in storage caused by insect pests and by bacterial and fungal decomposition, microwave and gamma radiations are being studied with other practical uses in mind. Some forms of radiation are known to lead to certain biochemical and physical changes in the material being subjected to radiation treatment. Exactly what changes occur and the impact these alterations have on the final product are still being investigated.

1513. Mc DONALD,C.E. and ZARLING,G. 1977
Prediction of spaghetti color from pigment content and enzymic bleaching activity of durum wheat.
Cereal Foods World.(USA), 22:483.

1514. NELSON,J.M. 1983
Modification of starch and its effect on pasta quality.
Diss.Abstr.Int.B. (USA), 43:138.

1515. NELSON,J.M. and YOUNGS,V.L. 1982
The effects of modified starches on pasta quality.
Cereal Foods World (USA), 27:447.

Four commercially modified non-durum starches were blended with Edmore durum wheat semolina at levels up to 10%. Durum starch isolated from Edmore semolina was also blended with the semolina at the same percentage levels. The blends were processed into spaghetti and several quality parameters were measured. Durum starch was found to be significantly different from the four commercially modified starches, giving a higher mean firmness score, higher mean cooking loss and lower mean cooked weight at the percentage levels studied. The percentage level of the starches added had a significant effect on firmness and cooked weight, but cooking loss was not affected. Durum starch was modified by cross-linking using epichlorohydrin, acetylation, and hydroxypropylation. Native and chemically modified durum starches were

incorporated with Edmore durum flour at 1, 5, and 10% levels, processed into spaghetti and several quality parameters measured. Physical and chemical properties of the native durum starch, commercially modified starches, and modified durum starches were measured. The granular structure of the starches and the spaghetti was evaluated using scanning electron microscopy.

1516. PALVOLGYI,L., SZANIEL,I. and BEKE,B. 1982
Estimates of the pasta quality durum wheat by diagram method.
Cereal Res.Commu. (Hungary), 10:197-203.

Six pasta classes ranging from very bad to excellent, were distinguished diagrammatically by using pasta cooking value and colour (yellow index) as horizontal and vertical axes, respectively. Five Hungarian varieties, two foreign varieties and seven lines were evaluated by this method. The Hungarian variety GK Minaret was classified as satisfactory, having the best combination of values for these characters.

1517. PAVAN,G. 1979
High temperature dehydration of pasta. (De)
Lebensmittel-Ind. (F.R.G), 26:319-321.

1518. PAVAN,G. 1981
Effect of high temperature dehydration on culinary and microbiological-hygienic qualities of pasta. (De)
Getreide,Mehl Und Brot.(F.R.G), 35:23-26.

1519. PETRUZZELLI,L., DELLA GATTA,C., DE LEO,P. and COLAPRICO,G. 1981
Semolina BAPA-ase activity and its possible relationship to pasta cooking quality.
J.Food Technol. (U.K), 16:213-217.

Semolina produced from five Italian durum wheat varieties were used to study the possible effect of semolina proteolytic activity on spaghetti cooking quality. There is a significative correlation between enzymatic activity and culinary quality.

1520. PODELL,A.F and DAVIS,R.S. 1983
Pasta extruder apparatus.
US Pat. 4 383 813-1983.

1521. POLLHAMER,E. 1982
Pasta quality in relation to variety, testing method and environment. (Hu)
Novenytermeles (Hungary), 31:317-331.

Data on pasta quality (including volume, colour and disintegration on overcooking) are tabulated for Hungarian and foreign bread wheats and durum wheats tested in 1976 and 1977. Varieties giving high-quality pastas are the durum wheats GK Minaret and GK Basa, and several Canadian durum wheats. The view that gluten quality is important for pasta quality was supported by experiment in which NPK fertilizer applications in ten varieties increased gluten quantity but reduced gluten quality and pasta quality.

1522. POPEIL BROTHERS INC. 1978
Methods for processing and filling a dough product
UA Pat. 4 112 127-1978.

1523. POTH,B. and DAHLKE,H. 1980
Determination of thiamine in cereal products. (De)
Backer Und Konditor (F.R.G), 28:294-296.

1524. RAO,D.S. and DEOSTHALE,Y.G. 1981
Mineral and trace element composition of wheat and wheat flours of different extraction rates.
J.Plant Foods (USA), 3:251-257.

