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ANNUAL REPORT

on

Development of Improved
High Yielding Sorghum Cultivars with
Disease and Insect Resistance

Contract No. AID/ta-c-1092

February 15, 1975 - February 14, 1976

Prepared by

Texas Agricultural Experiment Station
Department of Plant Sciences
Department of Entomology
and
Texas Agricultural Experiment Station
Lubbock

Submitted to

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Washington, D.C.

PERSONNEL

Department of Plant Sciences
Texas Agricultural Experiment Station
College Station, Texas 77843

R. A. Frederiksen

James Foster (Technician)
Melvin Keener (Data Programming)

Texas Agricultural Experiment Station
Lubbock, Texas 79401

D. T. Rosenow

Charles Woodfin (Technician)

J. W. Johnson

James Phillips (Technician)

Department of Entomology
Texas Agricultural Experiment Station
College Station, Texas 77843

G. L. Teetes

Co-workers:

J. Craig, Plant Pathologist, USDA, Dept of Plant Sciences
Texas Agricultural Experiment Station

F. R. Miller, Sorghum Breeder, Soil & Crop Sciences
Texas Agricultural Experiment Station

L. Reyes, Agronomist,
Texas Agricultural Experiment Station, Corpus Christi

L. W. Rooney, Cereal Chemist, Soil & Crop Sciences
Texas Agricultural Experiment Station

K. S. Schertz, Research Geneticist, USDA, Soil & Crop Sci.
Texas Agricultural Experiment Station

R. W. Toler, Virologist, Department of Plant Sciences
Texas Agricultural Experiment Station

REPORT SUMMARY

A. 1. Project Title and Contract Number: Development of Improve High Yielding Sorghum Cultivars with Disease and Insect Resistance: Contract Number AID/ta-c-1092

2. Key Investigators:

Richard A. Frederiksen
Department of Plant Sciences
Texas Agricultural Experiment Station
College Station, Texas 77843

Darrell T. Rosenow
Texas Agricultural Experiment Station
Lubbock, Texas 79401

3. Contract Period: February 15, 1974 - February 28, 1977

4. Period covered by report: Feb. 15, 1975 - Feb. 14, 1976

5. Total AID funding of contract to date: $279,946

6. Total expenditures and obligations through previous contract year: $142,057

7. Total expenditures and obligations for current year: $83.332[1] — Estimated: $91.22

8. Estimated expenditures for next contract year: $137,889

[1]Does r

b. Narrative Summary of Accomplishments and Utilization

During 1975, research toward the development of diseas and insect resistant sorghums expanded and advanced one generation.

Pests and diseases reduce yields and lower quality of tremendous quantities of grain sorghum throughout the world each year. Sources of resistance to most of the major sorghum diseases, insect, and arthropod pests were identified through a national and international testing program. These included head smut, downy mildew, maize dwarf mosaic, anthracnose, root and stalk rot, seed weathering, several foliar diseases, sorghu midge, greenbug, corn leaf aphid, and spider mites.

Sources of new germplasm were supplied from converted and partially converted exotic sorghums. Disease and insect resistant, dwarf height, photoperiod insensitive sorghums were combined in random mating populations both for easy distribution to sorghum improvement programs in LDC's and as a research tool for improvement of grain sorghum in temperate regions. Development of greenbug resistant hybrids, the discovery of high levels of midge resistance, and possible resistance to spider mites are new major breakthroughs in sorghum improvement. Both releases of appropriate germplasm and publication of new findings on insect and disease resistance through workshops, conferences, symposia and public and scientific publications have served to distribute the results of this program.

A data management system for more rapid summarization and distribution of internationally cooperative research was prepared.

ANNUAL RESEARCH REPORT

A. General Background

Sorghum (Sorghum bicolor (L.) Moench) is one of the principal food and feed commodities of the world. Sorghum is considered by many authorities as the third most important food grain, exceeded in utilization for food only by wheat and rice. Furthermore, sorghum is well adapted to cultivation under wide extremes in environmental conditions including arid, semi-arid, and sub-tropical areas of the world where other food commoditie are often less well adapted.

In southwestern USA, where sorghums are a principal agricultural commodity, serious disease and insect problems have occurred repeatedly. During the past few years, there have bee grave losses caused by head smut (Sphacelotheca reiliana); down mildew (Sclerospora sorghi); maize dwarf mosaic (MDMV); anthrac nose (Colletotrichum graminicola); charcoal rot (Macrophomina phaseoli); Fusarium stalk rot (Fusarium moniliforme); and a number of common foliage diseases.

Insects causing significant yield losses in grain sorghum annually are the sorghum midge (Contarinia sorghicola) and gree bug (Schizaphis graminum). Banks grass mite (Oligonychus pratensis) is a severe problem in the great plains region. Eco omically injurious insects that appear to be increasing in severity and distribution are white grubs (Phyllophaga crinita)

sugarcane rootstalk weevil (Anacentrinus deplanatus), corn leaf aphid (Rhopalosiphum maidis), and yellow sugarcane aphid (Sipha flava). Consequently, the need for superic sources of disease and insect resistance in sorghums is urgently needed in Texas as well as throughout the world.

In 1963, the Texas Agricultural Experiment Station and the United States Department of Agriculture initiated a program whereby exotic sorghums from the World Sorghum Collection were converted from tall, late maturing, photoperiod-sensitive types to shorter, earlier maturing, less photoperiod-sensitive lines. Conversion is accomplished by a crossing and backcrossing program using the short winter days of Puerto Rico for crossing and growing F_1's, with selection for short, early plants within segregating populations during the long summer days in Texas. Many exotic lines have been reported to be resistant to a number of diseases and insects, but until converted or partially converted, most of these lines are not available for use in temperate areas of the world. During the conversion process, we have been able to evaluate resistance from some partially converted exotic sorghums to diseases prevalent in the United States and to some insects. Some of these sorghums possess extraordinarily high levels of disease and insect resistance.

B. Statement of Project Objectives

1. To identify and define potential sources of multiple disease resistance and insect resistance in partially converted and converted exotic sorghums.
2. To develop agronomically elite populations of sorghum with high levels of multiple disease resistance and insect resistance.
3. To experimentally evaluate effectiveness and types of disease resistance from lines obtained through primary screening and from artificially synthesized populations.
4. To develop uniform methods of determining insect and disease resistance and to study, where appropriate, mechanisms of resistance.

C. Continued Relevance of Objectives

Clearly, the objectives are part of an on-going program which has been actively developing at the Texas Agricultural Experiment Station for the past 12 years. These objectives complement a broad-ranged, interdisciplinary research program which recognizes the importance of developing agronomically adapted, disease and insect resistant sorghum cultivars. Until very recently, the limited germplasm resources have restricted sorghum improvement; however, the recent development of converted

and partially converted exotic sorghums at the Texas Agricultural Experiment Station is opening tremendous opportunities for sorghum improvement.

These objectives are a sound and vital component of sorghum improvement for agriculture. They represent areas that need research and the findings and progress of this research will have application throughout the world.

D. Accomplishments to Date

Findings:

Three large disease and insect screening nurseries were grown in the Beeville, Texas area in 1975, and were referred to as Berclair Head Smut Nursery, Berclair Downy Mildew Nursery, and Beeville Station Nursery. The total number of plots in sorghum in each nursery was 3168, 2800 and 7850, respectively. Primary disease screening was for head smut and downy mildew; however, ratings were also made on advanced materials and sorghums were rated for reaction to bacterial stripe, grey leaf spot, and zonate leaf spot. General observations were made for general adaptation, yield potential, standability, and grain weathering resistance. In the Beeville Station Nursery, 2800 plots were planted specifically for midge resistance screening.

In the disease nurseries in the Beeville area, 800 plots of partially converted lines, mostly BC_1 and BC_2, were screened for disease resistance. Of these, 600 were items not previously screened. From these materials, 210 individual head selections were made.

