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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
Mission to Pakistan.

**PROJECT ASSISTANCE COMPLETION REPORT
UAF/GRTSM PROJECT ACTIVITIES**

**Agriculture Sector Support Program
A.I.D. Project No. 391 - 0492.
Project Implementation Letter (PIL) No. 34**

Prepared by

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July - August , 1994.

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LIST OF ACRONYMS

ASSP	Agricultural Sector Support Program
GOP	Government of Pakistan
GRTSM	Grain Research, Training and Storage Management (Cell)
KSU	Kansas State University (USA)
PARC	Pakistan Agricultural Research Council
PFD	Punjab Food Department
PIL	Project Implementation Letter
PLA	Personal Ledger Account
STDT	Storage Technology Development and Transfer
UAF	University of Agriculture, Faisalabad
USAID	United States Agency For International Development

PROJECT ASSISTANCE COMPLETION REPORT

1. BASIC PROJECT DATA

Title of the Project: Agricultural Sector Support Program (ASSP),
UAF/GRTSM Project Activities

Project Number: ASSP No. 391-0492

Authorization Document: Project Implementation Letter (PIL) No. 34

Date Authorized: January 05, 1993.

Amount Originally Authorized: US\$ 50,000 equivalent to approximately
Rs. 1,250,000

Amount Obligated: US\$ 50,000 equivalent to approximately
Rs. 1,250,000

Commodities - Custody
Transferred to UAF Cost not indicated

Amount Reimbursed: i) Amount reimbursed up to Nov. 1993
= Rs. 622,634
ii) Bills for the remaining period were being
processed by UAF.

* Total approximate amount to be reimbursed
as anticipated by UAF = Rs. 1,060,000

Project Assistance Completion
Date (PACD): June 30, 1994.

Implementing Agencies

1. Ministry of Finance and Economic Affairs
2. Ministry of Food Agriculture and Cooperatives
4. University of Agriculture, Faisalabad

2. PROJECT OBJECTIVES

The purpose of the project was to assist the Grain Research, Training and Storage Management (GRTSM) Cell established by the University of Agriculture, Faisalabad (UAF) to institutionalize the research, training and outreach program of the Storage Technology Development and Transfer (STDT) project activity of ASSP.

3. PROJECT COMPONENTS

The project components were defined as under:

- * Institutionalize the research, training and outreach program of the STDT project activity of ASSP.
- * Cooperate with PARC on insect resistance studies and research in bulk storage protection.
- * Cooperate with public and private sector institutions in research and training in grain storage and management including grading and quality control.
- * Set forth procedures for procurement of goods and services.

4. INPUTS

i) **Funds:** The PIL # 34 earmarked and committed U.S. dollars 50,000, equivalent to approximately Rs. 1.25 million, out of FY88 (\$27,000.00 DRA#391K606A.09) and (\$23,000.00 DRA#391K606B.03) FY89 funds. This amount was charged to the "Other Costs" line item of ASSP. The funds were from the local currency cost portion of the USAID contribution to support the operational cost of the newly established GRTSM Cell of UAF, but would not include the salaries and related payments for regular UAF employees. USAID provided the money for one and a half years effective January 01, 1993 with the requisite that UAF would ensure to provide equivalent funds in the following and subsequent fiscal years, to make the GRTSM Cell fully operational as a viable bulk handling and storage management unit of UAF. The illustrative budget is annexed with copy of the PIL No. 34 at Annex "A".

ii) **COMMODITIES:** USAID transferred to UAF custody of a portion of the STDT project commodities to facilitate UAF to make a start to implement the training, research and outreach program of the STDT project activities. The commodities comprised equipment for training, research and bulk grain handling. The cost of the equipment was not indicated.

5. PROJECT ACCOMPLISHMENTS

i) Opening of Personal Ledger Account (PLA): The UAF opened a PLA No. 7450 in the name of Dr. Muhammad Rafiq Khan, Project Director, GRTSM Cell and placed an amount of Rs. 200,000 in the PLA to meet the cost of the GRTSM Cell activities. The amount did not meet the condition laid in section (C2) of PIL # 34 which required UAF to place an approximate amount of Rs. 500,000 in the PLA. The amount was subsequently recouped as and when needed. The disbursements made by GRTSM Cell for allowable costs as given in the budget annexed with PIL # 34, are being reimbursed by USAID. Dr. Muhammad Rafiq Khan worked as Project Director GRTSM Cell in addition to his normal duties as Vice Chancellor (VC), UAF.

ii) Appointment of Professionals: After getting clearance from USAID, the following staff was appointed against the budget line item "Professionals":

Coordinator/Consultant	-----	One
Lecturer	-----	One
Accountant	-----	One
Research Fellows	-----	Three
Lab-Attendant	-----	One
Drivers	-----	Two
Mechanic/Heavy Duty Driver	-----	One
Daily Paid laborers	-----	Two

Prof. Dr. Manzoor Ahmad was appointed as Coordinator/consultant, GRTSM cell, UAF.

iii) Renovation of Grain Storage Research Laboratories: The GRTSM cell was housed in the old building of the department of Agri. Entomology. The building was in a dilapidated condition and the laboratories were not suitable and conducive for undertaking research in the field of grain storage management. Therefore the building was renovated and provided with adequate laboratory facilities. Thus the laboratories were made appropriate to function as the training and research center of the GRTM Cell. The VC, UAF graced the occasion of opening ceremony of those laboratories on June 17, 1993.

iv) Publication of Grain Storage Management News Letter: In order to facilitate transfer of knowledge, a bi-annual publication of "Grain Storage Management News Letter" was initiated by GRTSM Cell. Its first issue of January, 1994 is at Annex "B".

v) Diploma Course in Grain Storage Management: A Two-semester diploma course in Grain Storage Management was initiated by UAF. The Academic Council, the Syndicate and the University Senate approved the courses for the two semesters which are detailed at page 3 of Annex "B". The diploma course covered the theoretical and practical

aspects of grain storage management. The purpose of starting the diploma course was to produce trained manpower for food grain handling agencies because such facility did not exist in the country.