1525. RAYMAN,M.K., WEISS,K.R., RIEDEL,G.W., CHARBONNEAU,G.A. and JARVIS,G.A. 1981
Microbiological quality of pasta products sold in Canada.
J.Food Protec.(Canada), 44:746-749.

Microbiological quality of 449 samples of pasta was made in Canada and 130 samples of imported pasta was analyzed through official methods. Quality varies considerably from one product to the other. One imported and two Canadian ones were contaminated with salmonella. From the analytical results obtained, a guide on pasta quality is proposed in which four parameters determine acceptability.

1526. RESMINI,P. and DE BERNARDI,G. 1973
Proteic denaturation induced by the glucoxidase enzyme in macaroni production.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 539-546.

Alterations of albumins in spaghetti produced from semolina added with glucoxidase enzyme (with or without soft wheat flour) were investigated. The possible effects of these alterations on the cooking quality of macaroni products are briefly discussed.

1527. RESMINI,P. and DE BERNARDI,G. 1976
A rapid electrophoretic method to detect soft wheat (T . aestivum) in durum wheat (T . durum), in semolina and in macaroni products. (It)
Tecnica molitoria (Italy), 27:97-109.

1528. S.C.E.E.S.PARIS 1979
Hard wheat. (Fr)
Perspectives Agricoles (France), 14-32.

Varieties, pasta quality by production region in France.

1529. SAGI,F. and SAGI,H. 1977
Ultracentrifugational fractionation and forming of durum wheat flour.
Eur.FAO Rys.Durum Wheat Qual. (France).

1530. SALEM,B. 1982
Status of cereal technology in Tunisia.
Rep.Agric.Exper.Station,Oregon.Univ.USA. 252-262.

Quality analysis of cereal breeding lines, gluten, durum and bread wheat, triticale, flour.

1531. SARNO,R., STINGI,L. and NOTO,F. 1973
Quality trials on durum wheat new lines.
Proc.Symp.Genet.Breed.D.W.Bari (Italy), 633-640.

Results are reported of a research carried out over a three years period, for evaluation of the quality characteristics of new lines of durum wheats, obtained by crossbreeding from the Institute of Agronomy of the University of Palermo. From the trials the following results were obtained: the amount of ashes was between 1.99 (Capeiti) and 2.18 (BC5) in the first year, while in the second and in the third year the values were between 1.49 and 1.83. Regarding the proteins contents over the three years, there was a rise. The best lines for protein were PB3, 13F and BC1 (Trinakria). The lines BC4, 13F and PB3 were highest in gluten content. The semolina of the new lines was very good in the macaroni-making tests.

1532. SCHIEFER,E. 1976
Pasta industry - its development in the Common Market.
Getreide, Mehl Und Brot.(F.R.G), 30:169-173.

1533. SCHOFIELD,I.D., BARNES,P.J., KEARNES,H.K., BOTTOMLEY,H.K. and TIMMS,M.F. 1981
Biochemical changes in durum semolina proteins and lipids during pasta processing.
Cereal Foods World (USA), 26:506.

Protein extractability in a certain number of solvents decreases during kneading and extrusion. Extractability decrease in sodium dodecylsulfate (SDS) continues during drying. Ion chromatography sepharose gel shows that glutenins of high molecular weight are the most affected. Labelling C14 with iodoacetamide does not indicate any loss of free SH groups until extrusion, but afterwards during drying 40% are lost.

1534. SCHOPPET,E.F., SINNAMON,H.I., TALLEY,F.B., PANZER,C.C. and ACETO,H.C. 1976
Enrichment of pasta with cottage cheese whey proteins.
J.Food Sci.(USA), 41:1297-1300.

1535. SCHWARTZBERG,H.G. and KIM,K.H. 1981
The drying of plasticized pasta.
J.Korean Agric.Chem.Soc.(Korea), 24:29-39.

Cooked spaghettis are plasticized by immersing them for 10 minutes in a glycerol aqueous solution (at 10, 20 or 40% concentrations). This treatment prevents cracks to form and spaghetti surface to pleat during drying. This glycerol action is particularly helpful when drying takes place at high temperature and humidity differences are important. With high drying temperatures glycerol addition increases the browning outspread but shortens the necessary period to induce a perceptible browning. Since glycerol addition allows decreased drying time in all drying conditions and also allows the use of high temperatures, relatively small amounts of glycerol may reduce drying time by up to 93%.

1536. SCOTTI,G. 1982
Durum wheat: Widely selected

consumption. (Fr)
Le Producteur Agricole Francais.(France) 14-15.