In the Beeville area, 2630 F_2 through F_8 breeding lines involving partially converted converted lines and U.S. elite lines were planted for disease screening. Additionally, 1400 S_1's and 290 S_2's from various populations were evaluated for disease reaction. Within the S_1's, approximately 300 were selections made at Lubbock in 1974 for weathering resistant grain. The overall objective of this large breeding effort is to develop disease resistance in agronomically desirable, high yielding materials in the following breeding areas: waxy endosperm B and R lines, zerazera derivative B and R lines, lodging resistant B and R lines, grain weathering resistant material, greenbug resistant material, midge resistant material, and mite resistant material. Additionally, identifying breeding lines with superior levels of disease and insect resistance is a major objective of these large nurseries. From these South Texas nurseries, 1693 individual head selections were made in the regular pedigree breeding material. From S_1 and S_2 rows, 573 selections were made, of which 151 were specifically for weathering resistance.

At Lubbock, large nurseries were specifically planted for lodging and MDM evaluation. Also, other nurseries of regular breeding material were evaluated for disease and insect resistance, yield, adaptation, grain quality, and standability.

The IDIN, a 30-entry test composed primarily of the best multi-disease and insect resistant sorghums with appropriate elite sorghum for standard controls and disease differentials (Table 1.) was mailed to cooperators at 22 locations. Data to date were received from 6 locations in 5 countries: Argentina, India, Mexico, Senegal, and Venezuela to date.

Some nursery results will be received later because of timing of growing seasons with seed distribution but others unfortunately were lost. Drs. N. Zummo and S. Manzo did not receive their seed, which was unfortunate because they had an excellent site for disease evaluation at Samaru. A few of the IDIN entries were tested in the IAVN at Samaru, providing extraordinarily useful data on differential reaction to anthracnose (note section IAVN). Disease and insect reactions in Guaraboa and Sabaneta in Venezuela, were based on the 1974 IDIN. Major emphasis was placed on tropical adaptation and seed mold or weathering. When Frederiksen visited the nursery at Sabaneta, the plants were healthy. Low levels of downy mildew were present but consistent with expected host reaction. In Argentina, the season permitted

evaluation of the IDIN for foliar diseases. TAM 2572 (SC326-6) had the following note: "Muy bein granado-sin enfermedades foliares." Midge ratings were made but were not summarized this year. At Bambey, Senegal, entries differed in reaction to sooty stripe, rough spot and Cercospor Resistance to sooty stripe appeared rather common, whereas differences among entries for resistance to zonate leaf spot were insignificant. A few entries developed trace symptoms of anthracnose. Of interest here was that SC110-14, SC173-12, and SC599-6, highly resistant in the U.S., developed the disease. These data suggest that the virulent Nigerian race is present in Senegal.

Table 1. International disease and insect nursery (IDIN), 1975

Entry no.	Designation	IS no.	Variety, kind, or group
1	SC 56-14	12568	Cau-Nig
2	SC 103-12	2403	Caudatum
3	SC 108-14	12608	Zerazera
4	TAM 428 (110-9)	12610	Zerazera
5	SC 110-14	12610	Zerazera
6	SC 112-14 (uc)	12612	Zerazera
7	SC 120-14-1	2816	Zerazera
8	SC 170-6-8-8 (4252)	12661	Zerazera
9	SC 170-6-17 (4267)	12661	Zerazera
10	SC 173-12-6	12664	Zerazera
11	TAM 2566 (175-9)	12666	Zerazera
12	SC 175-14	12666	Zerazera
13	SC 237-14	3071	Dobbs
14	SC 239-14	3574	Zerazera
15	SC 326-6	3758	Nigricans
16	SC 414-12E-P1	2508	Cau-Kaf
17	SC 423-14 (2680)	2579	Zerazera
18	SC 599-6-3 (9247)		Rio
19	SC 599-6-10 (9188)		Rio
20	SC 748-5-3	3552	Cau-Guin
21	NSA 440-12		Kafir der.
22	(B 3197 X SC 170-6)(1753)		Kafir - Zera der.
23	(SC 599-6 X SC 134-6)(1880)		Rio-Dur Doc der.
24	QL 3 selection		C. Kaf der.
25	TAM 2567		Tx 2536 der.
26	B Tx 378	413	Redlan
27	B Tx 398	412	Martin
28	Tx 7078	415	Combine 7078
29	Tx 2536	10542	Y.E. Fet. der.
30	Sweet Sudan	721	Sw. Sudangrass

1975 International Disease Nursery Locations

Location (number)	Cooperator
Argentina (2)	Elba Alessandrini Ricardo A. Parodi Manfredi
Brazil (1)	Robert E. Shaffer Sete Lagoas
India (5)	N. V. Sundaram, K. A. Balasubramaniyan New Delhi Dharwar, India
Mexico (2)	Shree P. Singh CIMMYT Mexico 6, D.F.
Venezuela (2)	Mauricio Riccelli Maracay
Malaysia (1)	Mah Shook Ying Serdang, Selangar, Malaysia
El Salvador (1)	Francisco R. Arias M. San Tecia
Ethiopia (1)	Brhane Gebrekidan Diredawa, Ethiopia
Virgin Islands (1)	M. R. Wanjari U.S. Virgin Islands
Uganda (1)	S. Z. Mukuru Serere
Nicaragua (1)	Arnold Van Huis Roberto Arguello Managua, Nicaragua
Columbia (3)	Jim Wilson Asgrow Seed Company Cali, Columbia
Egypt (1)	S. I. Salama Giza, Egypt

Twenty-four all disease nurseries were grown at 12 locations in 1975. Data from many of these tests are summarized in the 2nd Annual Progress Report on Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance, ta-c-1092. Exceptionally good data were obtained on anthracnose, head smut, downy mildew, and the usual foliar diseases in South Texas and Puerto Rico. Artificial inoculation of ADN entries with MDMV permitted comparisons between natural and artificial disease reactions. Certain lines for example, generally develop little diseases under natural conditions, but are very sensitive when inoculated.

Several sorghum lines included in the IDIN and ADN were released or are in the process of being released. (Note seed distribution in Section E)

Combination of artificial inoculation and near ideal weather conditions permitted some of the better evaluations for stalk rot and lodging that have been made during the past five years. Clear cut differences among lines were evident at both Lubbock and Halfway. Sel. 1778 of SC 65 x SC 33 particularly appeared to possess excellent lodging and charcoal rot resistance. The standard resistant sorghum, New Mexico-31, had a moderately severe rating of 2.65, whereas sel. 1778 was rated 0.55.

Head smut reduced sorghum yields significantly and the incidence of disease was negatively correlated with yield. These relationships were direct and proportional within the incidence evaluated. Artificial inoculations were made with Exerohilum turcicum maize dwarf mosaic virus, Macrophomina phaseolina Fusarium moniliforme, Pestalotia sp. and Pythium graminicola.

Location of the 1975 All Disease Nurseries

Location	Principal Diseases
Berclair, Texas (head smut nursery	Head smut, downy mildew
Berclair, Texas (downy mildew nurs	Downy mildew, foliage diseases
Chilicothe, Texas	Periconia root rot
College Station, Texas (2)	Maize dwarf mosaic, Helminthosporium blight
Corpus Christi, Texas	Head smut
Halfway, Texas	Charcoal rot
Lubbock, Texas (6)	Rust, seed weathering, charcoal rot, lodging, Fusarium head blight, corn leaf aphid, MDM
Pecos, Texas (2)	Mites
Victoria, Texas	Head smut
Meridian, Mississippi	Foliage diseases
Experiment, Georgia	Anthracnose
Manhattan, Kansas (2)	MDM
El Centro, California	Late summer disease complex
Isabela, Puerto Rico	Anthracnose, rust, zonate leaf spot
Tampico, Mexico (2)	Leaf blight, rust

Sorghum entries from Kansas, Oklahoma, Mississippi, Nebraska Arkansas, Iowa, California and the Regional yield tests were all included in at least one of the major disease nurseries in South Texas.

