AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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Batch 87

1. SUBJECT CLASSIFICATION
A. PRIMARY: Serials — Y-AN20-0000-G730
B. SECONDARY: Food production and nutrition--Farm equipment--Pakistan

2. TITLE AND SUBTITLE
IRRI-PAK agricultural machinery program; progress report,July-Dec.1976

3. AUTHOR(S)
(101) IRRI

4. DOCUMENT DATE
1976

5. NUMBER OF PAGES
~~33p.~~ 54p.

6. ARC NUMBER
ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
IRRI

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(Research summary)
(Extension program of the AID project: Rice machinery development and industrial extension)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAF-687

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Agricultural machinery
Intermediate technology
Pakistan
Rice

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/ta-C-1208 GTS

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID/Pd-C-1208
IRRI
PN-AAF-687

IRRI-PAK

AGRICULTURAL MACHINERY PROGRAM

SEMI-ANNUAL
PROGRESS REPORT NO. 1
JULY 1 — DEC. 31, 1976

P. O. BOX 1237, ISLAMABAD, PAKISTAN

A collaborative Program of the Pakistan Agricultural Research Council and the International Rice Research Institute

53D.

ACKNOWLEDGEMENTS

We sincerely appreciate the willingness of our cooperating manufacturers to undertake the risky venture of introducing new agricultural machines in Pakistan. Of particular importance is the work of Messrs Habib Industries, Karachi and the Lahore Engineering and Foundry Organization(LEFO), Lahore, in introducing the IRRI Axial Flow Thresher.

The development of demand oriented farm machines is a costly undertaking which requires substantial financial and professional resources. The financial support provided by the Technical Assistance Bureau, USAID Washington, and the Ford Foundation, Islamabad, alongwith personnel and funds from the Agricultural Research Council has helped to assemble the necessary resources for this Project.

The decision of the Agricultural Research Council to establish an engineering cell as a counterpart organization to the IRRI Agricultural Machinery Project, will provide long range continuity in our efforts to introduce appropriate farm mechanization technology in Pakistan.

The interest and support of the officials of the Government of Pakistan has been most encouraging. These include Malik Khuda Bakhsh Bucha, Mr. Sultan Ali Chaudhry, past and current Chairman of the Agricultural Research Council(ARC), Mr. I.A. Imtiazi, Secretary, Federal Ministry of Food and Agriculture, Dr. Heshamul Haque, Director-General and the other officials of the Agricultural Research Council.

Mr. Joseph Wheeler, Dr. Richard Newberg and Mr. Niel Dimick of USAID and Dr. John Cool, Representative, The Ford Foundation, have extended full support to our efforts. We are specially indebted to the Ford Foundation for providing Project vehicles in the early stages of the program.

Our special thanks go to the Rice Research Institute, Kala Shah Kaku its Director, Dr. Abdul Majeed and his colleagues, Mr. I. A. Dar and Mr. Habibur Rehman for actively participating in the testing of the IRRI machines. We appreciate the loan of a diesel engine from M/s PECO Lahore for use in the testing of the axial flow thresher.

The Director, Barani Project, N.W.F.P.; The Rice Research Institute, Dokri; The Agricultural College, Tando Jam and the Director, Agricultural Extension, Sind, provided assistance in the small farm mechanization survey which is being conducted under a sub-contract with the Georgia Institute of Technology(GIT). The administrative, promotion and marketing assistance of Mr. Philip Hess of GIT during the initial start up period of the Project was extremely helpful. The assistance provided by the Project staff, especially by Mr. Mohammad Ilyas, in the preparation of this Report is highly appreciated.

A. U. Khan
Project Director and IRRI Representative

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INTRODUCTION AND SUMMARY

The IRRI-PAK Agricultural Machinery Program is an off-shoot of the Agricultural Machinery Development Program at the International Rice Research Institute in the Philippines. The Institute's agricultural machinery program is directed towards providing appropriate farm machinery designs to meet the needs of small farmers in the developing countries. One essential aspect of this Program is that the machines developed by the Program must be simple enough in design to be produced by small metal working shops in the developing countries. The Program has been quite successful in commercializing its machines , and over 30000 IRRI-developed machines were commercially produced in the South East Asian countries last year.

The Institute's core program has been supported by the Technical Assistance Bureau, USAID, washington, since its inception in 1967. In the interest of a more effective distribution of the machinery designs originating from the Institute, an industrial extension network was established last year under which two regional industrial extension programs were initiated in Thailand and in Pakistan. The Pakistan Program is responsible for the introduction of the IRRI machines in Pakistan and the neighbouring countries

which include Iran, Afghanistan, India, Nepal and Sri Lanka. The IRRI machines that will be introduced include a range of power tillers, small 4 wheel riding tractor, multicrop threshers, weeders, seeders, dryers, irrigation pumps and other small farm equipment.

The Institute is collaborating with the Agricultural Research Council in its efforts to transfer appropriate farm mechanization technology in Pakistan. Most of the IRRI machines have been originally developed for wetland farming practices and these need to be modified and adopted for the dryland farming conditions popular in this region. The IRRI-PAK Program, in its initial stages, is focussing its attention to this aspect; however, as additional resources are made available, it will divert its attention to other problems of agricultural mechanization in the region.

The Pakistan Program was initiated in mid 1976. Considerable difficulties were encountered during the reporting period in project implementation due to delays in clearing shipment of shop equipment and prototype machines from the Philippines. The project shipment was held up for nearly five months at the Karachi Customs. Intervention by the Director-General, Agricultural Research Council helped in waiving of the demurrage charges and the shipment was finally cleared in November 76. Prior to the arrival of the shipment, fabrication of IRRI prototype machines was undertaken through private machine

shops in the Rawalpindi area which was rather time consuming. Unusual delays were also encountered in the acquisition of a right-hand drive pick-up truck due to delays in USAID clearance and this created many logistical problems, particularly in the field testing of machines

In spite of these start-up problems, considerable progress has been made during this reporting period in setting up the Project facilities (fig No. 1) and in introducing the IRRI machines to manufacturers in Pakistan. The engineering design office (fig No. 2) has been adequately equipped and is now in operation. A metal working shop (fig No. 3) with a covered area of 600 sq. ft. has been erected at the IRRI-PAK Agricultural Machinery Program office at Rawalpindi. The shop has simple metal fabricating equipment (see fig No. 4) such as a lathe machine, a bench drill press, electric and gas welding equipment, bench grinders and other hand tools to permit fabrication and modification of prototype machines.

The present combined IRR and ARC staff strength consists of five engineers, and three support staff. Selection for the posts of the Agricultural Engineer and Deputy Agricultural Engineer on the ARC staff has already been made and it is expected that these engineers will soon be join the program.

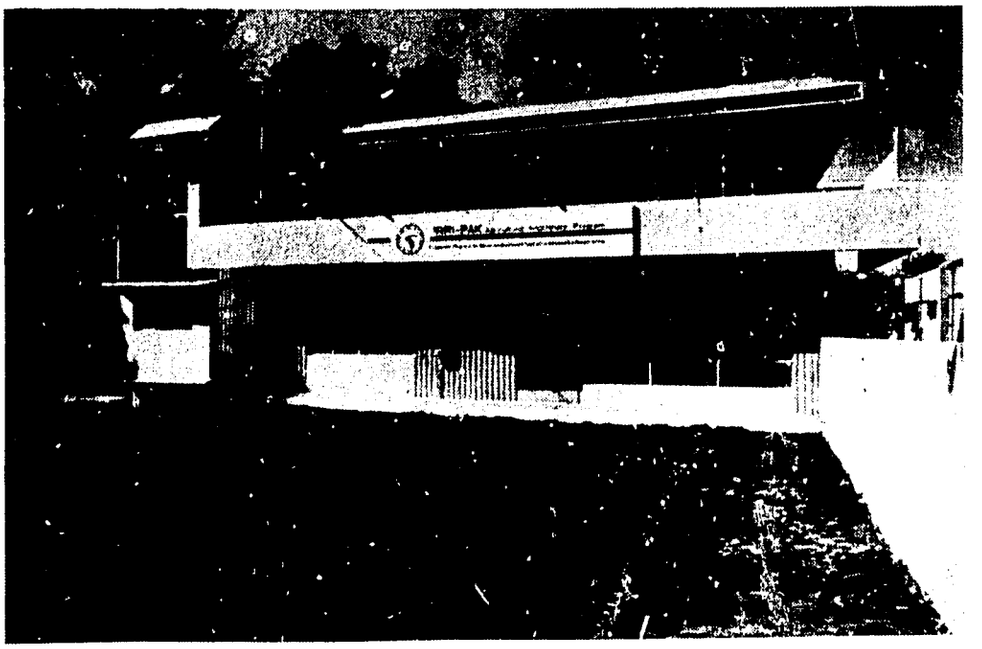

Fig. 1
IRRI-PAK Agricultural Machinery Program
Office at Rawalpindi, Pakistan.