A description of different products obtained from durum wheat pasta: Bulghur and Trahana, Halva Breakfast cereals.

1537. SCOTTI,G., SCRULETTA,D. and D'EGIDIO,M.G. 1977
Total proteins,protein composition and starch contents in Italian durum wheat semolina, correlation with pasta quality.
Prespectives Agricoles No.56 (France).

1538. SEYAM,A.A., SHUEY,W.C. and WALSH,D.E. 1976
Semolina starch damage and its effect on macaroni processing and quality.
Cereal Foods World (USA), 21:450.

Four durum wheat varieties were milled to coarse, medium and very fine granulations. The effect of starch damage on processing and quality of spaghetti were investigated. Starch damage in semolina was highly correlated with cooking loss and semolina absorption. Furthermore, starch damage had a high negative correlation with spaghetti firmness. The data suggested that starch damage of the semolina could be used as a factor to evaluate the cooking quality of spaghetti. The lower the starch damage the better the quality.

1539. SEYAM,A.A., WALSH,D.E., SHUEY,W.C. and MANEVAL,R.D. 1977
Effect of steam conditioning and heat treatment on durum wheat milling.
Food Sci.Technol.Abstr.(U.K), 9:355

A blend of durum wheats from the 1971 harvest was pre-tempered to 12.5% moisture for > 72 h before being subjected to one of the following additional treatments:(1) regular tempering, (2) steam treatment, (3) tempering + heat treatment, (4) tempering + steam treatment. Samples subjected to the different treatments were milled. Fractions of different particle size distribution were obtained by using different sieves. The semolina obtained was processed into spaghetti. Studies were made of the effect of wheat treatment and particle size distribution on semolina extraction rate and quality and on spaghetti quality. Treatment (2) gave the best extraction rate and a low speck count. Coarse semolina had a darker colour than fine semolina. The wheat treatment methods and particle size distribution had adverse effects on spaghetti quality.

1540. SHEJAL,J. 1978
Preservation of cereal grains and oil seeds in nitrogen.
Rijksuiv.Gent.Fac.Landbouw. (Belgium), 30:493-504.

1541. SHUEY,W.C., DICK,J.W. and MANEVAL,R.D. 1976
Experimental milling evaluation of durum wheat.
Cereal Foods World (USA), 21:449-450.

A technique using an experimental mill was developed to calculate the total extraction for durum wheat which included both semolina and flour. The experimental milling unit from which the data were obtained is comprised of a Buhler experimental mill equipped with corrugated rolls on the reduction side and two Miag laboratory purifiers.

1542. SHUEY,W.C., WATSON,C.A., CRAWFORD,R.D., MANEVAL,R.D. and LACHER,C.P. 1976
Durum wheat quality report: Physical, chemical, milling and macaroni characteristics, 1976 crop.
Fargo U.S Dept.Agric.(USA), 29.

1543. SHUEY,W.C., WATSON,C.A., MANEVAL,R.D. and CRAWFORD,R.D. 1976
Comparison of United States and Italian pasta products and durum semolina.
Cereal Foods World (USA), 21:450.

A comparison of the quality of pasta products and durum semolina obtained in the United States and Italy was made. There were wide ranges in quality characteristics of the material evaluated. Generally, the U.S. products were higher in protein content than the Italian products. The Italian products generally exhibited stronger type mixograms than the U.S. products.

1544. SHUEY,W.C., WATSON,C.A., MANEVAL,R.D. and CRAWFORD,R.D. 1977
Comparison of durum semolina and pasta products from various countries.
Cereal Foods World (USA), 22:278-283.

1545. SILANO,V., AURICCHIO,S., De RITIA,G., De VINCENZI,M. and OCCORSIO,P. 1981
Effects of gliadin-derived peptides from bread and durum wheat on small intestine cultures from rat fetus and coeliac children.
Cult.Techn.Symp.Prenatal Dev.5th(France) 385-394.

1546. SKINNER,C.M. 1981
Pasta manufacturing.
Macaroni J. (USA), 62:17-19.

General information on the different stages of pasta production.

1547. SOBKOWSKA,E., BATKO JOLANTA and CZARNECKI ZBIGNIEW. 1979
Investigation of protein and proteolytic enzyme distribution in wheat grain and milling fractions.
Rocz.Akad.Roln.poznaniu.(Poland), 81-89.