The first batch of nine students completed the diploma course out of which six were admitted on open merit and three were nominated by the PFD. The particulars of the students in the first batch are at page 6 of Annex "B". The training of the second batch was expected to be completed by end of year 1994.

vi) Outreach Program for Storage Management: GRTSM cell organized one-day workshops for the PFD staff working in the Faisalabad, Toba Tek Singh, Jhang and Sahiwal districts and Gujranwala division. The purpose of the workshops was to demonstrate the technique of fumigation under polyethylene cover and discuss the problems related to insect pests, rodents pests, fumigation techniques and magnitude of storage losses with the participants.

The first workshop was organized on October 12, 1993 at Faisalabad. All the PFD staff posted in the Faisalabad district participated in the workshop.

The second workshop was held at Toba Tek Singh and the third at Jhang. Those two workshops were attended by the PFD staff working in the Toba Tek Singh and Jhang districts respectively. The trainers of the workshop were from GRTSM, PFD and PARC.

The program had to be discontinued temporarily due to the wheat harvest and would be resumed by about August, 1994.

vii) Wheat Stock Preservation Program for the Rural Poor: Three workshops for one or two days were organized for the farmers and rural women in collaboration with National Rural Support Program to apprise them about insect pests and preservation methods of their domestic wheat stocks. About 60 male and female representatives of different community organizations participated in the three workshops.

viii) Research Projects: Eleven research projects were approved in a meeting held under the chairmanship of VC, UAF on July, 1993. The detail of the research projects is at page 2 of the Annex "B".

The research projects were problem-oriented and were being carried out in GRTSM Cell in collaboration with the PFD. The status of the research projects was as under:

* **Monitoring Resistance in Stored Grain Insect Pests to Phosphine and Grain Protectants:** (Researchers - Dr. Manzoor Ahmad/Mr. Mansoor-ul-Hassan). The work is in progress on the following aspects of the project:-

a) Studies on level of resistance against phosphine gas in various strains of *T. castaneum*.

- b) Studies on level of resistance against phosphine gas in various strains of R. dominica.
- c) Studies on level of resistance against grain protectants in various strains of T. castaneum and R. dominica.

* **Ecology of Grain Storage Losses :** (Researchers - Dr. Manzoor Ahmad/Mr. Mansoor-ul-Hassan). The research work is progress on "Assessment of Losses due to Insect Pests and Quality Analysis of Wheat".

* **Comparative Studies on Traditional and Supervised fumigation:** (Researcher - Dr. Manzoor Ahmad). The following research works had almost been completed:-

- a) Under-sheet Fumigation of Cap Storage at Jhang.
- b) Fumigation by Conventional and Improved Methods at Faisalabad HT godowns.

* **Determination of Phosphine Dosage for Effective Insect Control Under Polyethylene Cover:** (Researcher - Mr. Sajjad Ahmad from PARC). The research work had been completed and the results were expected to be sent to the end users soon. The Executive Summary is at Annex "C".

* **Physical Quality of Grain and Insect Management in Bini Shell:** (Researcher - MR. Sajjad Ahmad from PARC). The work had been completed and the research paper was expected to be issued soon. The Executive Summary is at Annex "D".

* **Physical Characteristics of Wheat in Punjab:** (Researcher - Dr. Faqir M. Anjum). The wheat samples of the year 1993 were collected from the PFD godowns and the local grain markets of: i) Sheikhpura and Jhang districts and ii) Faisalabad and Multan districts. The summary of physico-chemical characteristics of wheat grain in each of the two above sets of the districts is at Annex "E" and "F" respectively. The results of other tests had also been compiled.

The samples of the wheat year 1994 had also been collected from the PFD godowns and the local grain markets of the above two sets of the districts. After completing the work on the samples of the wheat 1994, the research results on the physical characteristics of wheat of year 1993 and year 1994 would be compiled and sent to the end users.

* **Comparative Study of Different Storage Structures:** (Researcher - Asghar Ali Rana). The work is in progress.

* **Economics of Bulk Handling of Wheat:** (Researcher - Mr. Qamar Mohyuddin). The research work is in Progress.

* **Qualitative and Quantitative Evaluation of Aflatoxin in Stored Wheat Samples:** (Researcher - Mr. M.A. Nasir). The project is in progress.

ix) Cooperation with Public and Private Sector Institutions:

a) **Public Sector Institutions:** The GRTSM Cell cooperated with the PFD to conduct all the training, research and outreach programs because PFD storage facilities, wheat stocks and officials had been associated with those programs. There had also been cooperation with PARC as Mr. M. Sajjad Ahmad, Senior Scientific Officer from PARC carried out research work in GRTSM Cell on two important research projects.

b) **Private Sector:** A program for the rural-poor had been conducted in collaboration with National Rural Support Program as already explained above.

x) **Procedures for Procurement of Goods and Services:** The normal procedures, rules and regulations prescribed for the UAF were adopted for the procurement of goods and services.

xi) **Organizing Seminars:** GRTSM could not organize any seminar though it was expected that three seminars of three days duration would be organized each year as is indicate in Annex I attached with PIL 34.

xii) **Utilization of the Bulk Grain Handling Equipment:** The GRTSM Cell could not carry out any bulk grain handling operation. Therefore the grain handling equipment received from USAID/STDT project was temporarily housed in the workshop of the Farm Machinery Department. Efforts were being made to establish a field laboratory at Post Graduate Research Station of the UAF for bulk handling and storage of food grain. It was expected that the field laboratory when established, would provide an appropriate facility to the students to get training in the bulk grain handling operations by using the above equipment.

xiii) Future Plan: The future plan indicated by the coordinator/consultant, is as under:

a) The GRTSM Cell has to continue its training, research and outreach program in the coming years. An amount of Rs. 700,000 has been requested for the year 1994-95 to continue the activities during the year. The services of the Professionals have been extended up to December 31, 1994.

b) The coordinated and problem-oriented research projects are to be carried out in collaboration with the PFD and other food handling agencies.

c) The diploma program needs to be raised to graduate and post-graduate levels and for this purpose strenuous efforts would be made to develop courses and process those through various statutory bodies of the University.