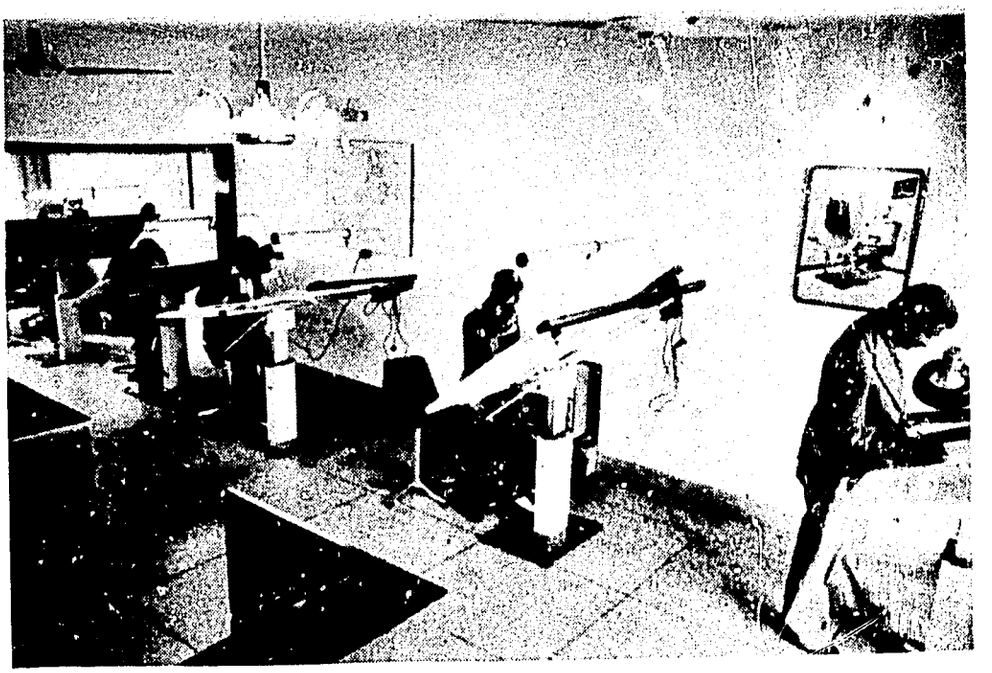

Fig. 2
The Engineering Design Office of the
IRRI-PAK Agricultural Machinery Program.

Fig. 3
Prototype Fabricating Machine Shop at the
IRRI-PAK Agricultural Machinery Program Office.

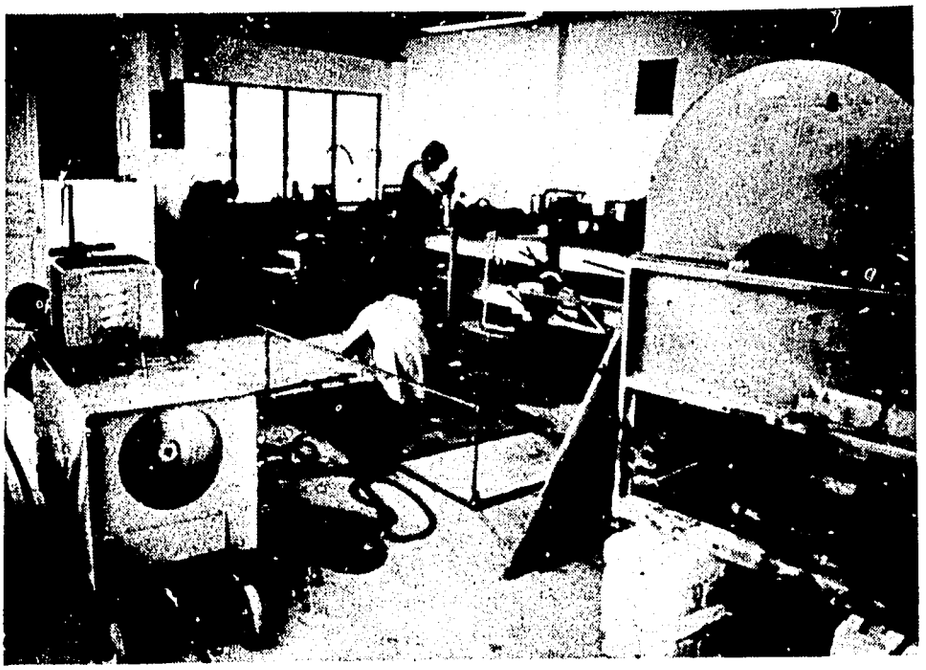

Fig. 4
Inside view of the IRRI-PAK Workshop.

Manufacturers response on the IRRI axial flow thresher has been most encouraging in Pakistan. The original IRRI machine required considerable modifications to thresh the locally popular paddy varities. Major program focus is now directed towards modifying this machine to thresh wheat and other crops popular in Pakistan. Five companies have fabricated their prototype threshers and these are being further improved by the Project staff.

Prototype units of the small IRRI portable thresher, the liquid chemical applicator and the diaphragm pump have also been fabricated by a number of companies. These are being evaluated and modified by the Project staff. Performance evaluation tests of the Root-zone applicator has been conducted at the Rice Research Institute, Kala Shah Kaku, Lahore during the last paddy season

Contacts have been established through personal visits with most established agricultural machinery manufacturers in Pakistan. Periodic newsletters, participation in exhibitions, seminars and demonstrations have been utilised to publicise the IRRI-PAK program to government officials, manufacturers and farmers in many parts of the country.

Under a sub-contract with Georgia Institute of Technology, a survey of paddy farmers was conducted in

the three major rice growing areas of Pakistan: the N.W.F.P., Punjab and Sind Provinces. This survey is being undertaken to study the farm machinery requirements of the medium size farmers who have the resources to acquire simple farm equipment but find most imported equipment beyond their means.

MACHINERY DESIGN AND DEVELOPMENT

The Axial Flow Thresher

An older version of the IRRI axial flow thresher with the rotary grain cleaner, made by the Habib Industries, Karachi, was modified to incorporate latest design improvements including the installation of an oscillating screen cleaner. Preliminary tests indicated that this machine was not suitable for threshing tall paddy varieties because of excessive wrappage of straw on the threshing drum. The machine was extensively field tested and modified during the last paddy threshing seasor

Two full length knives sets were rigidly bolted on the concave to cut straw in to smaller pieces. A number of other design changes, such as a new threshing drum cover revised pegs and knives arrangement on the drum and replacement of the 7 H.P. gasoline engine with a 6 H. P. locally - made Diesel engine were incorporated in the machine. Tests indicated that the two full length concave knives required too much power

The two rigidly fixed full length concave knives sets were later replaced with five smaller knives sets (fig No. 5) and these were pivotly mounted for easy insertion or removal from the concave. This arrangement provided greater straw cutting flexibility and reduced power requirements under