1548. SPICHER,G. 1976
The problem of producing germ-free pasta. 1: The contents of microbial germs of pasta with shell egg. (De)
Getreide,Mehl Und Brot. (F.R.G), 30:303-307.

A total of 74 samples of short, medium and long types of fresh egg pasta obtained from 6 manufacturers were subjected to microbiological studies of total bacterial count, coliforms, Escherichia coli, faecal streptococci, staphylococci and moulds.

1549. STEHRENBERGER,W. 1981
Extrusion.
Macaroni J. (USA), 63:8-18.

The principal factors affecting extrusion are considered: raw materials, granulation; supply systems for the pressing machine; kneading; vacuum extrusion elements, i.e. temperature and pressure; product shaping, extrusion velocity and molding.

1550. STRAKHOVA,T.V. 1979
Action of drying winter durum wheat grain on its biological, biochemical and technological properties. (Ru)
Doklady Vses.Akad.Sel'skokhoz.Nauka.USSR 44-46.

1551. SWARTZENTRUBER,A., PAYNE,W., WENTZ,B., BARNARD,R.L. and READ,R. 1982
Microbiological quality of macaroni and noodle products obtained at retail markets.
Appl.Envir.Microbiol.(USA), 44:540-543.

A statistical study was conducted nationwide on microbiological quality of macaroni and noodles sold in retail markets. Average countings of the different microorganisms considered are given.

1552. TACCHINO CANUTI,E. 1983
From hard wheat to noodles: Distribucion of heavy metals in the grinding products. (It)
Tecnica Molitoria (Italy), 34:473-476.

1553. TACCHINO CANUTI,E. 1983
Research on the shelf-life of durum wheat milling products and pasta goods. Preliminary comments. (It)
Tecnica Molitoria (Italy), 34:633-638.

This study examines the problem of the preservation of macaroni prepared on industrial scale starting from the raw material - durum wheat - and following the behaviour of the intermediate product, and its respective lipid fractions. Several specific analyses have been carried out at intervals in order to evaluate their alterations.

1554. TAHAR,N. 1981
New compositions for filling pasta food products, process for their preparation and alimentary products containing the said filling compositions.
Food Sci.Technol.Abstr. (U.K), 13:629.

1555. TAKAHASHI,K., SHIMIZU,F., SHIRAI,K. and WADA,K. 1982
Thermal behaviour of high-molecular weight substances in foods. 6: Gelatinization temperature of starch in relatively low moisture content. (Ja)
Denpun Kagabu (Japan), 29:34-40.

1556. TAMASIA G. 1981
From semolina to pasta. (It)
Tecnica Molitoria (Italy), 32:593-598.

Description of pasta manufacturing procedures accompanied with descriptive diagrams.

1557. TAN,B.H. and HALLORAN,G.M. 1982
Variation and correlations of proline accumulation in spring wheat cultivars.
Crop Sci. (USA), 22:459-463.

1558. TAUFIQ,F. 1982
High protein pasta products.
UK Pat. 2 079 289-1982.

1559. TAWFIK,M.E., MITKEES,R.A. and ABDEL-GAWAD,E. 1981
Varietal and locational effects on semolina doughs from durum wheat type. In International Conference of New Trends and Techniques Toward Food Supply. Cairo.
Egyptian Acad.Sci.Res.Technol,(Egypt), 25.

1560. TERADO,M., MINAMI,J. and YAMAMOTO,T. 1977
Gel electrophoretic observation of change in soluble proteins of wheat flour by treatment with "Kansui".
Agric.Biol.Chem. (Japan), 41:23-27.

1561. TRENTESAUX,M. 1979
New problems of semolina and pasta industries.(Fr)
Ind.Aliment.Agr. (France), 559-569

1562. TRENTESAUX,M. 1981
Marketing pasta: Criteria for quality-valuation. (Fr)
S.O.Inst.Chim.Anal.Control Qual.(France) 56-88.

Durum wheat is utilized for pasta production in France. Technological characteristics of the greatest importance are ability to give yellow color pasta and holding ability when cooked. The producers try to utilize processing methods which don't obtain these qualities. This study also treats new problems of the semolina and pasta industries.

1563. VASILJEVIC,S., BANASIK,O.J. and SHUEY,W.C. 1977
A micro unit for producing durum semolina (wheat).
Cereal Chem. (USA), 54:397-404.