6. LESSONS LEARNED:

- * If a new course is required to be introduced in a University which is oriented to a specific technology, it could be managed properly through a separate cell established within the University.
- * In case financial assistance is provided to a University for a short period, it could be utilized better for the "Training and Short-term Research Projects" because the desired results could be expected to be available to the end users by completion of the project as otherwise in case of "Long-term Research Projects" the results might not be available by completion of the projects and later on, if the University is unable to provide the finances, the projects would linger on indefinitely and possibly fizzle out completely.
- * The outreach training program is very useful to address the problems faced by the grain handling agencies because the program will include the demonstrations to illustrate and implement the research results related to the problems.
- * The bulk grain handling equipment could be properly utilized by the University for the training purposes had the University owned sufficient quantity of the food grain and adequate bulk storage facilities, or else had the University been provided finances to procure sufficient food grain and construct adequate capacity of bulk storage facilities.

Annex "A".

Copy of PIL No. 34 (5 pages)



UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

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OFFICE OF AGRICULTURE AND RURAL DEVELOPMENT

05 JAN 1993

Mr. S. Navaid Ali Nasri, Joint Secretary
Economic Affairs Division
Ministry of Finance and Economic Affairs
Government of Pakistan
Pak Secretariat Block C
Islamabad.

Subject: Agricultural Sector Support Program (ASSP)
A.I.D. Project No. 391-0492
Project Implementation Letter (PIL) No. 34

Dear Mr. Nasri:

The purposes of this PIL are to:-

- a) Earmark and commit funds to cover the operational cost of the Grain Research, Training and Storage Management (GRTSM) Cell established by the University of Agriculture, Faisalabad (UAF). This Cell is being established, in part, to institutionalize the research, training and outreach program of the Storage Technology Development and Transfer (STDT) activities under the subject Program. The GRTSM Cell/UAF will:
 - I) Cooperate with PARC on insect resistance studies and research in bulk grain storage protection; and
 - II) Cooperate with public and private sector institutions in research and training in grain storage and management including grading and quality control.
- b) Set forth procedures for procurement of goods and services.
- c) Set forth the procedure to be followed for replenishment/reimbursement of funds to the University of Agriculture, Faisalabad.

K492002 - \$27,000.00 DRA# 391K606A.09
L492071 - \$23,000.00 DRA# 391K606B.03

A. Earmarking and Commitment

This PIL earmarks and commits U.S. dollars \$50,000, approximately equivalent to Rs. 1.25 million, out of FY88 (\$27,000.00 DRA#391K606A.09) and (\$23,000.00 DRA#391K606B.03) FY89 funds. This amount will be charged to the "Other Costs" line items of ASSP. These funds are from the local currency costs portion of the USAID contribution and are to be used for small value procurement of equipment and professional services and other operational expenses. The funds will support the operational cost of the newly-established GRTSM Cell under UAF, but will not include salaries and related payments for regular UAF employees. USAID will provide this money for one and a half years, effective from January 01 1993 and UAF should ensure that equivalent funds are provided in the following and subsequent fiscal years, to make the GRTSM Cell fully operational as a viable research and outreach unit of UAF. The illustrative Budget is provided at Annex 1.

B. Procurement Procedures:

Local procurement of goods and services, as described in USAID Handbook 1, Supplement B, Chapter 18 (appended herewith as Annex 2), will be the mode employed. USAID requirements are summarized below:

1. All purchase orders and other contracts shall include all applicable USAID mandatory clauses, as discussed in Handbook 11 "Country Contracting," Chapters 1 and 3 (appended herewith as Annex 2).

2. The GRTSM Cell/UAF shall procure the required commodities. Suppliers of goods and services are to be selected with the maximum degree of competition practical, i.e., informal competitive procedures, whereby several potential suppliers are considered.

3. Price Requirements:

(i) The buyer shall pay no more than the lowest available price, including transportation. The term "reasonable price" means the price which satisfies this test.

(ii) The requirement that the buyer pay no more than the lowest available price will be satisfied if the buyer has followed sound procurement practice and accepts the most advantageous offer, price and other pertinent factors considered, such as quality of the goods and services, delivery time, transportation costs, payment terms, availability of spare parts, installation and repair services. When competitive offers are not available, as in the case of sole-source procurement, some form of cost or price analysis should be used to establish the reasonableness of price.

4. The GRTSM Cell/UAF may procure goods originating in Free World countries designated by AID Geographic Code 935 if the value of each individual transaction does not exceed the equivalent of \$5,000. The list of relevant AID Geographic Codes is appended herewith as Annex 4. For larger transactions, the only authorized countries of source and origin are the U.S. or Pakistan.

5. Suppliers of services are to be selected on the basis of technical qualifications.

6. No services or commodities will be procured from government or semi-government entities, and AID will not reimburse identifiable local taxes, tariffs, or other impositions of the GOP and/or any of its subdivisions or agencies. USAID funds may not be used to finance the purchase of goods from non-Free World countries or for entertainment, decoration or luxury items.

7. Salary and allowance levels must be consistent with existing GOP policy.

8. Marking: The implementing agency should ensure that goods procured with USAID funds are marked with appropriate decals, and construction sites and other appropriate locations are identified with display signs indicating participation by the United States in the activity. USAID will be pleased to provide the decals to mark equipment.

C. Replenishment/Disbursement Procedures:

1. USAID will not disburse any funds under this PIL until USAID has conducted a financial capability assessment of the Grain Research, Training and Storage Management (MRTSM) Cell and any material deficiency which may be identified in the assessment has been corrected.

2. The UAF will place approximately Rupees five hundred thousand (Rs 500,000) in a non-lapsable UAF Personal Ledger Account (PLA) opened in the name of the Project Director, GRTSM Cell within UAF, to meet the cost of GRTSM Cell activities.

3. The Project Director, GRTSM Cell will make disbursements from the PLA for allowable costs as given in Annex 1 attached to this PIL. The Budget is illustrative only, and expenditures for particular Budget line items are not restricted to the amounts shown. However, the totals for each of the expenditure categories can not be exceeded unless otherwise agreed to by USAID in writing.

4. On the last working day of each month, GRTSM Cell/UAF will prepare a report showing expenditures for that period. The expenditure will be listed by Budget line items shown in the Budget in Annex 1. The report will be presented in the format provided in Annex 5. Each report should be promptly submitted by UAF to the USAID Mission Controller through the ASSP/STDT Project Officer at USAID/Islamabad, Pakistan.

Radi/Nasri letter
Page Four

5. Upon review and approval of each report by USAID, the amount of expenses incurred by GRTSM Cell, which USAID approves from the above said report, will be replenished.