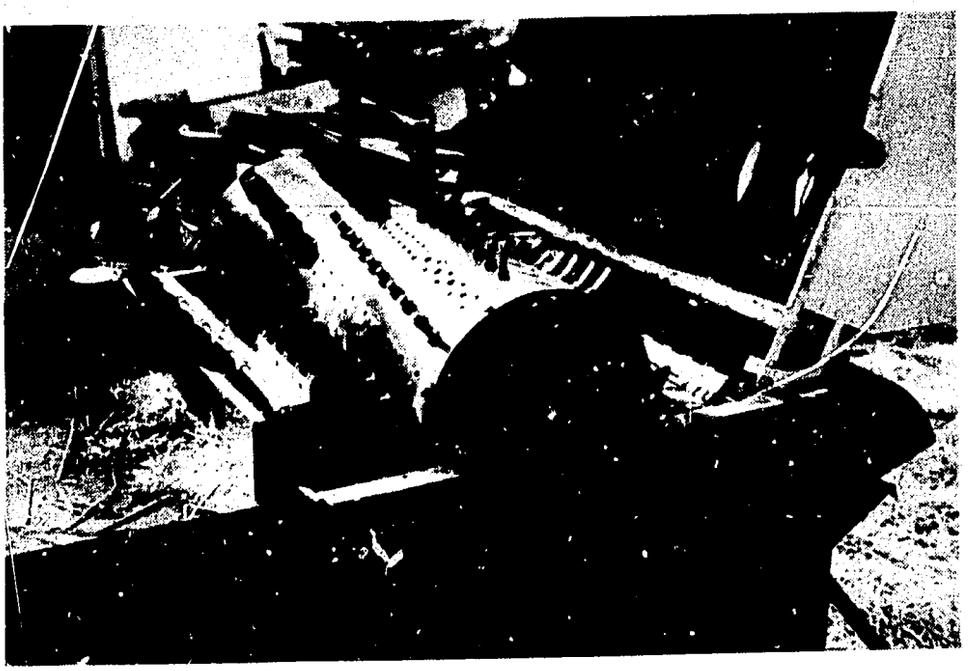

Fig. 5
The modified Axial Flow Thresher shown with the pivotly mounted concave knives sets for chopping paddy and wheat straw.

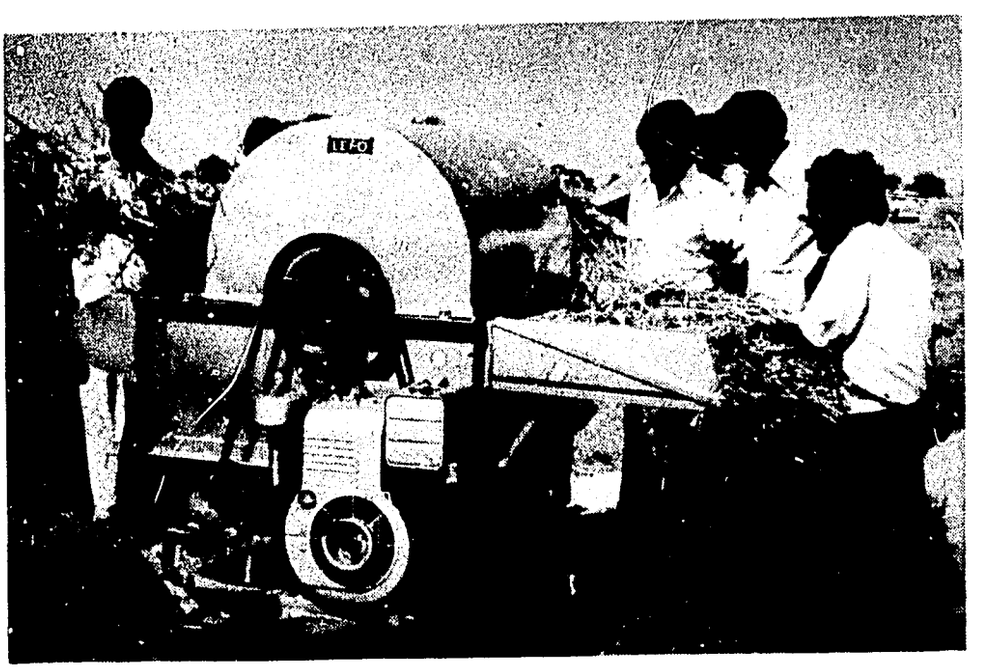

Fig. 6
Prototype Axial Flow Thresher fabricated by M/s. Lahore Engineering and Foundry Organization of Lahore being tested at The Rice Research Institute. Kala Shah Kaku.

varying crop conditions. With multiple knife sets, only as many knives were inserted into cutting position which would result in satisfactory cutting of straw. This machine could successfully thresh the tall paddy varieties and also cut paddy straw into smaller pieces for animal feed. During field tests(fig No. 6), the threshing output with dwarf paddy varieties was up to 0.7 ton/hr and with tall Basmatti varieties it was up to 0.5 ton/hr. Insertion of all the five sets of concave knives reduced the grain loss from 1.4% to 0.56% at the straw outlet when threshing dwarf paddy varieties. Losses when threshing tall Basmatti variety were negligible and never exceeded 0.07% during these tests. The detailed report alongwith data is included in Appendix "A".

From the tests it was concluded that the modified thresher can successfully thresh both the dwarf and the tall paddy varieties popularly grown in Pakistan. Work is now underway to adopt this machine for threshing other popular crops in Pakistan. Tests and development work on this machine will continue during the next wheat threshing season since wheat is the most important crop in Pakistan. It is felt that a multi-crop thresher which can satisfactorily thresh wheat as well as rice can find a large market in Pakistan.

Root Zone Liquid Applicator

A locally fabricated IRRI root zone liquid chemical applicator was evaluated at the Rice Research Institute, Kala Shah Kaku, Lahore, for controlling insects on paddy crops. Two techniques were used for the rootzone application of insecticides; (a) IRRI Root-Zone Liquid Applicator & (b) Mud ball technique. The tests indicate that the root-zone application of Lorsban insecticide with the IRRI liquid applicator provided better protection against rice stem-borer as compared to mud-ball techniques. Average paddy yields of 2096 kg/ha were obtained with the root-zone liquid applicator as compared to 1172 kg/ha for mud-ball application, 1022 kg/ha for untreated check and 2056 kg/ha for the fully treated check. While the fully treated check and the liquid applicator gave similar yields, approximately half as much chemical was needed with the IRRI root-zone liquid applicator as compared to the fully treated control. Appendix "A" includes the test report prepared by the Rice Research Institute Scientists at Kala Shah Kaku on this applicator.

INDUSTRIAL EXTENSION

Different approaches were used to publicise the IRRI machinery program among farmers, manufacturers and Government officials in Pakistan. These activities are described in details in Appendix "B" with the main highlights being as follows:

Two issues of the IRRI-PAK Agricultural Machinery newsletters were issued and approximately 500 copies of each of these were distributed to manufacturers, farmers and Government officials in Pakistan.

The IRRI axial flow thresher and the diaphragm pump were shown on national T.V. and were commented upon in the press and radio programs during the reporting period.

Exhibits and demonstrations of the IRRI machines were organized at three farmers fairs (fig No. 7, 8) at Mandi Bahauddin, Kala Shah Kaku and Rawalpindi.

More than twenty demonstrations of IRRI machines were held for farmers, manufacturers, research stations, universities and other interested parties in Pakistan.

The Project staff participated in four agricultural seminars and made formal presentations on the IRRI program at two such seminars.