A micro unit for producing semolina from durum wheats has been developed for 200-g samples. In one operation, the unit, a modified Brabender Quadromat Jr. Mill and a small laboratory purifier, produces over 50% purified semolina from durum wheat. The semolina is uniform in granular size and has a low bran speck count. The micro procedure compares favorably with the macro method. The number of samples that can be processed has been increased 60% over the present system to 120 samples/man day.

1564. VOISEY,P.W., LARMOND,E.L. and WASIK,R.J. 1977
Comparison of spaghetti texture made from different durum varieties by instrumental tests.
Eng.Res.Serv.Rep.(Canada)No.7008-680-Mar 142.

1565. WASIK,R.J. 1977
Measuring the texture of cooked spaghetti: 1. Firmness.

1566. WATSON,C.A., BANASIK,O.J. and SIBBITT,L.D. 1977
Relation of grading and wheat quality factors to end-use quality characteristics for durum wheat.
Macaroni J.(USA), 58:12-13.

1567. WEIBEL,R. 1980
Storage, transport, weigh out and blending of raw products for pasta manufacturing. (De)
Getreide,Mehl und Brot(F.R.G), 34:289-291.

1568. WILLIAMS,P.C. 1984
Survey of wheat flours used in the Near East.
RACHIS (ICARDA,Aleppo,Syria), 4:17-20.

Description of bread wheat, durum, barley, and triticale uses and characteristics in the Middle East. Discusses imports to and production in Middle Eastern countries and the resulting consistency or variability in quality characteristics of the flour.

1569. WILLIAMS,P.C. and JABY EL-HARAMEIN,F. 1984
Frekeh making in Syria-A small but significant local industry.
RACHIS (ICARDA,Aleppo,Syria), 4:25-27.

Review of the preparation of frekeh (green parched wheat) which is ideally prepared from durum wheat.

1570. WILLIAMS,P.C., JABY EL-HARAMEIN,F. and ADLEH,B. 1984
Burghul and its preparation.
RACHIS (ICARDA,Aleppo,Syria), 3:28-30.

A description is given of the preparation methods of burghul. Durum wheat is the preferred raw material in villages and towns in the Middle East.

1571. WILSON NUNEZ,L.A. 1976
Industrial quality control of two

varieties of durum wheat (T . durum Desf.), Quilafen and Condealfen-5, by means of application of different levels of nitrogen fertilization. (Es)
Quillota (Chile), 88.

1572. WINDEMANN,H. 1977
Characterization of T . durum and Triticum aestivum . (De)
Getreide,Mehl Und Brot. (F.R.G),
31:212-215.

The probability of distinguishing between hard and soft wheat and the determination of soft wheat semolina mixture in hard wheat semolina is very difficult. With the help of electrophoresis one is able to determine the various constituents in pasta products. High drying temperatures does not have a negative effect on the determination.

1573. WINTER,M.J. and DAWE,P.R. 1981
Rapidly rehydratable pasta.
UK Pat.2066040A-1981.

1574. WOODCOCK,E.A., WARITHESEN,J.J. and LABUZA,J.P. 1982
Riboflavin photochemical degradation in pasta measured by high performance liquid chromatography.
J.Food Sci. (USA), 47:545-555.

A technique utilizing high performance liquid chromatography (HPLC) was developed to determine the kinetics of riboflavin losses in enriched macaroni as a function of temperature, water activity and light. Riboflavin and lumichrome were extracted from macaroni and assayed by reverse-phase HPLC with fluorescence detection. Riboflavin degradation and lumichrome production in macaroni occurred in two phases, a rapid initial phase followed by a slower phase, Photodegradation of riboflavin appears to follow first-order reaction kinetics. Under the experimental conditions used, more than 50% of the riboflavin content of macaroni was lost within one day. Light intensity was the rate determining factor for riboflavin loss and lumichrome production.

1575. WYLAND,A.R. and D'APPOLONIA,B.L. 1982
Influence of drying temperature and farina blending on spaghetti quality.
Cereal Chem. (USA), 59:199-201.

A study of the influence of drying temperature on spaghetti quality indicated that increasing the drying temperature improved spaghetti color, increased firmness values, and decreased cooking loss and cooked weight values. Increasing the proportion of hard red spring (HRS) wheat farina in farina-semolina blends brought about an increase in firmness and a decrease in cooking loss, cooked weight, and spaghetti color. When the hard red winter (HRW) farina content was increased, firmness values did not change significantly, but color, cooking loss, and cooked weight values decreased as in the HRS samples. The firmness values of samples containing HRS farina were higher than those of samples containing HRW whereas the cooking loss values were lower. These data, indicate that blends using farina obtained from HRS wheat produce spaghetti superior in quality to spaghetti from HRW farina-semolina blends.