Second year evaluation of weathering resistant sorghums demonstrated that selections at Lubbock were very effective. The three best non-brown lines are SC 279-14, SC 546-14, and SC 748-5. These data confirm in part that resistance to seed molding is environmentally nonspecific.

Texas Populations:

TP1R, TP2R, TP5RB, TP7B, TP11R, TP12, TP13 and TP14 were random mated in 1975. TP12, TP13 and TP14 are new high lysine, B line waxy and R line waxy populations, respectively.

Populations, TP1R (greenbug resistant), TP2R (multiple disease resistant), TP6B (standard B line), TP7B (disease resistant B line) and TP8R (midge resistant), were all released or are in the process of being released for distribution. Population improvement through S_1 testing and under condition for natural selection, was done in both South Texas and at Lubbock.

TP1 was reselected for greenbug resistance under a large natural population of insects. Major screening nurseries for midge and mites were grown in South Texas and West Texas, respectively. Selections from pedigree breeding nurseries indicate that high levels of midge resistance can be transferred from the brown-seeded line, TAM 2566, to non-brown sorghum. Hybrids produced from greenbug resistant lines released in 1974, TAM 2567 and TAM 2568, produc

600 percent more grain than standard hybrids when greenbugs were not controlled.

Four sorghum lines, SC 599(9188), SC 599(9247), B TAM 618 and TAM 2568 had less leaf death and stalk death and a smaller percent reduction in seed size from mite feeding than did several standard sorghum varieties when exposed to high mite populations. Selections from F_3 rows of crosses between mite susceptible and resistant lines indicate that mite resistance can be transferred to agronomically improved sorghums.

Greater numbers of greenbugs feeding for a longer period of time on resistant sorghums than susceptible sorghums were required to cause an equal amount of yield loss. However, the same amount of damage, this is, the same amount of leaf loss to resistant sorghums resulted in similar amounts of yield loss when compared to susceptible sorghums. Under natural conditions, resistant sorghums were not severely damaged and only under artificially produced conditions such as caging, which excluded predators and parasites. did significant damage occur.

When resistant and susceptible sorghums were isolated in a cotton field to mimic a large field planting, greenbug numbers on resistant sorghum were about one-third that found on susceptible sorghums. Predator numbers in general were lower in resistant than susceptible sorghum. The ratio of predators to greenbugs was about equal in either sorghum type.

In 1975, sorghum nurseries containing sources of diverse germ plasm were screened for resistance to the corn leaf aphid,

Rhopalosiphum maidis Fitch. Based on damage ratings on these sorghums, it was apparent that some of the commonly used sorghum parental lines were highly susceptible to corn leaf aphid damage. For example, B "Redlan" was extremely susceptible.

Also, in these screening trials, several zerazera sorghums, especially TAM 428, resisted corn leaf aphid damage. The resistance of TAM 428 is effected by the other parental line used in hybrid combination. Sources for resistance to the corn leaf aphid do exist, even in some agronomically improved lines.

n the laboratory studies, there were no extreme preference responses of Banks grass mites to selected sorghum lines. However, total length of the life span of the Banks grass mite was significantly shorter when reared on SC 599-6 than when reared on SC 56-6, Tx 7000, B Tx 378, KS 30, Sweet Sudan, or Honey sorghums. This may imply that there is some antibiotic effect of SC 599-6 sorghum on the Banks grass mite. The effect of plant growth stages 1-6 on mites is that there is a longer life span and ovipositional period with fewer eggs deposited per female mite per day; while at plant growth stages 6-8, there is a shorter life span and ovipositional period with higher number of eggs deposited per female mite per day.

In field tests, mite populations began to increase between July 30 and August 6 at plant growth stages 5 and 6, which continues to verify the existence of some physiological change in the sorghum plant at these growth stages which permits mite population increase.

factors which resulted in lower mite numbers in the field were: a) differences in maturity of the plants, b) differences in plant types, and c) differences in sugar content. Factors which influenced damage were: a) low sugar content and b) early senescence. Those entries which showed low death stalk ratings were those which also showed the lower percent loss in seed size and good qualities for resistance.

Data obtained from a Large Scale Mite Test indicated that the Small Scale Mite Test was a valid test in that evaluation of mite numbers was just as accurate on small plots as it was on the larger plots.

The laboratory and field data indicate that the most promising sources of resistance to the Banks grass mite occur in converted Rio sorghums which are high in sugar content and are non-senescent.

2. Interpretation of Data and Supporting Evidence:

The Second Annual Report for ta-c-1092 presents essentially the complete body of data which should be referred to for more specific details of progress made during the past year. Some of the more significant findings included the confirmation of sources of superior resistance to seed mold (weathering). Seed mold ranks as one of the major deterrents to the utilization of dwarf early maturing varieties and hybrids in LDCs. In Senegal, Nigeria and at ICRISAT, selection for mold resistant sorghums represents one of their major research efforts. We believe that our program

complements theirs. One of our weathering resistant lines is already in the International Disease & Insect Nursery and SC 279 will be included in 1976. The differentation of races of pathogens between sorghum growing regions of the world dramatically underlines the need for cooperative international testing and continuous constructive evaluation of host plant resistance under multiple environments. For example, anthracnose developed on TAM 428 in Africa and to a lesser degree in South America. Races of Colletotrichum graminicola have been suspected but these new data represent the first evidence for different races attacking sorghum.

The progress toward developing lodging and stalk rot resistant sorghums will benefit the more arid sorghum growing regions where high temperatures and low moisture conditions promote these conditions. The greenbug resistant sorghums will be grown on two million hectare in North America during 1976 — which means a $20,000,000 dollar savings from costs to control greenbugs chemically as well as eliminating other undesirable effects of pesticide use.

Commercially acceptable midge and mite resistant sorghums, in time, may also be developed.

The use of disease and insect resistant sorghums means the difference between success and failure in crop production in LDC's as well as developed countries. The outstanding value of the research on sorghum improvement in Texas has been the ability to coordinate agronomic characters with host resistance. This is because multi-million hectare field laboratories (Texas farms) annually challenge

the high yielding sorghum under some of the most severe environments in the world. At the same time, examples of some of the finest grain sorghum cultivation exists in Texas. The broad based state-wide program is continuing in its program to coordinate research activities and programs in Africa, India, and South America. Staff from ta-c-1092 represented our programs at Consultant Meetings at ICRISAT and have visited Brezil, Venezuela, Senegal, Nigeria, and CIMMYT regarding sorghum improvement research. Dr. H. Doggett visited Texas A&M University in March 1976 and Rob Williams will be here in April. Dr. S. Singh, along with other CIMMYT staff, visited our nurseries in June.

3. Research Design:

Subtile changes in design are needed, in part, to facilitate data processing summarization and handling. Currently, we are expanding the use of computer facilities for data banking. To permit more international involvment we are discussing procedures with H. Doggett, of ICRISAT, on better methods of exchanging germplasm and integrating research programs.

E. Persons requesting and receiving seed of disease and insect resistant sorghum lines or germplasm in 1975

International:

Elba B. Alessandrini
ARGENTINA

Carlos Barberis
ARGENTINA

Continental Grain Co.
ARGENTINA

R. G. Henzell
AUSTRALIA

Pacific Oil Seeds
AUSTRALIA

Continental Grain Co.
BRAZIL

M. A. Faris
BRAZIL

J. L. Overman
BRAZIL

C. J. Rossetto
BRAZIL

R. Schaffert
BRAZIL

C. Y. Hsieh
REPUBLIC OF CHINA

Alfanso Diaz - D.
COLUMBIA

S. Rautou
FRANCE

H. G. Schuet.
GERMANY

H. Doggett
INDIA

M. V. Kadam
INDIA

M. S. Pawar
INDIA

Pralhad Karkikar
INDIA

N. G. P. Rao
INDIA

L. E. House
LEBANON

Gonzale Granados
MEXICO

Shree Singh
MEXICO

O. S. [illegible]
NIGERIA

R. B. Thankare
NIGERIA

L. E. Wallace
NIGERIA

F. C. dela Cruz
PHILIPPINES

ontinental Grain Co
HAILAND

auricio Riccelli
ENEZUELA

U. S. - Private Breeders:

James Allison
Taylor Evans Seed Co.