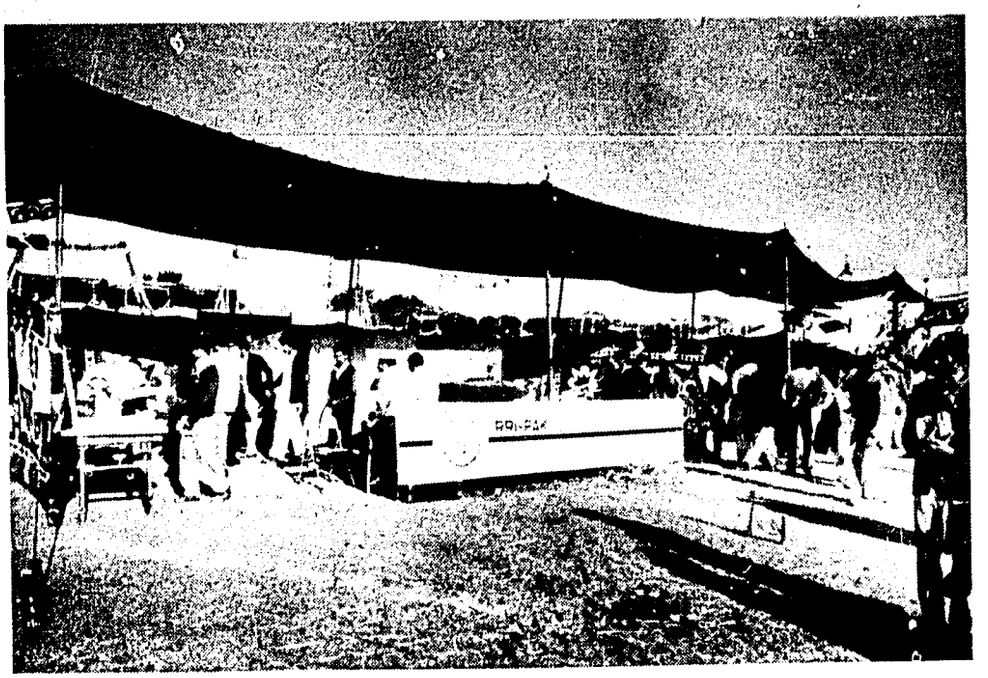

Fig. 7
The IRRI-PAK Machinery Program display at the Farmer's Fair, Rawalpindi.

Fig. 8
The Diaphragm Pump being demonstrated to the Chief Minister and the Secretary Agriculture, Government of Punjab.

MANUFACTURING DEVELOPMENTS

Interest in manufacturing the axial flow thresher is quite high in Pakistan. Five companies have fabricated a total of eleven machines during the reporting period. Some of the manufacturers machines were tested and modified by the Project staff during the period. A few additional companies were provided with engineering drawings on the thresher and are now fabricating their prototype machines. The detailed manufacturing developments are included in Appendix "C".

Two prototype units of the diaphragm pump were fabricated by a manufacturer at Rawalpindi. Two other companies; one at Lyallpur and one at Gujranwala, have fabricated their prototype pumps and are now evaluating its market.

One portable paddy thresher was fabricated by a company at Rawalpindi and this machine is now being modified to thresh tall paddy varieties as well as the other grain crops popular in Pakistan.

Ten root-zone liquid fertilizer applicators were fabricated by three firms at Rawalpindi and Lyallpur. These applicators have been distributed to research stations and other interested parties for evaluation and demonstration.

FARM MECHANIZATION SURVEY

A survey of medium-size farmers was initiated in the major rice growing areas of Pakistan. Farmers with medium-size holdings have adequate resources to acquire an intermediate level of mechanization. They find that suitable farm machines are, however, not available in Pakistan to meet their needs. The IRRI-PAK Machinery Program is directed towards meeting the agricultural machinery demand of this specific farm market. Nearly 200 rice farmers from the Swat areas of the N.W.F.P.; Sheikhupura; Lahore; Lyallpur and Gujrat Districts in the Punjab and the Larkana; Dadu; Sukkur; Jacobabad; Hyderabad; Thatta and Badin Districts of Sind have been interviewed in this survey. The data obtained in the survey is being utilized to evaluate the farm machinery requirements and to develop machinery specifications for demand oriented machines which need to be developed by the IRRI-PAK Program. Information gathered in this survey will be highly useful in guiding the activities of the IRRI-PAK Agricultural Machinery Program. A sample survey questionnaire is included in Appendix "D". The data collected during the survey is now being analysed and a detailed report will be included in the next semi-annual report.

TRAINING PROGRAM

Four engineers, two from the Rice Research Institutes at Kala Shah Kaku and Dokri and two from cooperating manufacturers, spent one week each at the Program Office at Rawalpindi. The engineers worked with the Project staff and were trained in the over-all program operation and in the IRRI's approach to machinery development.

Mohammad Ilyas, an engineer on the IRRI-PAK Program participated in a two-week IRRI Agricultural Engineering Training Program in the Philippines and spent two additional weeks familiarizing with the different machinery projects currently underway at the Institute. He also spent some time in Thailand with our counterpart program, IRRI-Thai Agricultural Machinery Program, and visited cooperating manufacturers of IRRI machines in Thailand and in Bombay, India, during his way back to Pakistan.

APPENDIX "A"

IRRI AXIAL FLOW THRESHER TESTS

Report No. 1

An older version of IRRI Axial Flow Thresher, which was fabricated by Habib Industries, Karachi was modified to incorporate the latest improvement. The rotary screen cleaner, grain auger, collecting boards and upper concave were eliminated. A new modified threshing drum cover and an oscillating conveyor-screen was installed. The position of the winnowing blowers was raised to direct air on the grain falling from concave to the oscillating tray. Two sets of full length knives were rigidly bolted to the concave for chopping straw. The machine had provisions for installing of either round pegs, or flat knives on the threshing drum.

This machine was extensively tested and further modified at the Rice Research Institute Kala Shah Kaku during the last paddy threshing season. Test were done to determine the design modification necessary to thresh the tall paddy varieties and to evaluate the threshing output and losses on the dwarf and tall varieties grown in Pakistan. The dwarf PK-178, IR-6, IR-8 and the tall PK-370 Basmati paddy varities were threshed during these tests.

Test Procedure:

The machine was operated for half an hour before initiating each test to observe performance and make necessary adjustments.

Threshing performance on the tall Basmati paddy was evaluated, without the concave knives, with one set of full length concave knives and, with two sets of full length concave knives.

Test were conducted with a combination of knives and pegs on the threshing drum as well as only knives or pegs on the drum.

Observations:-

The machine was able to successfully thresh the dwarf paddy varieties without the knives.

Threshing of tall Basmati varities however was not possible without the concave knives. The long straw wrapped aroung the drum and over loaded the machine thus the machine could not operate at a normal feed rate without clogging.

The concave knives eliminated the straw wrapping problem since straw was chopped into smaller pieces when the threshing drum pegs or knives passed between the concave knives.

The two sets of full length concave knives, however, consumed too much power in chopping straw and 7 h.p. gasoline engine was not powerful enough to permit normal operation.

The two sets of full length concave knives were also tried individually to study power requirement. With only one set of knife the length of the copped straw increased thereby increasing the straw wrapping tendency. This resulted in engine over loading and reduced threshing output.

The arrangement of the knives on the threshing drum was such that each set of eight drum knives rotated in a single plane. This arrangement resulted in fairly wide spaces between two adjoining knife planes and straw tended to accumulate on the concave at these points this reduced concave separation efficiency. This unstaggered arrangement of knives on the drum did not effectively draw the material inward at the feed opening and this reduced threshing output.

The clearance between the straw thrower paddles and the thrower housing bottom was 11/16". This excessive clearance reduced the throwing action of the paddles. Excessive back feeding was also encountered at the thrower outlet, especially when threshing tall varieties. Partially thrown long straw tended to be pulled back into the machine and clogged the thrower outlet which had to be pulled out manually. The machine did not have a partition between the thrower section and the concave near the thrower outlet and this increased the back feeding tendency.

The last deflecting louver in the threshing drum was too short and did not partially overlap the straw thrower paddles.

This did not deflect the material to the centre of the thrower paddle and resulted in the straw wrapping around the drum, next to the thrower paddles

To over come the above problems the following modification were made in the machine:

A. Straw Cutting Knife:

The two sets of full length fixed concave knives were split into five shorter sets of pivotly mounted concave knives; two on the feeding side and three on the straw outlet side of the threshing drum. The smaller sets of knives provided great flexibility in straw for chopping and permited saving in power for the straw chopping operation. The cut length of the straw can be varied by changing the number of knives sets. The pivotly mounted knive sets can be easily inserted into cutting position by unskilled operators without the use of any tools.

The threshing drum knives in the feed area of the drum were replaced with round pegs mounted in a staggered arrangement to increase crop pulling in action and permit better sweeping of the concave. The round pegs offer wider impact area to the crop and this improves threshing performance. The round shape of the pegs also minimizes grain damage when threshing delicate crops such as beans. The arrangement of the pegs and knives on the threshing drum were staggered

such that each alternate knive or peg was in a different circular plane. This resulted in increased threshing impac and better sweeping of the concave which improved threshing and separating performance.