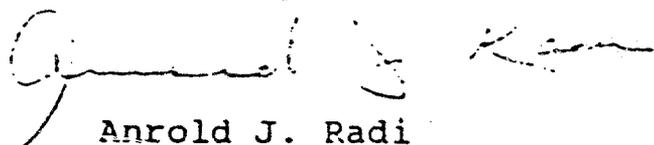
6. GRTSM Cell will maintain separate books and records relating to the activities authorized in this PIL, in accordance with generally accepted accounting principles and practices. These records will show the receipts and use of USAID funds by which goods and services are acquired. These books and records will also be adequate to show the nature, basis and extent of replenishment, and compliance with applicable AID regulations in procurement of USAID-funded goods and services.

7. Upon request and at all reasonable times, GRTSM Cell will allow authorized representatives of USAID to review books, records and other documents relevant to the implementation of the STDT component of ASSP and utilization of USAID-financed goods and services.

The procedures set forth in this PIL were developed in consultation with UAF. The Joint Secretary Food in Pakistan's Ministry of Food and Agriculture (MINFA), who is also an Additional Representative for the STDT component of ASSP, has appended his signature below to indicate MINFA concurrence in these procedures.

If you have any questions about the contents of this PIL, please do not hesitate to contact me or my staff.

Sincerely,



Anrold J. Radi
Chief

Attachments: Annex 1: Illustrative Budget
Annex 2: Chapter 18, AID Handbook 1, Supp. B
Annex 3: Chapters 1 & 3, AID Handbook 11
Annex 4: AID Geographic Codes
Annex 5: Format for Expenditure Report

M. Bashir 29/12/72

Mr. Mohammad Bashir
Joint Secretary Food Wing, MINFA

ANNEX 1

ILLUSTRATIVE BUDGET

(Pak Rs.)

EXPENSE CATEGORY	AMOUNT
Professionals 1/	499,200
Travel and Transportation 2/	300,000
Repair and Maintenance of Durable Goods 3/	120,000
Training/Seminars 4/	50,000
Research Activities 5/	270,000
TOTAL	1,249,200
Or Say	1,250,000
Converted to U.S. Dollars (\$1=Rs.25)	50,000

- 1/ It is presumed that 2 persons will work for one year @ Rs.20,800/month.
- 2/ It is presumed that 5 professionals will travel to various locations such as Chichawatni, Multan, Okara, Hafizabad, Lahore, etc. Three trips/pm/each are estimated (POL:500+Lodging:350+Per Diem:250=1,100/trip)
- 3/ Bulk handling equipment, including grain pumps, machines which will encounter wear and tear during the process of bulk procurement
- 4/ Three seminars of three days duration with 20 participants will be organized each year
- 5/ Purchase of lab test material, collection of samples from various godown sites and other research-related material

Annex "B".

**Grain Storage Management
News Letter (8 pages)**



GRAIN STORAGE MANAGEMENT NEWSLETTER

A Quarterly Publication of:

Grain Research, Training and Storage Management Cell
University of Agriculture, Faisalabad.

Vol. 1 No. 1

January, 1994

PATRON:

Dr. Muhammad Rafiq Khan
Vice Chancellor,
University of Agriculture, Faisalabad.

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From the Desk of Editor-in-Chief

Grain storage management is as important a field as grain production itself but unfortunately, it has remained neglected in the past. As a matter of fact, a grain saved is a grain produced, rest all is in vain. It is an admitted fact that proper storage management and distribution has a direct relationship with the independence of nations and stability of national governments. Higher post-production losses are also an indicator of a nation's backwardness, the more the backward a nation is, the greater the post-production losses. In Pakistan, post-harvest losses are reported to the tune of 17.1 per cent in paddy, 15.3 per cent in wheat and 12.6 per cent in maize. The magnitude of these losses is really unbearable and it is not worthy of a nation that wants to live independently and honourably.

Our population is increasing at a rate more than 3 per cent per annum and our production does not commensurate with the population increase. No doubt, we have a vast land and much of it is a culturable waste.

We have one of the best irrigation systems in the world but still the irrigation facility is very limited and it is not possible to bring more area under cereal crops to meet our food-grain requirements. This can be done but at the cost of other crops and that is not possible under the present state of country's economy.

The wise policy would, therefore, be to restrict postharvest losses. The present state of affairs is that there exists no adequate arrangements, for producing manpower trained in grain storage management. Grain storage management is a highly technical subject but because of the non-availability of trained manpower, the food handling agencies have to employ non-technical persons for technical jobs. There also did not exist proper infrastructure for undertaking comprehensive research in postharvest production area.

Grain storage management is a multi-disciplinary field and needs co-ordinated efforts to achieve the desired results. It is because of lack of coordination that the efforts made in the field of post-production by different disciplines individually could not yield tangible results.

Thanks to the University faculty who has realised the importance of research and training in grain storage management by way of initiating one-year diploma course and undertaking coordinated research programme. In grain storage management, seven different disciplines viz., Agricultural Entomology, Plant Pathology, Crop Physiology, Agricultural Marketing, Food Technology, Basic Engineering and Farm Machinery and Power are involved.

In the past, there also did not exist any facility for the transfer of knowledge, generated in the field of grain storage management, to the end users. The Grain Research Training and Storage Management Cell of the University has accepted this challenge and has started transfer of knowledge by holding training workshops at division/district headquarter level for the field staff of Food Department of that area. The cell has also realised the importance of publishing Grain Storage Management Newsletter. This is a biannual publication and would prove to be a step in the right direction for the transfer of knowledge. The present issue is first of its kind in Pakistan.

Research Projects taken up in Grain Storage Management Cell

A meeting was held under the chairmanship of Professor Dr. Muhammad Rafiq Khan, Vice Chancellor, University of Agriculture, Faisalabad in July, 1993 and the following research projects were approved. These projects are problem-oriented and are being carried out in close collaboration with the Punjab Food Department.