Freddy G. Alston
George Warner Seed Co.

Gayland Anderson
Hunt Seed Co.

Jimmy L. Barber
North Amer. Plant Breeders

Charles Berry
P A G Seeds

Carl Claassen
Pacific Oilseeds, Inc.

Hugh Clearman
WAC Seed Co.

Leon Clement
Delta & Pine Land Co.

Dick Crill
Northrup, King & Co.

Gene Dalton
Pioneer Hi-Bred, Int.

R. L. Ellsworth
Excel Hybrid Seeds, I

J. L. Ervin
Holden Foundation Seeds

Ted Givens
ACCO Seed Co.

K. L. Greenly
Midwest Research Assoc.

D. F. Gross
Trojan Seed Co.

Art Jonnson
Browning Seed Co.

Howard Harrison
Coker's Pedigreed Seed Co

Tom Hoegemeyer
Hoegemeyer Hybrids, Inc.

B. R. McGhee
McNair Seed Co.

R. C. Mitchell
R. C. Mitchell Seed Co.

R. D. Oliphant
Conlee Seed Co., Inc.

James Osborne
NC+ Hybrids

H. C. Pacagnini
Argentina

Paul Revier
Funk Seeds, Int.

Wayne Richardson
Richardson Seed Co.

Glenn Robison
DeKalb AgResearch, Inc.

C. O. Sandlin
Funk Seeds, International

Dr. S. P. Sengupta
MOR-COT Seeds, Inc.

Raymond Sidwell
Northrup, King & Co.

Bill Townsend
Garrison Seed Co.

Gene Turney
Frontier Brand Seed

D. L. Van Horn
McNair Seed Co

U.S. - Private Breeders (Continued)

H. Kidd
Pioneer Hybrid, Inc.

R. R. Kalton
Land O'Lakes, Inc.

R. F. Koenig
Miller Seed Co.

Noble Koepp
Growers Seed

N. W. Kramer
ACCO Seed

M. D. Lacy
R. C. Young Seed & Grain

Armon Lauderback
WAC Seed, Inc.

Bruce Maunder
DeKalb AgResearch, Inc.

U. S. - Public Breeders:

K. E. Atkins
Iowa State Univ

J. Eastin
Univ. of Neb

Ralph Finkner
N. M. State Univ.

H. L. Hackerott
Kansas State Univ

Greg Hinze
Col. State Expt. Station

Abad Morales
Univ. of Puerto Ric

Paul Nordquist
Univ. of Nebraska

D. S. Pada
U. S. Virgin Island

K. S. Porter
Purdue University

Bill Ross
Univ. of Nebraska

T. Sotomayor
Puerto Rico

Dr. R. Voigt
Univ. of Arizona

W. R. Wanjari
U. S. Virgin Islands

Dale E. Weibel
Oklahoma State Univ.

Bill Wiseman
USDA. Tifton, GA

G. Worker
California

Dr. J. O. York
Fayetteville, Arkansas

V. E. Youngman
Dept of Agron.
Colorado State Univ

Biological List and Short Abstracts of Research Reports for 1975 Representing Efforts to Disseminate the Results of the Research Project.

1. Frederiksen, R. A., D. T. Rosenow, and L. Reyes. 1975. Races of Spacelotheca reiliana on Sorghum in Texas. Plant Dis. Reptr. 59:549-551.

2. Frederiksen, R. A., D. T. Rosenow and L. Reyes. 1975. Resistance to Exerohilum turcicum in sorghum. Plant Dis. Reptr. 59:547-548.

3. Frederiksen, R. A. 1975. The role of plant quarantine in control of millet and sorghum diseases. African Journal of Plant Protection. In Press.

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RACES OF *SPHACELOTHECA REILIANA* ON SORGHUM IN TEXAS

R. A. Frederiksen, D. T. Rosenow and L. Reyes

ABSTRACT

Race 3 of *Sphacelotheca reiliana*, causing head smut of sorghum, has spread from a few counties in 1969 to become the predominant race throughout Texas in 1974. During the past 2 years, a new population of the head smut fungus, race 4, was discovered near Victoria, Texas. Race 4 of *S. reiliana* attacks TAM 2571, a partially converted line derived from a tropical sorghum. TAM 2571 is resistant to race 3 and to most other sorghum diseases.

1975. Plant Dis. Reptr. 59:549-557.

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RESISTANCE TO EXEROHILUM TURCICUM IN SORGHUM

R. A. Frederiksen, D. T. Rosenow and L. Reyes

ABSTRACT

A short temperate zone sorghum selection, TAM 2572, derived from the exotic line IS3758, was resistant to Exserohilum turcicum in field trials in Texas and near Tampico, Mexico, as well as when artificially inoculated in the greenhouse. Only fleck lesions developed in both the field and greenhouse.

1975. Plant Dis. Reptr. 59:547-548

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THE ROLE OF PLANT QUARANTINE IN CONTROL OF MILLET AND SORGHUM DISEASES

R. A. Frederiksen

ABSTRACT

Essentially all of the major and damaging diseases of sorghum are present in the African countries. Plant quarantine programs to prohibit the entrance of these diseases are not needed. However, these programs can play a major role in monitoring the existance of current disease problems, the distribution of key pathogens and potentially significant physiological races. Examples of key pathogens for sorghum, their distribution and severity is reviewed.

1975. African Journal of Plant Protection. In Press

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

RESISTANCE IN SORGHUM TO THE BANKS GRASS MITE

D. G. Foster, G. L. Teetes, J. W. Johnson and D. T. Rosenow

ABSTRACT

The Banks grass mite, Oligonychus pratensis (Banks), continues to pose a threat to grain sorghum production on the Texas High Plains. Although, gennerally a sporadic pest of grain sorghum since about 1967 concern over this pest stems from the damage it inflicts and from evidence that the mite can readily develop resistance to insecticides. The Banks grass mite presently cannot be controlled with insecticides registered for use on corn or grain sorghum in the Trans-Pecos area of Texas.

Differential preference reactions of the Banks grass mite when given a choice of Honey, KS 30, TX 7000, or SC 599 are presented. KS 30 appeared to be the most preferred sorghum and was infested with a mean of 1.4 mites followed respectively by TX 7000 (1.0), SC 599 (.9), and Honey (.7). Greatest number of eggs were laid by female mites on TX 7000 sorghum (35.1 after 72 hr.) followed respectively by KS 30 (27.8), SC 599 (18.6), and Honey (16.5).

Little effect on the duration of the developmental stages of the mite on various sorghum types were recorded. However, significant data on the laboratory biology of the pest was obtained. Mean developmental time in days of the various life stages of the mite was as follows: egg (3.9) larva (2.0), pronymph (1.5), deutonymph (1.8) and adult (13.5)

1975. Sorghum Newsletter. 18:89-90

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance

EVALUATIONS OF SORGHUMS FOR REACTION TO INSECTICIDE RESISTANT GREENBUGS

J. W. Johnson, G. L. Teetes and J. M. Phillips

ABSTRACT

Resistance to disulfoton in populations of greenbugs was suspected following failure to obtain adequate control in grain sorghum grown in some areas of the Texas High Plains in 1974. Teetes (Personal communication, 1974) reports that laboratory tests confirmed the finding of resistance to disulfoton and demonstrated a decrease in susceptibility of about 30-fold.