B. Straw Thrower:

The clearance between the thrower paddles and the lower part of the thrower housing was reduced to 1/8" by better centering of the threshing drum in the concave and by increasing the paddle size by 9/16". A small partition was also installed next to straw outlet to separate the thrower housing and the rest of the concave. This permitted better separation of the incoming straw and the outgoing straw from the thrower.

The last deflecting louver in the drum cover was extended by about 1.5" to deliver the threshed straw at the centre of the thrower paddles.

C. Engine:

The 7h.p. gasoline engine did not have sufficient power for threshing tall paddy varities. Operational cost of gasoline engine is rather high in Pakistan. A locally produced 6 h.p. medium speed diesel engine was installed on the thresher. This engine was much heaviers than the gasoline engine and appropriate modification were made on the chasis to accommodate this engine.

After incorporating the above modifications the thresher was again field tested at the Rice Research Institute, Kala Shah Kaku, Lahore. The machine was operated for several hours to measure the threshing output and grain losses, with varying combinations of the concave knives.

Observations and Conclusion:

1. The machine performed well with the dwarf IR-6 & PK-178 and tall varities of paddy.

2. The dwarf varieties, IRRI-6 & PK-176, can be easily threshed with the machine without the use of any concave knives.

3. The tall Basmati Varieties, at normal moisture levels, required the use of the first two sets of concave knives.

4. The threshing losses was observed to be excessively high during these tests with the dwarf IRRI varieties but were acceptable for the long straw Basmati 370 varieties.

5. In general the use of concave knives reduces grain loss for all varieties.

Recommendation:

1. With the diesel engine the machine vibrations had increased. There is a need for an eccentric balance on the oscillating tray drive shaft and a reduction of the cam throw from 1/2 to 3/8 is necessary to reduce machine vibration.

2. A check for the reasons for excessive losses with dwarf varieties, indicated that the angle of the deflecting louvers in the threshing drum cover was 25° and not 12.5° as recommended in the original IRRI design. This excessive angle reduces crop retention time in the machine particularly for the shorter varieties, and resulted in excessive losses.

3. The weight of the diesel engine 105 (kg) was excessive and it made the machine front heavy. The wheels needed repositioning to achieve better balance.

4. The front part of the thresher frame, where the engine is mounted needed better bracing with the rest of the frame as the frame bends at this point, during transport.

5. The key ways on the oscillating screen drive-shaft needed redesign. The shaft vibrations slide the keys out of the pulleys.

6. Some pegs are needed on the concave to slow the movement of the threshing material and improve grain straw separation.

Test Report No. 2

Axial Flow Thresher

The machine was modified according to the recommendation of the report No. 1. The final specification of the machine was as follows:

1) Staggered arrangement of the knives and pegs on the threshing drum.
2) Five smaller sets of concave knives
3) The deflecting angle of the louver in the threshing drum was 12.5°
4) PECO air cooled diesel engine of 6 h.p. and 1800 r.p.m.

The tests were conducted at the Rice Research Institute, Kala Shah Kaku, on IR-6 paddy varieties. It was not possible to use other paddy varieties since it was late in the season as other varieties had already been harvested.

The threshing output and grain loss data was collected without the concave knives and with varying combinations of concave knives. The test data is given in Table No. 1.

The machine performed very well throughout the test and the losses for the dwarf varieties was quite low. The threshing loss was 1.04% when operating without any concave knives and was 0.56% when all five sets of concave knive were used. The threshing output in given in Table No. 2.

TABLE NO. I

Concave Knive sets Position	Threshing kg/min	Output ton/hr	Threshing Loss Weight LB	Threshing Loss %age	Blower Loss Weight LB	Blower Loss %age	Seive Loss Weight LB	Seive Loss %age
All 5 In	9.9	0.66	0.127	0.57	0.013	0.05	-	Negligible
" "	9.9	0.66	0.121	0.54	0.013	0.05	-	"
" "	9.45	0.63	0.125	0.59	0.015	0.07	-	"
All 5 Cut	10.35	0.69	0.24	1.04	0.017	0.07	-	"
" "	9.45	0.63	0.223	1.03	0.017	0.08	-	"
" "	9.45	0.63	0.227	1.06	0.013	0.06	-	"
No. I Inside	9.9	0.66	0.1609	0.725	0.015	0.06	0.011	0.04
No. " "	10.12	0.67	0.1653	0.728	0.0132	0.06	-	Negligible
No. " "	9.45	0.63	0.1543	0.728	0.0132	0.06	-	"
No. 1 & 2 Inside	9	0.6	0.1322	0.656	0.0176	0.08	-	"
No. " "	9.9	0.66	0.1388	0.626	0.011	0.04	-	"
No. " "	9.9	0.66	0.1477	0.666	0.015	0.06	-	"
No. 1,2&3 Inside	10.35	0.69	0.143	0.617	0.015	0.06	-	"
No. " " "	9.9	0.66	0.132	0.59	0.013	0.05	-	"
No. " " "	9.9	0.66	0.192	0.59	0.013	0.05	-	"

Note: Grain losses data with varying combination of concave knive when threshing dwarf IRR-6 paddy variety.

TABLE NO. 2

Sr. No.	Crop Variety	Crop Yield Lbs	Kgs.	Ton	Crop Condition	Threshing Output/hour Lbs.	Kgs.	Tons
1.	PK-178	2952	1328.4	1.476	Normal moisture content	1434	645.3	0.717
2.	PK-178				Fairly wet	1312	590.4	0.656
3.	IRRI-6	2706	1217.7	1.35	Normal moisture content	1400	630	0.7
4.	IRRI-6				Fairly wet	1295	582.75	0.64
5.	Basmati-370	1545.6	701.1	0.779	Normal moisture content	984	442.8	0.49
6.	Basmati-370				Fairly wet	820	369	0.41

Note: Threshing output data of IRRI Axial Flow Thresher

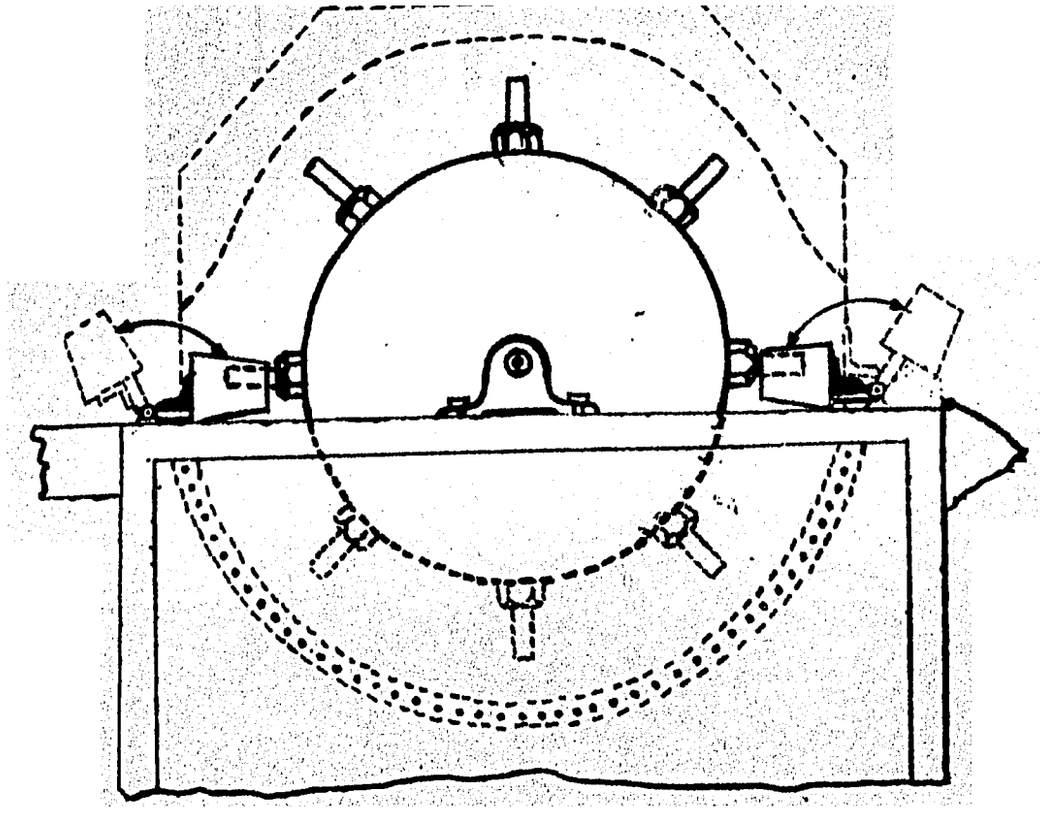

Fig. 3. Pivotly Mounted Concave Knive Sets.