Researcher	Title of Experiment	Brief Objectives
Dr. Manzoor Ahmad/ Mr. Mansoor-ul-Hasan	i. Monitoring resistance in stored grain insect pests to phosphine and grain protectants.	To find out level of resistance to phosphine gas and grain protectants in different stored grain insect pests.
	ii. Ecology of grain storage losses.	Extent of losses due to insects in different storage structures.
	iii. Comparative studies on traditional and supervised fumigation.	Improvement in conventional fumigation methods.
Mr. M. Sajjad Ahmad	i. Testing of low cost gas tight cover for open bulk head.	Control of insect pests in bulk head storage.
	ii. Determination of phosphine dosage for effective insect pest control under polyethylene covers.	Proper phosphine dosage for effective control of insect pests.
	iii. Physical quality of grain and insect management in Binishell storage.	Quality analysis of stored grains and phosphine monitoring.
Dr. Faqir M. Anjum	Physiochemical characteristics of wheat in Punjab.	Study of variation in physiochemical properties.
Asghar Ali Rana	Comparative study of different storage structures.	To find out defects in present storage structures and suggestions for their improvement.
Dr. A.D. Chaudhry Dr. Abdul Rehman	Practical demonstration of bulk handling equipment.	Practical demonstration and to improve working efficiency.
Mr. Qamar Mohyuddin	Economics of bulk handling.	To study cost and benefits of bag and bulk handling system.
Mr. M.A. Nasir	Qualitative and quantitative evaluation of aflatoxin in stored wheat samples.	To find out the extent of aflatoxin producing strains of fungi associated with stored grain samples in different storage structures.

Two Semester Diploma Course in Grain Storage Management at the University of Agriculture, Faisalabad.

University of Agriculture, Faisalabad has initiated two semester Diploma Course in Grain Storage Management - a vital field that remained neglected in the past. No such facility existed earlier in any part of the country and as such there was no arrangement for producing trained manpower for food handling agencies. The Academic Council, the Syndicate and finally the University Senate approved the following courses for this diploma:

partment of Agri. Entomology. This building was in a dilapidated condition. The concerted efforts put in by the faculty made these laboratories the main training and research centre of grain storage management. The Vice Chancellor, University of Agriculture, Faisalabad graced the occasion of opening ceremony of grain storage laboratories on June 17, 1993.

The Vice Chancellor appreciated the efforts made by the faculty in giving this programme a practical shape and hoped that this will go a long way in minimising food grain losses. He further said that it was the first step in this direction and the progress made in

USAID Mission to Pakistan helps in establishing Grain Research, Training and Storage Management Cell

The University of Agriculture, Faisalabad would acknowledge with thanks the help rendered by the USAID mission to Pakistan for undertaking training and research activities on grain storage management. The USAID mission allocated a sum of Rs. 1.25 million for the establishment of Grain Research, Training and Storage Management (GRTSM) Cell at the University and meeting day-to-day expenses for the first 1½ year relating to research and training programme. The U.S. Government through the agency of USAID mission, also transferred the custody and confirmed the title to the Government of Islamic Republic of Pakistan for the laboratory and field equipments to the University for the purposes of implementing the Grain Research, Training and Storage Management activities under the storage technology development and transfer (STDT) sub-component of the Agricultural Sector Support Programme (STDT). The equipment was purchased for use on the STDT activities.

Course	Title	Credit Hours
(First Semester)		
GSM-1	Introduction to Grain Storage Management	5 (2-6)
GSM-3	Insect and Mite Pests of Stored Grain	5 (3-4)
GSM-5	Grain Structure	2 (1-2)
GSM-7	Grain Storage Inspection and Book Keeping	3 (1-4)
GSM-9	Storage Systems	4 (1-6)
GSM-11	Introduction to Grain Processing and Flour Milling	4 (2-4)
(Second Semester)		
GSM-2	Store Grain Microflora and their Management	4 (3-2)
GSM-4	Vertebrate Pests of Stored Grain and their Management	4 (3-2)
GSM-6	Food Policies and Laws	2 (1-2)
GSM-8	Food Grain Marketing and Procurement	3 (2-2)
GSM-10	Grain Protectants and Fumigants	4 (2-4)
GSM-12	Supervised Field Experience	6 (2-8)
GSM-14	Bulk Handling Machinery and Computer Programming	4 (2-4)

Dr. Manzoor Ahmad played a pivotal role in getting consensus of scientists from all over the country and getting these courses approved and in initiating the training programme.

Vice Chancellor inaugurates Grain Storage Research Laboratories

The Grain Research, Training and Storage Management Cell, University of Agriculture, Faisalabad was housed in the old insectary building of the De-

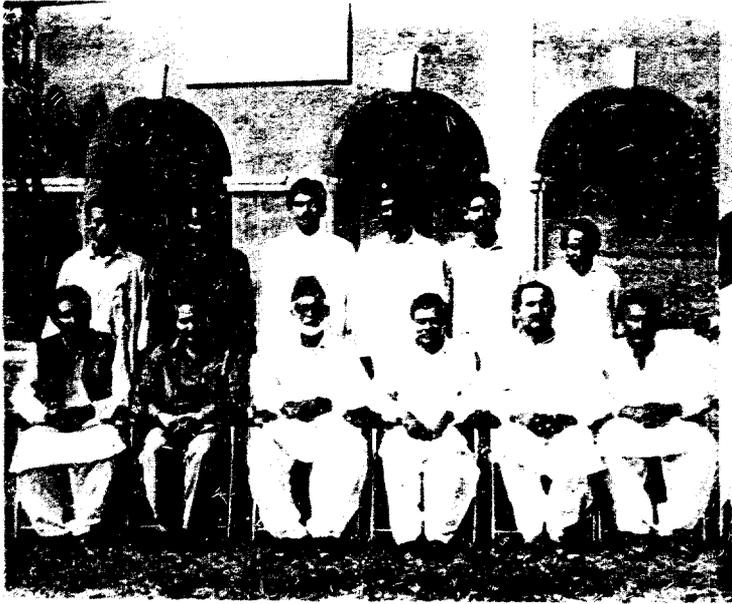
this field will certainly bring tangible results. The Vice Chancellor reminded the faculty that it was its sacred responsibility to come up to the expectation of the nation in developing technology for the containment of post-harvest losses and this could only be achieved through dedicated and selfless efforts.

PICTORIAL HIGHLIGHTS OF IN-AUGURATION CEREMONY, AND WORKSHOPS ON GRAIN STORAGE PROBLEMS & FUMIGATION ON PAGE

Government of the Punjab approached for amendment in Rules and to recognise Food Department as a Professional Department

The Registrar, University of Agriculture, Faisalabad approached the Secretary, Punjab Food Department to make necessary amendments in rules for making Diploma Course a pre-requisite for entry into service of Food Department so that trained manpower could be absorbed.