Sorghums previously identified as resistant to biotype C were evaluated for seedling resistance to the insecticide resistant greenbug population and found to be resistant.

1975. Sorghum Newsletter. 18:90.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

RELEASE OF INSECT RESISTANT SORGHUMS

J. W. Johnson, D. T. Rosenow and G. L. Teetes

ABSTRACT

The Texas Agricultural Experiment Station released sorghums resistant to greenbugs and midge. TAM BK-43 and TAM BK-44 are greenbug resistant B line composities, TAM 2567 and TAM 2568 are yellow endosperm greenbug resistant restorer lines. TAM 2566 is a three dwarf, brown seeded line with high levels of resistance to the sorghum midge.

Grain yields of hybrids made with TAM 2567 and TAM 2568 are presented. Yield of the susceptible check hybrid (a widely grown heterovellow hybrid) was 40% below the TAM 2567 hybrid when greenbug populations were large.

Midge damage ratings of TAM 2566 and other lines are presented. Tests in Georgia and Mississippi were grown and evaluated for resistance by B. R. Wiseman and Lynn Gourley, respectively. Hybrids produced with TAM 2566 are agronomically desirable, brown seeded types with high yield potential. Midge resistance of TAM 2566 hybrids is intermediate between TAM 2566 and the female line used in producing the hybrid.

1975. Sorghum Newsletter. 18:90.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

EVALUATION OF SORGHUM HYBRIDS FOR RESISTANCE TO THE CORN LEAF APHID

J. W. Johnson, G. L. Teetes and D. T. Rosenow

ABSTRACT

The corn leaf aphid, Rhopalosiphum maidis (Fitch), reached damaging levels in several tests on the Lubbock Center in 1974. Prior to blooming, the tests were evaluated for damage caused by corn leaf aphid feedi Entries in the irrigated Texas Sorghum State Wide Performance Test were classified into five groups based on phenotype appearance. Damage ratings were averaged for all medium late and late-maturing hybrids that had similar phenotypic appearance. Since there appeared to be a maturity-damage interaction with early hybrids having less damage regardless of parentage, comparisons are presented only for hybrids of similar maturity.

Four experimental hybrid tests, each with three replications, had common hybrids as checks. Ratings taken on each test were averaged and are presented.

Data from the study indicate that of the hybrids evaluated, TAM 428 hybrids are more resistant to corn leaf aphids than the standard red hybrids and that the yellow endosperm hybrids tested were the most susceptible of the three groups. It appeared that different females had little or no effect on reaction of hybrids, where the same pollinator was used. Several greenbug resistant hybrids were included in the test but there was no indication of an association of greenbug resistance derived from SA 7536-1 and corn leaf aphid resistance.

1975. Sorghum Newsletter. 18:91

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistanc

RELEASE OF CONVERTED ALIEN LINES FROM THE WORLD SORGHUM COLLECTION

D. T. Rosenow, J. W. Johnson, F. R. Miller, and L. E. Clark

ABSTRACT

The Texas Agricultural Experiment Station of the Texas A&M University System and the Agricultural Research Service, U. S. Department of Agriculture, announced the released in December, 1974, of 120 combine height, early-maturing converted alien lines for use as genetic stocks and germplasm source materials by sorghum breeders. These 120 converted lines were developed in a research program, known as the sorghum conversion program, conducted cooperatively by the Texas Agricultural Experiment Station and the Mayaguez Institute of Tropical Agriculture (formerly the Federal Experiment Station) of the Agricultural Research Service at Mayaguez, Puerto Rico.

1975. Sorghum Newsletter. 18:87-88.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

PROGRESS IN SORGHUM BREEDING AND IMPROVEMENT IN THE AMERICAS AND POTENTIAL FOR FUTURE IMPROVEMENT

D. T. Rosenow

ABSTRACT

Early history includes introduction and improvement in these varieties through simple selection. The development of combine height varieties in the 1930's marked the beginning of mechanized harvest.

Development of hybrids in the 1950's was the catalyst for dramatic changes in the sorghum industry in the Americas, including higher yields, expanded areas of production, and formation of private seed companies. Major breeding problems first encountered in the 1960's are discussed.

The availability and utilization of new germplasm, beginning in the late 1960's, marks the beginning of a new era in sorghum breeding and improvement in the Americas. The World Sorghum Collection and the cooperative Texas Agricultural Experiment Station--United States Department of Agriculture sorghum conversion program are providing the new, diverse germplasm sources. The potential in this new germplasm appears outstanding. Outstanding sources of disease and insect resistance, lodging resistance, and grain quality factors have already been identified and are in use in breeding programs.

1975. International Sorghum Workshop, Mayaguez, Puerto Rico.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

INTRODUCTION AND USE OF SORGHUM GERMPLASM IN THE U.S.A. TO MINIMIZE VULNERABILITY

D. T. Rosenow

ABSTRACT

Much diversity exists in sorghum [Sorghum bicolor (L.) Moench]. Unfortunately, most lines in the world Sorghum Collection are of tropical origin and will not mature in the United States because of their short day photoperiod requirement. Use of such introductions is difficult. A breeding scheme involving backcrossing has been developed to transfer tall, tropical varieties into short, day-neutral genotypes adapted to temperate zones. This project known as the Sorghum Conversion Program, involves a backcrossing program under short winter days in Puerto Rico, with selection for short, early genotypes under long days in Texas. The converted lines are released to all breeders and represent diverse germplasm, much available for the first time in a usable form in temperate zones. A few private companies have small, but similar, conversion programs. The conversion materials possess superior sources of most desirable characteristics, most notably disease and insect resistance and grain quality factors. Promising evidence exists in the converted lines for new cytoplasmic-genic sterility systems. Many sorghum breeding programs are making extensive use of this new germplasm.

1975. Agron. Abs. p. 61.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

RESPONSE OF IMPROVED RESISTANT SORGHUM HYBRIDS TO NATURAL AND ARTIFICIAL GREENBUG POPULATIONS

G. L. Teetes, J. W. Johnson and D. T. Rosenow

ABSTRACT

Agronomically improved greenbug resistant sorghum, Sorghum bicolor L. (Moench), hybrids infested with fewer greenbugs, Schizaphis graminum (Rondani), were damaged less and produced higher yields than a genetically comparable greenbug susceptible hybrid under natural insect infestations at Lubbock, Texas. Yields of resistant hybrids were not significantly increased by insecticide treatment under natural greenbug infestations. When large greenbug populations were artificially created by excluding predators and parasites with screen cages, yields of resistant hybrids were reduced. Indications are that greenbug-resistant hybrids with resistance incorporated from one parent should be sufficient to prevent yield loss by natural greenbug population levels.

1975. Journal of Entomology. Vol. 68(4) 546-8.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

OBSERVATIONS ON RESISTANCE TO SORGHUM LEAF BLIGHT

D. M. Tuleen

ABSTRACT

Resistance to sorghum leaf blight, caused by the fungus, Exserohilum turcicum, was investigated in the field and in the laboratory. Evaluations of 70 cultivars revealed no generalized resistance to other foliar diseases or charcoal rot in those cultivars showing resistance to leaf blight. Preliminary testing suggests that E. turcicum resistance in TAM 2572 is controlled by two dominant genes.

Some factors found to enhance sorghum leaf blight infection include: an inoculum density greater than 1,000 conidia/cm² leaf surface; a susceptible host in the 3- to 5- leaf stage of maturity; saturated or near-saturated atmosphere for a 48-hour incubation period. Response of inoculated seedlings in the laboratory was indicative of reactions of plants infected in the field.