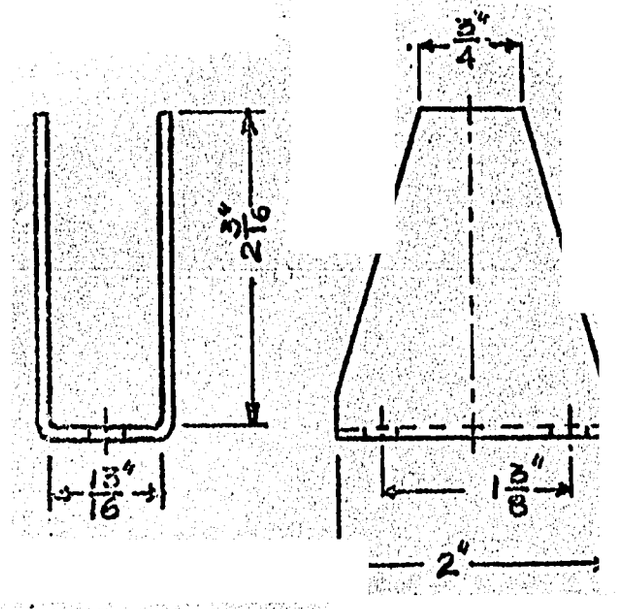

Fig.1 Concave Knive

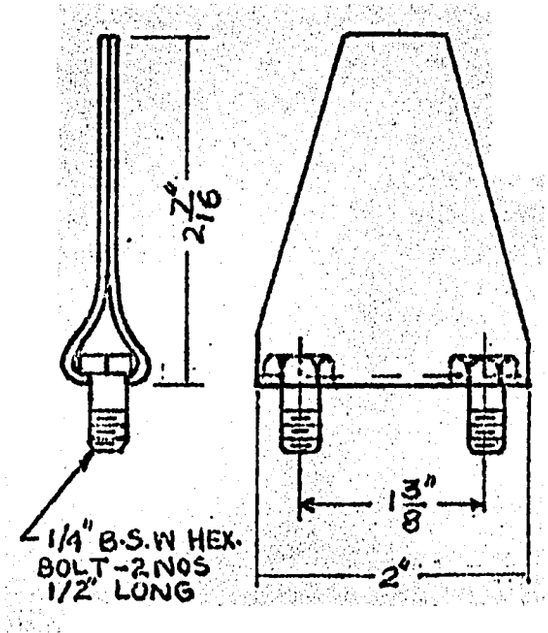

Fig.2 Drum Knive

Both the concave and drum knive are based on the design of the American Spring and Pressing Company, Bombay, India.

Test Report
Root-Zone Application of Insecticide for Rice Borers Protection Kala Shah Kaku 1976

BY

I. A. Dar, A. Majid and Mushtaq Ahmad*

Lorsban insecticide (E.C./granule) was applied to root-zone of rice plants by two methods viz; mud-ball (MB) and IRRI root-zone applicator. The E. C. was applied with rod-zone/applicator and granules in mud balls as described in the IRRI report 2/76. The insecticide was applied at different doses and times after transplantation. The data given in the attached table show that the IRRI applicator gave best protection against rice stem borers (Tryporyza incertulas and T innotata) as the average DH (dead heart and WH (white head) incidence recorded was 3.72 and 3.16% respectively against MB where the corresponding figures were 20.0 and 6.89%. In the treated (Basudin G) and untreated checks the DH and WH were 4.63 and 2.05%, and 29.28 and 15.54% respectively.

These observations were further substantiated by the yield data. The IRRI applicator treatments gave average yield of 2096 kg/ha as compared to MB (1172 kg), treated check/Basuddin (2056 kg) and untreated check (1022 kg). On the basis of lowest borer incidence and highest paddy yield from the IRRI applicator treatments, it can be concluded that the IRRI applicator is superior to others. Even one application

30 DAT gave better results than 2 applications. It is probably that the 2nd application (in TI) was not necessary as the borer moth population at that time (mid-October) decreased greatly. So the 2nd application did not have any pronounced effect. On the other hand one application by the IRRI applicator made 55 DAT could not be effective as the crop remained unprotected from insects for the first 55 days and during this period the crop had suffered from borer attack which could not be recouped.

An added advantage observed with the IRRI applicator was that the plant growth was vigorous in these treatments than the others, and the number of productive tillers per hill also increased. It can be attributed to insect protection afforded by this method alongwith aerating the soil in the root zone area of the plants

Poor performance of MB may be due to very slow release of insecticide in small quantity from mud ball. The small quantity of the insecticide absorbed in the plants might not be lethal to the borers.

Efficacy of the insecticide can be definitely improved by root-zone method of application as is evident from the results. Application of the insecticide with root zone applicator is quite time consuming as it takes 4-5 hours to treat one acre by one man. Therefore, this method, though economical and effective, can be more suitable for small farmers. The

insecticide to be used in this method should be of low toxicity dermally as the operator is more exposed to contact with insecticide.

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* Assistant Entomologist, Director and Assistant Research Officer, respectively of the Rice Research Institute, Kala Shah Kaku.

Evaluation of Root Zone Application of Insecticide for the Control of Rice Stem Borers, Kala Shah Kaku, 1976

D.O.T. = 12.8.76
Replications = 3
Variety = Basmati 370

Layout = R.B.D.
Plot size = 9 x 2.5 cm
Treatments = 10

T.No.	Treatments (Method of application)	Dose a.i./ha(kg) 30 DAT (a)	55 DAT (b)	DH% (b)	WH% (c)	Productive tiller/hill	Plant Height (cm)	Yield kg/ha	% increase over control
	IRRI Applicator								
1.	MRZ (d)	1.0	1.0	0.74	1.79	8	145	2295	
2.	MRZ	0.5	0.5	4.65	3.13	8	143	2138	
3.	MRZ	1.0	x	1.93	3.71	8	135	2315	
4.	MRZ	x	1.0	7.59	4.02	7	138	1634	
	Average			3.72	3.16	7.75	140	2096	
5.	MB (e)	1.0	1.0	21.63	5.88	4	128	1190	
6.	MB	0.5	0.5	16.26	8.67	5	130	1079	
7.	MB	1.0	x	27.60	6.28	4	125	1307	
8.	MB	x	1.0	14.54	6.75	5	133	1307	
	Average			20.0	6.89	4.5	129	1172	
9.	Treated check (Basudin 10 G)	1.5	2.0	4.63	2.05	7	138	2056	
10.	Untreated Check	-	-	29.28	15.54	4	128	1022	

a. = Day after transplanting.
b. = Dead heart; average of 3 replications, recorded 62 DAT.
c. = White heads; average of 3 replications.
d. = Application with mechanical root zone applicator.
e. = Application with mud basis.

APPENDIX "B"

Industrial Extension

Mass Media

Two IRRI-PAK Agricultural Mchinery Newsletters were issued during the period. These newsletters include a general description of the program, some details of the IRRI machines, other program activities and the manufacturing development. Over 500 copies of each newsletter were distributed to manufacturers, farmers, government officials and other interested parties in the country. Efforts were also made to introduce the program through newspapers, radio and T.V. The IRRI axial flow thresher was shown on national T.V. and commented upon by radio commentators in local language broadcasts.