It was also requested that for the promotion from Food Inspector to AFC and all other cadres above AFC i.e. DFC, Assistant Director, DDF, etc., the Diploma in Grain Storage Management may be prescribed as a compulsory pre-requisite.



First batch completes Diploma Course.

Standing from L to R: Tauheed Khan, Akbar Ali, Amir Mukhtar, Ali Sher Shahid, Aftab Akram, Khalil-ur-Rehman.

Chairs: Akhtar Javed (F.G.I.), M. Sajjad Ahmad (S.S.O.), Dr. Manzoor Ahmad (Convenor), Dr. M. Akhtar (Chairman), Ghulam Shabbir (F.G.I.), Muhammad Shahbaz (F.G.I.).



Dr. Muhammad Rafiq Khan, Vice Chancellor, University of Agriculture, Faisalabad inaugurating Grain Research, Training & Storage Management Cell.



Workshop on Grain Storage Management

Addressing the audience: Ch. M. Shareef, Dr. Manzoor Ahmad, Rana Saeed Khan, M. Sajjad.



e Vice Chancellor visiting Grain Storage Reseach Laboratories. Also seen on the occasion are: Dr. Mazoor Ahmad, Dr. A.D. Chaudhry, Dr. M. Akhtar, Dr. Shamshad Akbar, Ch. Abdullah Asghar and A.H. Sabri.



Demonstration of Undersheet Fumigation.

19

First Batch completes Diploma Course

The first batch of following nine students completed diploma course in Grain Storage Management. Of these, six got admission on open merit whereas three were nominees of Punjab Food Department.

Regd. No	Name	Father's Name
92-ag-1378	Mr. Akbar Ali	Nizam-ud-Din
92-ag-1379	Mr. Toheed Khan	Rana Abdul Hameed Khan
92-ag-1380	Mr. Amir Mukhtar	Jahangir Ali
92-ag-1381	Mr. Ali Sher Shahid	Muhammad Ramzan
92-ag-1382	Mr. Khalil-ur-Rehman	Fazal-ur-Rehman
92-ag-1383	Mr. Aftab Akram	Muhammad Ishaque
92-ag-1384	Mr. Ghulam Shabbir Khan	Muhammad Amin Khan
92-ag-1385	Mr. Muhammad Shahbaz	Muhammad Nazir
92-ag-1386	Mr. Muhammad Mukhtar	Ch. Faiz Muhammad

Out-reach Programme takes a start

The GRTSM Cell organised one-day workshop on grain fumigation and demonstrated fumigation under polythene cover at PR Centre 5 of Food Department on October 12, 1993. The entire staff of the Food Department of Faisalabad district participated in the workshop. Ch. Muhammad Shareef, Additional Director Food, Punjab was the Chief Guest. Rana Saeed Khan presented the welcome address, Professor Dr. Manzoor Ahmad explained the aims and objectives of the workshop. He said that proper grain storage management was of basic importance in our national policy of self-reliance and self-sufficiency. The factors responsible for grain deterioration were also discussed. Mr. M. Sajjad Ahmad,

S.S.O. (PARC) gave detail of fumigation techniques and properties of phosphine gas. Ch. Muhammad Shareef in concluding remarks, pointed problems confronted with the fumigation under polyethylene cover. After demonstration, the participants were advised to participate in recording observations on the phosphine concentration in two stacks build up for the purpose.

Second Workshop on Grain Storage Pest Management and Fumigation at Toba Tek Singh

The Second workshop was held at Toba Tek Singh for the Field Staff of the Punjab Food Department working in that district. Professor Dr. Muhammad Akhtar, Chairman, Department of Agri. Entomology, University of Agriculture, Faisalabad was the Chief Guest. Rana M. Saeed Khan presented the welcome address. Prof. Dr. Manzoor Ahmad, M/s Mansoor-ul-Hasan, Farooq Ahmad and Muhammad Sajjad Ahmad delivered lectures on various aspects of grain storage management and fumigation. Dr. Muhammad Akhtar in his inaugural address appreciated the programme of grain storage management technology transfer and the understanding and co-operation that has been developed

within the University of Agriculture, Faisalabad and Punjab Food Department.

Third Workshop on Grain Storage Pest Management and Fumigation in Jhang

The Grain Research, Training and Storage Management Cell, University of Agriculture, Faisalabad organised a workshop for the field staff of the Food Department working in District Jhang. The meeting started with the recitation from Holy Quran by Dr. Abdul Rahman. Mr. Shafi Tariq Chak, Director, Food Department, Government of the Punjab was the Chief Guest. Rana Saeed Ahmad Khan, Deputy Director Food Faisalabad Division welcomed the Chief Guest and participants to the workshop. He thanked the Chief Guest for sparing time from his busy schedule for the workshop. Mr. Khan appreciated the efforts put in by the University in organising three such workshops in Faisalabad Division.

Prof. Dr. Manzoor Ahmad, Co-ordinator/Consultant, GRT & SM Cell, University of Agriculture, Faisalabad explained in detail the aims and objectives of the workshop. He said that grain is a living entity and as such needs training for proper handling during storage. He also pointed out that our Government policy of self-reliance and self-sufficiency was deeply connected with the effective food security and distribution. He gave the magnitude of storage losses occurring in our own country and in many other countries of the world. He discussed the role of moisture, temperature, relative humidity and other biological factors in grain storage management.

Dr. Manzoor Ahmad advised the participants not to purchase wet wheat as the wet grains become the source of grain spoilage of the entire



Participants are Trainers of the 2nd Workshop.
 Amongst the trainers prominent are: Farooq Ahmad and Mansoor-ul-Hasan while Dr. M. Akhtar and Dr. Manzoor Ahmad are addressing.

stack during storage. In order to avoid losses, he emphasised on keeping the grain as dry as possible and as cool as possible. He also described the importance of inspection and house-keeping as important components of management practices.

Mr. Mansoor-ul-Hasan in his lecture explained the life and seasonal history and identification of each of the insect pests of economic importance viz. Khapra Beetle, Lesser Grain Beetle, Flour Beetle, Rice Weevil and Grain Moth, etc.