A high percentage of germinating spores produced appressoria on leaf surfaces amd a hypersensitive fleck response involving mesophyll tissue but failed to elicit typical lesions. A histological study suggests that mycelium progresses from mesophyll to vascular tissue where it proliferates in susceptible reactions. Resistant cultivars appeared to be better able to restrict mycelial colonization at their vascular tissue than susceptible cultivars. The pathogenesis of this blight is fundamentally one of a localized wilt disease. Vascular plugging occurs both in the form of an apparent host-produced occlusion (hypersensitivity in resistant cultivars) and from the fungus hyphae (in susceptible cultivars).

Evidence for a host-specific toxin produced by *E. turcicum* is presented for the first time.

1975. M. S. thesis. Texas A&M University, College Station, Texas

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance

STUDIES ON OOSPORE GERMINATION, CHEMICAL CONTROL AND CULTURAL CONTROL OF SCLEROSPORA SORGHI, WESTON AND UPPAL, IN SORGHUM

Prakong Vudhivanich

ABSTRACT

eta-glucuronidase and susceptible host extracts failed to stimulate germination of oospores of Sclerospora sorghi. Sometimes a few oospores germinated, but the average never exceeded 1%. The oospores from fresh leaves tended to be more viable than oospores from dry leaves.

In greenhous trials under controlled soil temperatures. the incorporation of KN_3 and NaN_3 into oospore infested soil reduced disease incidence. The application of KN_3 at a rate of 5 ppm completely controlled infection. Both products at a rate of 10 ppm also resulted in complete control. At this rate, KN_3 caused a marked reduction in stand and plant growth.

2-chloro-6-methoxy-4-(trichloromethyl) was effective in controlling downy mildew when applied as a seed treatment at a rate of 1.0 gm per kg of seed. Soil incorporation with Pyroxychlor controlled sorghum downy mildew in the greenhouse when soil incorporation was made at 0.0005, 0.0025, and 0.005 gm per kg of soil prior to planting. Foliar application of Pyroxychlor at emergence and 5-day intervals gave results which were not statistically different.

Cultural control by deep plowing to a depth of 25 to 30 cm reduced the inoculum of the sorghum downy mildew pathogen. Mold-board plowing Almost completely removed the inoculum from surface soil.

In crop rotation experiment, Burgandy pea, cowpea, flax (C.I. 1789), Luther barley, Ora oat and sorghum-sudangrass hybrid (Haygrazer) showed

the ability to reduce inoculum potential significantly.

1975. M. S. Thesis. Texas A&M University, College Station, Texas.

Research supported in part by the United States Agency for International Development through Contract AID/ta-c-1092 entitled Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance.

International Trips Made Representing Efforts to Disseminate Results of the Research Project

BRAZIL

From February 14 to March 2, 1975, Drs. Jerry W. Johsnon and George L. Teetes travelled in the sorghum growing regions and visited several research centers in northeast, south and central Brazil. Dr. Robert E. Schaffert, with the Brazilian National Project on Corn and Sorghum, coordinated the tour. Also assisting with the tour were Dr. James Overman, Dr. Mohamed A. Faris, Antonio F. de Souza Veiga and Carlos Jorge Rosseto.

The following areas and centers were visited: Rio de Janiero, Guanabara; Sete Lagoas, Minas Gerais (The main, new corn and sorghum research center will be located here), IPEACO (Research Center), PIPAEMG (Research Farm); Uberaba, Minas Gerais, IPEACO (Research Farm and PIPAEMG); Capinopolis, Minas Gerais. Research Farm of Agroceres; Ribeirao Preto, Sao Paulo, Research Farm of Contibrasil; Campinas, Sao Paulo, Instituto Agronomico; Sao Paulo, Sao Paulo; Belo Horizonte, Minas Gerais; Recife, Pernambuco, IPA and IPEAWE; Salvador, Bahia; and Brasilia.

In general, the insect situation in sorghum in Brazil was not extremely different than in Texas. The sorghum midge is the key pest. Bollworms and fall armyworms infest the heads and whorls of sorghum, but are occasional pests as they are in Texas. The greenbug situation was the most interesting. In the state of Minas Gerais, greenbugs were present on sorghum, but there was no wheat or any history of wheat in the area. Seeds were sent to Brazil of the various plants required to determine the biotypes.

The sorghum midge could be managed by planting date manipulation in some areas, but resistant varieties will be extremely important in

that developing country. Midge resistant sorghums developed in Texa were observed in several International Disease and Insect Nurseries in Brazil. Their reaction to midge appeared very similar to what ha been observed in Texas.

Dr. Carlos Rosseto has also discovered a midge resistant sorghum AF 28. We were able to obtain seed of this line. The cooperative research effort with the Brazilians should continu

MEXICO

From April 16-18, 1975, R. A. Frederiksen toured the sorghum research nurseries and facilities with Dr. Shree Singh, CIMMYT, in Poza Rica and El Batan, Mexico. IDIN notes were made on rust and Cercospora leaf spot. Other sorghum diseases present included leaf blight, Fusarium stalk rot, Fusarium head blight, bacterial stripe, anthracnose, sorghum downy mildew, maize dwarf mosaic, zonate leaf spot and seed mold. Later, in June and July, a sorghum downy mildew epidemic developed in maize at the Poza Rica nursery site. Several sorghum selections at Poza Rica were noted with excellent leaf disease resistance including certain items released from the Texas Agricultural Experiment Station.

VENEZUELA

From Ausust 22-29, 1975, R. A. Frederiksen completed a tour of the downy mildew epidemic in Venezuela. The visit was sponsored by Fondo Nacional de Investigaciones Agropecuarias, Venezuela. A report describ ing a Venezuelan national program for control of downy mildew was prepared with Dr. B. L. Renfro, Rockefeller Foundation, Thailand. The following areas or topics were recommended:

I. Development of a coordinated Venezuelan maize and sorghum improvement program.

II. An outline of research needed to make critical control recommendation suggestions for cooperative applied research in breeding, pathology, and regulation were made.

II. Additional equipment and resources needed to accelerate downy mildew control.

IV. Expansion of the research staff. We recommend hiring at least one senior staff scientist to help coordinate the research. Graduate training and other educational programs. Several enezuelan students are at Texas A&M and others are expected.

NIGERIA-INDIA

From September 23 to October 9, 1975, R. A. Frederiksen traveled to India for a downy mildew and ergot consultants meeting on pearl millet at ICRISAT, and had the opportunity to review the millet and sorghum research in Nigeria enroute. For two days, meetings were held with J.P. 26 staff and members of the faculty of Ahmadu Bello University and tours were made of the research plots and farmers fields in Northern Nigeria. Major research activities included striga, smut, ergot, and downy mildew resistance selections in pearl millet, seed mold, striga, anthracnose, and oval leaf spot research on sorghum. Dr. Zummo considers himself to be a foliage disease pathologist and by unique coincidence, environments during the past 2 years have permitted severe levels of foliage disease development. It was observed that Dr. Zummo and Simon K. Manzo are contributing leadership to cooperative programs which have significant value.

In reference to the trip to ICRISAT, one of the major concerns at the consultants meetings was the question of physiologic races of

Sclerospora graminicola, causing downy mildew. Dr. Zummo and Dr. Girard (Bambey, Senegal) are cooperating in a multi-country regional nursery program that will provide evidence to determine whether such races exist. For example, Senegal dwarf pearl millet resistant at Bambey, Senegal, was heavily attacked at Samaru. Consequently, their report will be of value to each of the millet improvement programs.

A similar nursery program has been established for striga, and it includes sorghum, maize, and millet differential varieties. Between these nurseries and the local pearl millet "sick plots", observations have been made on sources of resistance for downy mildew, ergot, striga, and smut.

In addition to host plant resistance, biological control of striga is being investigated. Dr. Zummo is evaluating the effectiveness of 2 pathogens of striga. While it would be inappropriate for me to review the specifics of the progress to date, I was impressed with the potential usefulness of such a control program in Africa. This work requires a high priority status and should be continued following the termination of J. P. 26.