Exhibitions

Equipment from the IRRI-PAK program was displayed and demonstrated in an exhibition of farm machinery that was held for the Prime Minister of Pakistan at Mandi Bahauddin, Punjab, during the Farmers Week.

A number of IRRI machines were also demonstrated at the Rice Research Institute, Kala Shah Kaku at a fair inaugurated by the Chief Minister of Punjab and attended by many high Government officials and progressive farmers.

An IRRI machinery display and demonstration was arranged at a farmers fair at Rawalpindi in which many well-known agricultural and political personalities saw the IRRI machines. These included the Federal Minister of Health, the Minister for Revenue of Punjab Government and many high Federal and Punjab Government officials.

Demonstrations

Over 20 demonstrations were held in the rural areas of Punjab, such as Kala Shah Kaku; Bhai Phero; Mandi Bahauddin; Lyallpur and Gujrat. These demonstrations were held to evaluate farmers reaction to the IRRI machines and to gain better knowledge of their machinery requirements. The Secretary of Agriculture, Punjab, engineers from the Directorate of agricultural engineering, Punjab, were also invited to some of these demonstrations. Although considerable interest was shown by farmers in the IRRI axial flow thresher, the desirability of threshing wheat and paddy with one machine was repeatedly commented upon during these demonstrations.

Seminars

The Project staff participated in the following seminars and workshops and presented papers and held discussions on

the IRRI-PAK project at two of the seminars during the period of this report:

1. Farmer Economic Survey Studies Workshop, Islamabad.
2. Workshop on National Science and Technology Policy, Peshawar.
3. Fourth Annual Meeting of the PL-480 Research Project Leaders, Lahore.
4. ARC/FAO seminar on Agricultural Perspective Planning in Pakistan, at Islamabad.

Personal Contacts

Personal contacts were made with the following manufacturers, both from state enterprise and the private sector to introduce the IRRI-PAK machinery program and to explore possibilities of local manufacture of IRRI machines.

1. The Pakistan Tractor Corporation, State Life Insurance Building No. 3, Karachi.
2. ---- Pakistan Automobile Corporation, National Shipping Corporation Building, Karachi
3. Nayya Daur Motors, State Life Building No. 3, Karachi.
4. Fedoral Light Engineering Corporation,

5. Manager, Sind Industrial Trading, Estate, S.I.T.E., Karachi.
6. Small Industrial Estate, Government of Punjab, Gujrat.
7. Heavy Mechanical Complex, Taxila.
8. Bella Engineering Co., Karachi
9. Pakistan Engineering Company LTD., Lahore.
10. Karkhana Allate -Zari, Bahawalpur
11. Matchless Diesel Engine Co., Dil Mohammad Street, Lahore.
12. Climax Engineering Co., G.T.Road, Gujranwala
13. Allwin Engineering Industries, 15th Mile, Karachi-Hyderabad Road, Landi, Karachi -22.
14. Mirza Industries, Station Road, Sukkur, Sind.
15. Murad Engineering Works, Grass Mandi, Multan.
16. Caravan Engineering Works, Okara.
17. Mughal Engineering Works, Sahiwal.
18. Sarhad Engineering Works, Nowshera Road, Mardan.
19. Roomi Industries, G.T. Road, Mian Channu.
20. Rehman Engineering Works, S.I.T.E., Hyderabad.
21. Anwar Industries, Sheikhupura Road, Lyallpur.
22. Wahid Engineering, Sumundri Road, Lyallpur.
23. Ghazi Industries, G.T. Road, Mian Channu.

24. Zahoor Engineering Works, Rawalpindi.

25. Bethlehem Technical Foundation, Rawalpindi.

26. Master Engineering Works, Sumundri Road, Lyallpur

27. Javed Engineering Co., G. T. Road, Gujranwala.

28. Ittefaq Brothers, G. T. Road, Lahore.

29. Lahore Engineering & Foundry Organization, Kot Lakhpat, Lahore.

30. Nowshera Engineering Works, Nowshera.

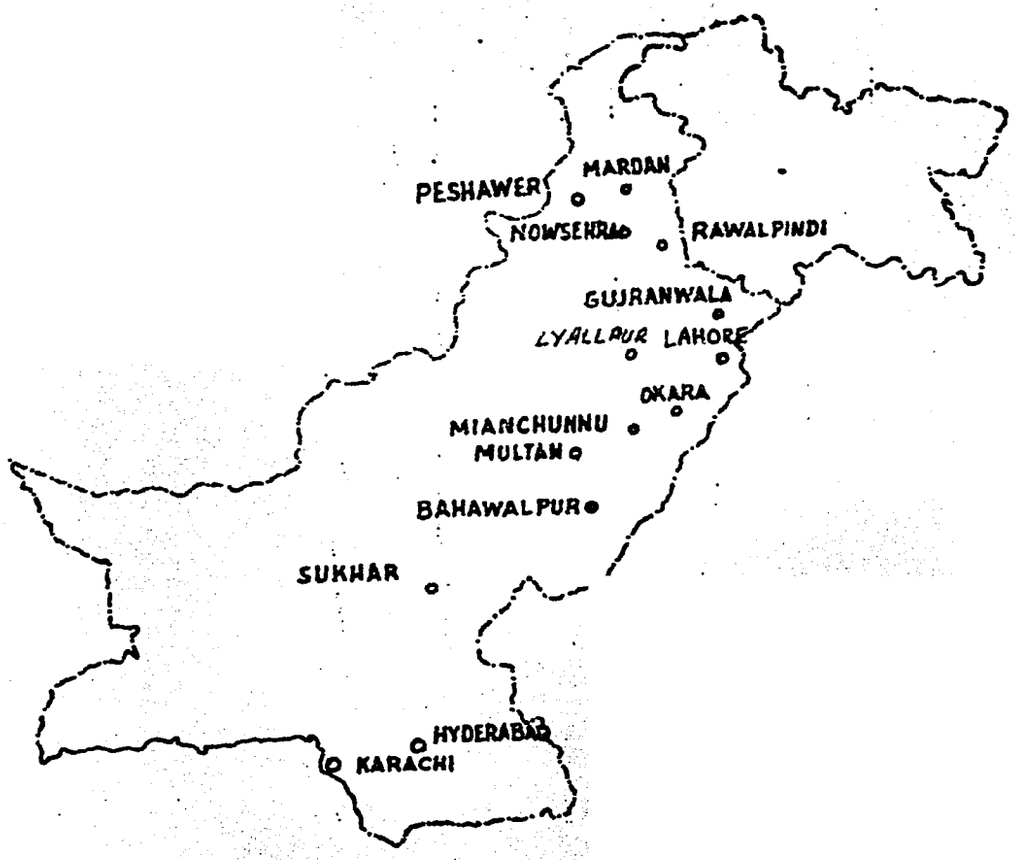
Regional Extension Work

Dr. A. U. Khan, the Project Director, visited India to discuss matters related to the Industrial Extension of the IRRI machines with officials of the Suri Research Foundation, New Delhi, a sub-contractor in India for extending the IRRI machines among local manufacturers.

He also visited the Light Carts Limited, Meerut, a company interested in manufacturing the IRRI machines and the Indian Agricultural Research Institute, Pusa, to learn about the latest development in agricultural mechanization and in low cost energy research in India

Mohammad Ilayas, a Project Engineer, visited the American Spring and Pressing Works, Malad, Bombay. This company is manufacturing the IRRI Axial Flow Thresher in

India for wheat. The experience gained by this company for threshing wheat with the axial flow thresher is of considerable interest to all wheat growing countries.



Karachi

Habib Ind.*

Allwin Engg

Auto Corp

Light Engg

Naya Daur

Bella Engg

Hyderabad

Rehman Engg

Sukkur

Mirza Engg

Bahawalpur

Allat-i-Zari

Multan

Murad Engg

Mian Channu

Ghazi Ind.

Roomi Ind.

Okara

Carvan Engg

Paidar Engg

Lyallpur

Master Engg
Anwar & Co
Wahid Engg
Danishmand

Lahore

LEFO*
PECO

Lahore (cont.)