Mr. Farooq Ahmad discussed the importance of rats and birds as pests of stored grain. He gave methodology for population assessment on the basis of rat visibility, rat droppings and damage to the bags. Identification and characters of various species of rats on the basis of morphological characters and habits were also discussed. The control measures were discussed

in detail and he stressed on rat and bird proofing of storages and control through environmental modification. Proper use of poisons and precautions to be observed in baiting were also explained by him.

Mr. Sajjad Ahmad, Senior Scientific Officer from Pakistan Agricultural Research Council discussed fumigants used in storages, properties of phosphine gas and advantages of phosphine use over other fumigants. He stated that defective fumigation was the cause of resistance build up in various species of insect pests. He explained the stepwise procedures for different fumigation practices for bagged storages. Mr. Sajjad compared the whole-godown and under-sheet fumigation with the help of graphs. He proved that gas retention in case whole-godown fumigation was very poor whereas it was better retained in polyethylene sheets.

The Chief Guest, Mr. Tariq Shafi Chak, Director Food in his speech thanked the speakers of the workshop. He said that he found the workshop very helpful for staff as well as for himself to learn about the fumigation and other aspects related to grain storage management. He stressed upon the participants to adopt the new procedures of pest management. He said that some handout in Urdu should be prepared for distribution to the field staff for day to day inspections and fumigation.

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 Chiniot Bazar, Faisalabad.

UNDER-SHEET PHOSPHINE FUMIGATION OF BAG-CUM-BULK WHEAT IN A BINI-SHELL

Mohammad Sajjad Ahmad
*Grain Research, Training, Storage
and Management Cell,
University of Agriculture, Faisalabad.*

Bini-shell is a dome shape concrete made structure being used by Punjab Food Department of store bagged wheat. The Department is now experimenting bag-cum-bulk storage in these structures to enhance the rated capacity of individual bini-shell from 1500 to more than 1700 mt. To protect the stored wheat from insect infestation, whole-godown fumigation is a routine practice of godown's managers. This is normally done by scattering the total number of Aluminium phosphide (AIP) tablets around and on the top of the stack. This practice proved to be defective because lethal concentration of phosphine gas could only be retained for 6 to 8 days in different parts of the stack. In the present study, an attempt has been made for the first time to investigate the efficiency of under-sheet fumigation of bag-cum-bulk wheat in bini-shell. The experiment done at Chak Kuriana (Jhang) revealed that above 200 ppm concentration of gas could be maintained for more than 33 days in all parts of the bag-cum-bulk. The gas retention period was significantly higher than that attained with whole-godown fumigation by using same dose rate of 1.25 tablets per cubic meter of enclosed space. The under-sheet fumigation also resulted into longer retention and uniform distribution of phosphine gas in whole bag-cum-bulk. After diminishing the gas, the polyethylene sheet served as a physical barrier for insects entering from exterior. Such prolonged gas retention period is helpful in arresting the prevailing resistance in stored-grain insects against phosphine gas.

STUDIES ON RESISTANCE IN *TRIBOLIUM CASTANEUM* (HERBST.) AGAINST MALATHION

M. Tahir Farooq, Manzoor Ahmad and
Mansoor-ul-Hasan
*Department of Agri. Entomology,
University of Agriculture, Faisalabad.*

The strains of *Tribolium castaneum* were obtained from different places, viz., Faisalabad, Samundri, Chichawatni, Multan and Bahwalpur. These strains were reared in the laboratory for getting individuals of the same age under controlled temperature and humidity. The individual of the susceptible strain were also reared in the same way.

Different concentrations of Malathion 6.0, 4.0, 2.0, 1.0, 0.5, 0.25 and 0.12 per cent were prepared and applied to the given strain. The LD₅₀ values for susceptible, Faisalabad, Samundri, Chichawatni, Multan and Bahwalpur strains were found to be 0.37, 0.69, 0.89, 0.97, 0.54 and 0.56, respectively. The strains were 1.86, 2.40, 1.46, and 1.15 times more resistant than the susceptible strain.

SOME STUDIES ON PHOSPHINE RETENTION IN NEW AND OLD HOUSE-TYPE GODOWNS, AND UNDER POLYETHYLENE SHEET AT FAISALABAD

Asim Abbas, M. Altaf Sabri and Manzoor Ahmad
*Department of Agri. Entomology,
University of Agriculture, Faisalabad.*

Studies were carried out on phosphine retention in old and new house-type godowns, at Faisalabad, by conventional and improved methods of fumigation in comparison to fumigation under polyethylene sheet. Under improved method of fumigation, the stores were carefully sealed to avoid, as far as possible, phosphine leakage whereas in the conventional method, the staff of the Food Department was allowed to follow their usual practice of fumigation. In the conventional fumigation, phosphine concentration remained above 200 ppm for three days in the old house-type godown (427.7-203.3 ppm) and for four days in the new house-type godown (452.2-261.0 ppm). In the improved method of fumigation, phosphine remained above 200 ppm for four days in the old house-type godown (427.2-233.4 ppm) and for 5 days in the new house-type godown (532.2-296.7 ppm).

Under polyethylene sheet, phosphine concentration remained very high (1255.5-482.2 ppm) for 7 days - the period of study.

COMPARATIVE RESIDUAL PERFORMANCE OF COOPEX, MALATHION AND NOGOS AGAINST *RHIZOPERTHA DOMINICA* AND *TRIBOLIUM CASTANEUM* ON WHEAT GRAINS

A.A.G. Muhammad, Furrugh Rafiq Khan and
Farooq Ahmad
*Department of Entomology,
University of Agriculture, Faisalabad.*

Studies were carried out on the comparative residual performance of Coopex, Nogos and Malathion, in terms of residual toxicity as well as persistence, against 7-day old adults of *Rhizopertha dominica* and *Tribolium castaneum* (Laboratory strains). In terms of LD₁₀₀, Coopex was more toxic (2, 3 ppm) than Nogos (2, 4 ppm) and Malathion (6, 8 ppm). The residual persistence, in terms of LD₉₀, in case of the respective insecticides was 2, 2 and 60 days against *R. dominica* and 2, 2 and 30 days against *T. castaneum*.

Annex "C".