Another technique developed at Samaru was a standard scale for evaluating seed mold. Seeds from different lots were separated and graded into 10 lots ranging from free from molds to completely covered. These seed lots were dried, killed, and fixed and sub samples of each lot were distributed to cooperating centers for reference when grading seed lots for mold. All seed lots to be graded are threshed and examined under a 10X lens. Highly consistant and reproducible evaluation among various workers have been possible using this system. On the field trip between Zaria and Kano, striga, anthracnose

kernel smut and other foliar diseases were noted.

In India, an indepth study and review on downy mildew and ergot of pearl millet was made with 11 other consultants and ICRISAT staff members. The panel established research priorities and recommendations which were presented to the ICRISAT staff.

Sorghum and millet research plots were toured with Drs. Williams, Rao and Singh, cereal pathologists at ICRISAT. Currently, they have developed useful techniques for artificially evaluating seed mold and ergot. While we do not anticipate working with the ergots of millet and sorghum in the U. S., their seed mold techniques will be very useful. They had large plantings of TAM bks 45, 46, 47, and 48 at ICRISAT which generally looked good but had poor seed quality under prevailing conditions at Hyderabad. All of the usual foliage pathogens were present at Hyderabad and the staff anticipates a full scale screening program during future growing seasons. Both millet and sorghum downy mildew nurseries are being established.

Following the consultants meeting, a tour was made with Dr. Sundaram of the Indian Agriculture Research Institute and others to Mysore to spend a day with Dr. Safeeulla and his students. Dr. Safeeula has an excellent nursery and laboratory research program on downy mildew and an impressive staff. Most of their research is published and it was of considerable interest to examine first hand their axenic cultures of Sclerospora graminicola and microscopic sections of downy mildew infected seed. I also visited the staff at Coimbatore, where they have a large and aggressive sorghum and millet improvement program for South India. We were able to visit Professor Govindu at the University of Agricultural Science, Hebbal, Bangalore,

briefly, and spent one day at Delhi reviewing the sorghum and millet work at IARI with Dr. Sundaram. Currently, Dr. Sundaram is directin the All India Coordinated Sorghum and Millet Research as well as maintaining a strong pathology research program for these cereals. During 1975, for example, he sent out some 3000 "mini trials" of pearl millet. These trials were partially for disease and agronomic data as well as for extension purposes. Another highlight of his program has been the selection of ergot resistant millets. The nature of this resistance is not understood, but I would strongly urge that it be examined. We also toured a number of farmers' fields of sorghum and millet. He wanted me to see the low yield potential of the "common" millets, the high degree of damage in the downy mildew susceptible hybrids and the extremely favorable results of the newer downy mildew resistant hybrids. In sorghum, mostly of a photosensitive type, we saw unusually severe damage caused by Cercospor leaf spot. Other sorghum diseases included kernel smut and seed mold.

F. Statement of Expenditure

Budget Category	Estimated 2/15/74-3/1/76	Actual 2/15/74-3/1/76	Planned for 2/15/76-2/28/77	Estimated 3 year total /15/74-2/28/7
Salaries and Wage	$54,700	$51,388	$54,600	$105,988
Fringe Benefits	4,770	3,801	5,191	8,992
Overhead	26,212	24,902	26,750	51,652
Equipment and Supplies	23,600	28,343	15,140	43,483
Travel and Per Diem	25,397	27,561	21,188	48,749
Other Direct Costs	15,285	6.062	15,020	21,083
Total	$149,946	142,057	$137.889	$279 946

Listed below is a partial list of news releases and public media articles. Copies of other news media articles are given on the following pages as examples.

Sorghum 'Resistance Mechanism', Soughwest Farm Press, January, 1976.

Can You Hold Greenbugs in Check?, Dekalb Crop Management, Spring, 1975.

Greenbug Resistant Sorghum Hybrids, The Progressive Farmer, December, 1974.

Greenbug Resistant Sorghum, TAES. Brief Reports on Agricultural Research in Texas, July, 1975.

Sorghum With Resistance to Greenbugs, Dekalb Crop Management, Fall, 1975.

TAES Field Day to Spotlight Cotton Varieties and Greenbug Resistant Grain Sorghums, TEAS News Release. Research Report #78, August, 1975.

Greenbug Resistant Hybrids Need More Management, The Progressive Farmer, March, 1976.

TAES Releases Sorghum Breeding Stocks. TAES News Release. Research Report #72, June, 1975.

New Sorghums Fight Greenbugs, Farmers Stockman, December, 1975.

NEWS

THE TEXAS AGRICULTURAL EXPERIMENT STATION / J. E. Miller, Director / The Texas A&M University System
Agricultural Research and Extension Center / Lubbock / Telephone (AC 806) 746-6101

December 6, 1974

RESEARCH REPORT #55

LUBBOCK -- A Lubbock research scientist has been invited to address a premier gathering of U.S. agricultural researchers in Chicago, December 10-12.

He is Dr. Jerry Johnson, a six-year veteran researcher with the Texas Agricultural Experiment Station at Lubbock.

Johnson's topic, the development of insect resistance in sorghum varieties for the High Plains, is one of 20 selected talks for the 29th Annual Corn and Sorghum Research Conference.

The prestigious meeting sponsored by the American Seed Trade Association is expected to draw some 900 of the country's top corn and sorghum researchers from throughout the U.S.

The TAES scientist will depart Lubbock on the 9th, returning the 13th

Johnson, recently promoted to associate professor, received recognition in the press and in scholastic journals earlier this year along with his co-researchers for developing midge (an insect) resistant sorghum lines for the High Plains. He also has been instrumental in helping to develop greenbug resistant material for the High Plains, working with TAES researchers Dr. Darrell Rosenow and Dr. George Teetes Rosenow is associate professor, working in sorghum research, and Teetes is associate professor in entomology.

NEWS

THE TEXAS AGRICULTURAL EXPERIMENT STATION / J. E. Miller, Director / The Texas A&M University System
Agricultural Research and Extension Center / Lubbock / Telephone (AC 806) 746-6101

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Research Report #60

TAES SORGHUM SCIENTIST STILL HAS NOT HARVESTED SORGHUM

LUBBOCK -- An agricultural scientist here is four months behind in harvesting part of his grain sorghum. What's more, the crop--some of it standing, some fallen over--won't be harvested for another two to four weeks.

Dr. Darrell Rosenow, associate professor with the Texas Agricultural Experiment Station is using High Plains winter winds to improve experimental sorghum varieties.

More specifically, his aim is to develop a sorghum plant that won't readily fall over, bend, break or lean under we atures. Scientists and farmers alike refer to each of these maladies as lodging.

"Strong winds, which reach 50 mph or higher several times during the winter cause most commercial hybrids to become 100 percent lodged," says Rosenow. "By comparison we have several experimental sorghum lines that lodge less than [illegible] percent under the same conditions."

Plants which are bent, broken, or leaning prevent efficient harvesting, or cannot be harvested at all

"Moisture stress, weak neck lodging (heads broken over at base by winds or ice), and stalk breakage caused by strong winds are the major problems encountered on the High Plains," Rosenow explains.

'Severe moisture stress late in the season can turn a well irrigated sorghum

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field into a mass of fallen stalks with poorly developed grain. When plants go into severe moisture stress during the grain development stage, stalks are weakened and charcoal rot often develops inside the stalk."

Charcoal rot is a threat to both irrigated and dryland farmers alike, Rosenow adds. In tests at the Texas A&M University Agricultural Research and Extension Center where lodging test plots are grown, irrigation water is cut off late in the season to induce moisture stress. Then charcoal rot-infected toothpicks are inserted into the base of the stalks, allowing researchers to identify experimental sorghum lines with superior charcoal rot resistance.

"Unfortunately, it appears that for a hybrid to have good lodging resistance both parents must be resistant," Rosenow concludes. "This means it takes much longer to finally develop an agronomically acceptable hybrid.