Ravi Engg
Ittefaq*
Matchless
F.W. Engg

Gujranwala

Javaid Engg*

Climax Engg

Rawalpindi

B.T.F*

Zahoor Engg

Mardan

Sarhad Engg

Nowshera

Nowshera Engg

Manufacturers who have completed their IRRI prototype machines.

MANUFACTURERS PERSONALLY CONTACTED BY PROJECT STAFF

APPENDIX "C"

Manufacturing Development

Nine Pakistani manufacturers were provided with engineering drawings on some of the IRRI machines. Six of these companies have already completed their prototype IRRI machines and are planning to start commercial fabrication during the next cropping season. These are:

I. Habib Industries, B-61, S.I.T.E., Karachi

About two years ago Habib Industries built a few older version of the IRRI axial flow threshers with the rotary screen cleaners from drawings received directly from the Institute. This company tried this machine for threshing wheat but encountered considerable operational difficulties with it. The original IRRI machine was primarily designed for threshing the new dwarf paddy variety and did not function well for threshing either tall paddy varieties that are popular in Pakistan or for threshing wheat.

The Project staff discussed the wheat threshing problems with the Habib Industries and also consulted some of the users of the Habib thresher. IRRI-PAK project engineers also visited the Prime Minister's farm at Larkana, where one of the Habib thresher is being used for threshing paddy. Based on their observation and discussions, one Habib

Industries thresher was modified at the IRRI-PAK machine shop to thresh tall paddy varieties. The latest design features that have developed at the Institute in the axial flow thresher were also incorporated in the Habib Machine. This machine was further tested and modified during the last rice threshing season and the results have been discussed elsew

are now incorporating these design improvements in their remaining machines. Further tests are planned on the Habib Machine during the coming wheat threshing season.

II. Lahore Engineering and Foundry Organization(LEFO), Kot Lakhpat, Lahore.

This is a large nationalised manufacturing firm producing diesel engines, machine tools, road rollers and wheat threshers. Eight older version of the IRRI axial flow threshers, with the rotary screens were fabricated by this company. Six of these machines were field tested at different location in the Punjab during the last paddy threshing season. The company is now fabricating an axial flow thresher based on the latest IRRI design with the oscillating screen cleaner.

III. Ittefaq Brothers, G.T. Road, Lahore

This company has fabricated two prototype axial flow

threshers with the oscillating screen cleaner from the latest IRRI drawings. One of their machine has been brought to the IRRI-PAK Project for tests and necessary design modifications.

IV. Javed Engineering Co., G.T. Road, Gujranwala

This is a small company which manufactures tractor-driven implements and wheat threshers. It has fabricated a prototype axial flow thresher with oscillating screen and one IRRI diaphragm pump. The company is evaluating the performance and market for these two machines.

V. Master Engineering Works, Sumundari Road, Lyallpur

This company has fabricated a prototype axial flow thresher and is conducting tests and demonstration with this machine. They have also made a diaphragm pump and are evaluating its market.

VI. Bethlehem Technical Foundation (BTF) Dhok Allah Bukhsh, Rawalpindi.

B.T.F. has fabricated ten liquid chemical applicators, three diaphragm pumps and one portable paddy thresher. The design of the portable paddy thresher is being modified and improved by the Project staff to meet local threshing requirements. The company is evaluating the market for the IRRI machines.

VII. Zahoor Engineering Works, Dhok Khaba, Rawalpindi.

This company is fabricating a prototype self-propelle cart and is interested in producing some of the other IRRI machines.

A number of other Pakistani manufacturers have shown interest in the production of the IRRI machines. Engineering drawings have been supplied to the companies listed below and some of these companies have started the fabrication of their prototype machines:

1. Ghazi Industries, G. T. Road, Mian Channu.
2. Roomi Industries, G. T. Road, Mian Channu.
3. Rehman Engineering Works, Hyderabad.
4. Wahid Engineering, Sumundri Road, Lyallpur.
5. Sarhad Engineering Works, Mardan.
6. Okara Engineering Works, Okara.

APPENDIX "D"

SURVEY FORM

SMALL FARM MECHANIZATION IN PAKISTAN

Farmer's Name_____ Enumerator_____

Address_____ Date_____

A. GENERAL INFORMATION

1. Farm size (acres)_____

   Tenancy status_____

2. Family size_____

3. Level of Education_____

4. Labour force on farm (Permanent)

   Family men_____

   Family Women_____

   Hired labour_____

5. Source of Irrigation water:

   Canal_____ Pump_____ Rainfed_____

   Combination(specify)_____

6. Approximate yearly cash income_____

7. Non Farm income_____

8. Distance from the Pakka Road_____

9. Distance from the Market Town_____

B. GENERAL MECHANIZATION

10. Do you own a tractor_____ If yes, model_____

Horsepower_____

11. What equipment you use for?

	Owned	Hired
a) Land levelling	_____	_____
b) Seed bed preparation	_____	_____
c) Sowing	_____	_____
d) Weeding	_____	_____
e) Fertilizer application	_____	_____
f) Insect & Pest Control	_____	_____
g) Harvesting	_____	_____
H) Threshing	_____	_____
i) Post-harvest processing	_____	_____
j) Others	_____	_____

12. Are you satisfied with the performance of your machines, explain_____

13. What additional equipment would you wish to acquire for:

a) Land levelling_____

b) Seed bed preparation_____

c) Sowing_____

d) Weeding_____

e) Fertilizer application_____

f) Insect & pest control_____

g) Harvesting_____

h) Threshing_____

i) Post harvesting processing_____

j) Others_____

14. Do you hire out any of your machines to others_____

If yes, name_____

15. Do you hire in any machine_____If yes, name the machine and its source_____

16. How much additional labour do you need at peak times _____and for what operation_____.

17. Do you have difficulty in getting required seasonal labour_____If yes, what difficulty_____

18. Do you pay extra wages at peak times_____

What is the normal wage_____

19. Do you think that farm output can be increased by mechanised farming?_____

20. Do you receive any technical help from some outside agency, if yes, please explain_____

21. Have you been contacted by any machinery dealer or manufacturer_____

22. Do you use chemical fertilizer_____

C. FINANCING

23. Capital source for IRRI's machines.

Personal_____Amount_____

Borrowed_____ Amount_____

Interest_____%_____

If borrowed, from whom, Commercial Bank_____

Dealer's Credit_____ Agricultural Development

Bank_____ Others(specify)_____

D. REPAIR AND SERVICING

24. Distance from machine repairing facilities_____

25. Are spare parts readily available, yes_____ no_____

E. RICE MACHINERY

26. Do you grow rice?_____

27. Describe rice production method in respect of:

a) Seed bed preparation_____

b) Puddling_____

c) Transplanting and its cost per acre_____

d) Fertilizer application_____

e) Weeding_____

f) Harvesting and its cost per acre_____

g) Threshing and its cost per acre_____

h) Transporting_____

i) Drying_____

j) Storing_____

k) Milling_____

l) Any other_____

28. What machines would you like to purchase for rice crop_____

F. IRRIGATION

29. Investment on irrigation equipment_____

REMARKS: (Farmers Crop, small or average Farmer, reliability of information, hospitality of the farmer, etc.)

_____

_____

_____

LIST OF PERSONNEL

Technical Staff

Name	Organization	Title	Period (Month)
1. Dr. A. U. Khan	IRRI	Project Director	5
2. Philip L. Hess	IRRI/GIT	Research Engineer	3
3. Hamid Ayub	IRRI	Research Assistant	4
4. Mohammad Ilyas	IRRI	Research Assistant	6
5. Murtaza Ali Shah	IRRI	Research Assistant	3
6. Sahibzada Anwar Ahmed	ARC	Asstt. Agri. Engg.	6
7. Ghulam Sarwar	IRRI/GIT	Research Aide	4
8. Pervaiz Akhtar	IRRI	Research Aide	2

Support Staff

1. Inyat Ullah	IRRI	Secretary	6
2. Mohammad Jameel	IRRI	Senior Mechanic	4
3. Oscar Massy	ARC	Mechanic	4