1576. YOUNG,L.G. and KING,G.L. 1981
By-products of hard wheat (T . durum) for pregnant sow feeding.
Selezione Veterinaria (Italy),
22:1321-1323.

1577. ZUERCHER,K. and HADORN,H. 1979
Problems of lipoid extraction in pasta. (De)
Mitt.Gebiete Leb.Unfer.Hygiene.(F.R.G),
70:271-277.

1578. ZWINGELBERG,H. 1980
Surface cleaning of durum wheat (T . durum) with a vertical pearling machine. (De)
Getreide,Mehl Und Brot. (F.R.G),
34:169-173.

The vertical grinding machine, which is used for grinding and polishing cereals and food legumes, is studied for its possible use with durum wheat kernels. The quality of the end product is related to the preparation of the grinding processing and to the level of grinding. The semolina was increased by 3% when the grinding level was 4% and the vertical labor machine utilized.

Production Statistics

1579. ALLEN,K. 1979
Weather, prices keeps durum wheat

acreage down [Arizona.1979].
Prog.Fmr.West (USA), 94:48.

1580. ANON. 1980
Durum wheat: a lasting impetus? (Fr)
Semences et Progres,(France), 32-33.

1581. ANON. 1982
Manufacturing semolina remarkable productivity.
LAS,Special Aliments Cerealiers.(France) 109-111.

1582. ANON. 1982
Pasta-new consumption politics.
LAS,Special Aliments Cerealiers.(France) 146-148.

1583. ANON. 1982
Evolution of varieties. (Fr)
Cultivar (France), 147:44.

The production of several durum varieties in France from 1976-81 is listed.

1584. EVERAERT,G. 1978
Cereals in the world. (Fr)
Bull.An.E.L'Ecole Meun.ENSMIC (France), 313-327.

1585. FERRIERE,I. and GLEMAS,P. 1981
Annual durum wheat balance. (Fr)
Cultivar (France), 148.

1586. I.W.C. (U.K) 1982
The world durum wheat situation.
I.W.C.(U.K) 1982., 35.

World hard wheat production was 25.2 mt in 1981, 1.0 mt more than in 1980, but is expected to fall to 23 mt in 1982. During the 1970s world hard wheat consumption appears to have increased on average by about 2.2% per annum. Developing countries account for about half of world total consumption and the EC for another 25%. Excluding intra EC trade, and semolina and pasta products, trade in hard wheat exceeded 4 mt in 1979/1980 and rose to 5.3 mt in 1981/1982, mainly on account of higher north African imports.

1587. O.N.I.C. FRANCE 1978
Durum wheat. Statistical survey.(Fr)
Bull.O.N.I.C.France., 78-83.

1588. O.N.I.C. FRANCE 1979
Cereals Market: Statistics 1978-79. (Fr)
O.N.I.C. Publ.(France).

1589. SEIBEL,W. 1980
Iternational situation with durum wheat (T. durum) in the crop years of 1979/80. (De)
Getreide,Mehl Und Brot. (F.R.G), 34:197-199.

The production of durum wheat in USA and Canada, the most important countries for durum export, has again increased in 1978 but in 1979 slightly decreased. In the EEC, France and Italy had increased their production in comparison to 1977. The climatic conditions for 1979 were world wide satisfactory, thus semolina color and cooking parameters of the pasta will not be a limiting marketing factor during this year. It is expected that the offer will be favorable.

1590. SEIBEL,W. 1982
The international situation of durum wheat in the production of cereals in the years 1980/81 and 1981/82. (De)
Getreide,Mehl Und Brot. (F.R.G), 36:169-171.

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International Center for Agricultural Research in the Dry Areas
ICARDA
Box 5466, Aleppo, Syria

Telex: Aleppo, Office 1: 331206 ICARDA SY
Tel Hadya farm: 331208, 331263 ICARDA SY

Telephone: Aleppo, Office 1: (21) 557399, 551280
Aleppo, Office 2: (21) 216722, 226485
Tel Hadya farm: (21) 213433, 213477, 234890, 235220

AMMAN OFFICE
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