Sorghums that stand well through winter at Lubbock have an excellent chance of being resistant to other types of lodging, he emphasizes. These include root lodging, when the entire stalk leans due to wind and wet soil, and root rot. With the latter, the root system decays, making plants more susceptible to lodging.

Rosenow's research efforts are in cooperation with TAES scientists Dr. Jerry Johnson, sorghum breeder, Dr. George Teetes, entomologist, both of Lubbock, Dr. R. A. Frederiksen, pathologist, Dr. Fred Miller, sorghum breeder, and Dr. Keith Schertz, ARS-USDA geneticist, all of College Station.

joj-nsm

FOR MORE INFORMATION, CONTACT:

Dr. Darrell Rosenow
Texas A&M Agricultural
Research and Extension Center
Route 3
Lubbock, Texas 79401
(806) 746-6101

RADIO - TV NEWS

THE TEXAS AGRICULTURAL EXPERIMENT STATION/ J. E. Miller, Director/ The Texas A&M University System
College Station, Texas 77843 Telephone (AC-713) 845-2211

August 25, 1975 FOR RELEASE ON RECEIPT

A SPECIALIZED SORGHUM BREEDING PROGRAM WAS REVEALED THIS WEEK TO THE AMERICAN SOCIETY OF AGRONOMISTS MEETING IN KNOXVILLE, TENNESSEE. RESEARCH SCIENTIST, DR. DARREL ROSENOW OF THE TEXAS AGRICULTURAL EXPERIMENT STATION, DESCRIBED THE SORGHUM BREEDING METHOD TO TRANSFER TALL, LATE MATURING TROPICAL SORGHUM VARIETIES INTO SHORT, DAY-NEUTRAL LINES TO ADAPT SORGHUM TO TEMPERATE ZONES. CURRENTLY, MOST SORGHUM LINES ARE TROPICAL AND WILL NOT MATURE IN TEMPERATE ZONES. THE PROJECT IS KNOWN AS THE SORGHUM CONVERSION PROGRAM, A COOPERATIVE EFFORT BETWEEN THE TEXAS AGRICULTURAL EXPERIMENT STATION AND THE USDA AGRICULTURAL RESEARCH SERVICE. AMONG THE MOST NOTABLE CHARACTERISTICS IN THE PROJECT IS THAT THE CONVERSION PROGRAM WILL INTRODUCE BETTER INSECT AND DISEASE RESISTANCE, BETTER LODGING RESISTANCE, AND IMPROVED GRAIN QUALITY IN THE SORGHUM.

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G Work Plan and Budget Forcast for Coming Year

1. Evaluate and screen selected sorghum introductions as they become available and appropriate converted and partially converted exotic lines for downy mildew, head smut, foliage diseases, webworm, bollworm, cornleaf aphid, yellow sugarcane aphid, midge, and mite in nurseries at the appropriate locations in the state.

2. Breeding lines containing disease and insect resistance will be screened and evaluated for resistance to downy mildew, head smut, maize dwarf mosaic, lodging, charcoal rot, greenbug midge, and Banks grass mite. They will also be evaluated for anthracnose, seed mold, head blight, gray leaf spot, zonate leaf spot, leaf blight, rust, and bacterial stripe if they reach sufficiently high infection levels.

3. The International Disease and Insect Nursery (IDIN) will be updated to include new and improved disease and insect resistant sources. The IDIN will be distributed to all persons requesting seed and to anyone throughout the world with which contact has been established and which indicate an interest in obtaining promising sorghum materials. Data recording forms and instructions will be sent with each test.

4. The All Disease Nursery (ADN) will be updated to include improved disease resistant sources as well as elite insect resistant sources. The ADN will be grown at strategic locations over the United States for disease evaluation. Insect

Lodging nurseries will be planted at several locations over Texas to screen promising lines for the several types of lodging which may occur such as root lodging, weak neck, moisture stress-charcoal rot type lodging, after-freeze stalk breakage, and insect-lodging complexes.

6. Artificial inoculations with selected pathogens will be done to complement natural screening programs when: a) isolation of specific races or diseases are needed, b) for identification of certain host genetic traits, c) during off-seasons when natural infection is not possible, and d) fo studies on nature and mechanisms of host resistance.

Biological, chemical, and cultural control of selected pathogens will be studied as a means of enhancing host resistance or as alternate means of control

8. The Grain Weathering Test (seed mold) will be grown at several locations throughout Texas under severe weathering conditions to screen for resistance to seed mold. Molds from various regions will also be used in artificially inoculated tests.

9. Several populations containing disease and insect resistance will be grown and random mated. TP13 (R-line waxy) and TP14 (R-line waxy) will be random mated in Puerto Rico and be random mated the third time at Lubbock during the summer or 1976. TP10 (MDM resistant) will be artificially inoculated for MDM and only the resistant plants random mated. In TP9 (lodging resistant), 200 S$_1$ lines will be

evaluated for lodging resistance and root rot for recombinati

A new head smut resistant population will be developed by recombining head smut resistant S_1's selected from several existing populations. Up to 500 S_1's from the existing popula tions will be screened for head smut resistance at various smut nurseries over the State which represent the different races of head smut.

10 Selected elite disease and insect resistant breeding lir will be released and distributed as they are identified and seed is increased. Also, random mated populations such as TP2 (multiple disease resistant), TP13 (B waxy), and TP14 (R waxy) may be released if the random matings are completed successfully.

11 Continue to select improved agronomic lines with midge resistance from the midge breeding nursery. A replicated Midge Resistant test will be assembled from the midge resistant lines selected from breeding nurseries in 1975. The test will be grown at several locations throughout the Southe United States and South America.

12 Midge resistant selections will be made from TP8R for evaluation in S_1 rows to identify those lines to be composited for additional random mating. S_1 rows will be grown in the Rio Grande Valley in the winter of 1976 Selections will be made within S_1 rows of improved agronomic types for inclusion in the midge breeding nursery.

13. Emphasis will be placed on the development of midge resistant "B" lines. Selections will be made from F_2 populations of midge resistant lines and elite U.S. "B" line material. These selections will be crossed to "A" lines and both the "B" lines and F_1's will be planted in one or more midge nurseries to identify lines that are midge resistant and have produced sterile F_1 hybrids.

14. Continue to backcross previously identified greenbug resistant lines to elite U.S. lines to transfer the genes for resistance into improved agronomic types.

15. Evaluate the performance of greenbug resistant sorghums under expanded acreage of 1976.

16. Grow S_1 rows from TP1R to identify those rows to be included in the next cycle or random mating.

17. Evaluate mite resistant sorghums, F_1 hybrids and derived breeding lines in nurseries at Pecos.

18. Continue screening and evaluation of sorghum midge resistant sorghums. Conduct screening trials of regional tests of selected material prepared by Dr. Jerry W. Johnson. Develop a uniform testing program of screening midge resistant sorghums by manipulation of planting dates and adult midge counts.

19. Continue to improve techniques for determining the mechanisms of resistance to the sorghum midge and spider mites. Compare resistant and susceptible sorghums under natural and

introduced infestations and determine a) egg deposition and hatching, b) larval development and survival, and c) adult emergence and sex.

Budget Estimate

	LUBBOCK	COLLEGE STATION		Grand total
		Pathology	Entomology	
Salary & Wages	$31,000	$11,100	$8,500	$50,600
Fringe benefits*	3,000	1,125	725	4,850
Overhead**	15,190	5.435	4,165	24,790
Equipment & supplies	8,140	3,500	3,500	15,140
Travel & per diem	10,500	4.500	4,600	19.600
Other direct costs	8,700	3,820	2,500	15,020
Total	$76,530	$29,480	23,990	$130,000

*Based on 0.08525 Salary and wages and TAMU Insurance Contribution ($180 per employee)

**20 percent of salary and wages.