Phosphine Dosage Determination for
Insect Pest Control In Polyethylene
Covers

- Executive Summary: (2 pages)

**PHOSPHINE DOSAGE DETERMINATION
FOR INSECT PEST CONTROL IN
POLYETHYLENE COVERS**

MUHAMMAD SALJAD AHMAD *
Senior Scientific Officer
Pakistan Agricultural Research Council

Presently Posted at

Grain Research Training and Storage Management Cell
University of Agriculture
FAISALABAD

July, 1994

EXECUTIVE SUMMARY

Phosphine is the most widely used fumigant to disinfest the stored commodities in whole of the world. However, fumigation carried out by untrained persons in leaky structures led to the situation where insects have gotten high tolerance against this valuable fumigant. To control the resistant insect populations, comparatively longer exposure (retention) period is essential than for the susceptible strains. Such longer gas retention period is very difficult to attain in godowns by using present practice (whole-godown fumigation). Increase in quantity of fumigant has very little effect on exposure period. It is also known that increase in concentration of phosphine gas has less effect on level of response or mortality of insects. The minimum lethal concentration of phosphine maintained for long period is recognized as comparatively more effective than the high one held briefly. Fumigation of bagged commodity under gas-tight or polyethylene sheets is a recommended method for better management of both susceptible and resistant stored grain insects. To retain the lethal concentration of phosphine gas (>200 ppm or 0.28 gm per M^3) for maximum period in polyethylene enclosure, multiple dose technique was tested in five sheeted stacks. Different dose rates were tested in single and multiple application modes. The dose rates of 1.0, 1.25, 1.50, 1.75, and 2.0 gm of phosphine per mt resulted 7, 9, 12, 16, and 17 day's retention period when applied once at the start of experiment. This period was significantly increased when same doses were fractionated and applied successively. The maximum retention period (29 days) however, was attained with dose rate of 1.75 gm/mt when applied in four successive installments.

Annex "D".

Phosphine Fumigation, Insect
Distribution, and Physical Quality
Changes in Bag-cum-Bulk Wheat Stored
in Bini Shells

- Executive Summary (2 pages).

**PHOSPHINE FUMIGATION, INSECT DISTRIBUTION, AND
PHYSICAL QUALITY CHANGES IN BAG-CUM-BULK
WHEAT STORED IN BINISHELLS**

By

MOHAMMAD SAJJAD AHMAD *
Senior Scientific Officer
Pakistan Agricultural Research Council

* Presently Posted at:

Grain Research Training and Storage Management Cell
University of Agriculture
FAISALABAD

1994

EXECUTIVE SUMMARY

Bini-shell is a dome shaped concrete made structure being used by Punjab Food Department (PFD) to store the procured wheat in bagged or bag-cum-bulk form. Phosphine fumigation by using Aluminium phosphide (AlP) is a major tool to keep the wheat free from insect infestation. The present practice of whole-godown fumigation was proved to be partially effective because (1) lethal level of phosphine gas could not be retained for sufficient long period and (2) appearance of live insects in different zones of wheat bulk after fumigation. To improve the fumigation of bag-cum-bulk wheat stored in bini-shell; PEPF (Polyethylene Enclosure and Phosphine Fumigation) technique was tried. The lethal concentration (above 200 ppm) of phosphine gas was retained in polyethylene enclosure for more than 33 days. Before fumigation, insect data showed a significant number of live insects while no live insect was detected after fumigation. The depreciated cost of under-sheet fumigation was Rs. 4.28 per ton as compared to Rs. 3.73 and Rs. 4.53 for whole-godown fumigation with dose rates of 1.0 and 1.25 tablets per cubic metre respectively.

The knowledge about Insect dispersion and population during storage is helpful for launching any pest control programme. In present study, the red flour beetle, *Tribolium castaneum* and lesser grain borer, *Rhizopertha dominica* were the major insect species infesting the grain mass. They were found in every sampling zone, while their number was relatively more significant in bag wall and on the surface than deeper grain layers. In the start (May 1993), the average number of red flour beetle and lesser grain borer was small while it increased significantly afterward and was maximum in March 1994.

In storage, biotic and abiotic factors considerably effect the grain quality and quantity. The moisture content of grain in start of the study was below 9% which increased gradually and was above 10% in November. In March 1994, however, the average moisture content decreased to about 9%. The percentage of black pointed grain increased to some extent in rainy season (July and August) on grain surface; afterward, no significant change occurred in the percent number of heat damaged grain. The insect damaged grain increased in number from the start of study (in May 1993) up to the termination (in March 1994). At the end the percent number of insect damaged grain was about 7.31 times more than that in start.

Annex "E".

Physico-Chemical Characteristics of
Wheat Grown in Sheikhupura and Jhang
Districts - Summary.

PHYSICO-CHEMICAL CHARACTERISTICS OF WHEAT GRAIN GROWN IN
SHEIKHUPURA AND JHANG DISTRICTS.

Faqir H. Anjum and Nighat Firdous

Deptt. Food Tech. Uni. Agri., Faisalabad.

The physico-chemical analysis was carried out on the sampler collected from different field (used as reference), provincial food department godowns and local grain markets of Sheikhupura and Jhang districts. In case of physical analysis it was found that extraneous matters separatable through sieve No 5 and 12 affected significantly due to districts. Test weight, 1000-kernel weight and particle size index were also analysed. Type of samples within location showed significant affect on these three physical characteristics of wheat grain. With the exception of 1000- kernel weight highly significant differences were observed due to location within districts for test weight and P.S.I. Protein content and moisture content in wheat grain varied significantly between samples of two districts. Other parameters like moisture content and ash were not effected significantly either due to difference in location within districts or type of samples within location.

Annex "F".

Physico-Chemical Characteristics of
Wheat Grown in Faisalabad and Multan
Districts - Summary.

PHYSICO-CHEMICAL CHARACTERISTICS OF WHEAT GRAIN GROWN IN FAISALABAD AND MULTAN DISTRICTS

Faqir M. Anjum and M. Asif

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In this study wheat grain samples were collected from field (used as reference), provincial food department godowns and local grain markets of Multan and Faisalabad districts. The samples were tested for various physico-chemical properties. Test weight and other physical characteristics i.e; 1000-kernel weight and partical size index were significantly effected due to difference between districts. The differences of location within districts did not show any effect on these physical grain characteristics 1000-kernel weight and partical size index were observed to vary significantly due to types of sample within location. Partical size index revealed that wheat grain texture can be categorized as medium hard to medium soft texture. There was a significant variation in moisture content and ash content between the districts and non significant difference in protein content was found due to variation in districts, location within districts and types of samples within location.