Cooperative Agreement AID 492-CA-1707
Project No. 498-0265

Annual Progress Report
September 1, 1982

Project Title: Extension of Small-Scale Agricultural Equipment
The International Rice Research Institute

During the 1981-82 year progress has been made in the three countries in which we have been involved: The Philippines, Indonesia, and Thailand. New equipment, especially the reaper, small power tiller, and the rolling injection planter have been introduced. A number of new cooperators have been added.

The Strategy Statement for India has been approved by USAID in Washington, D.C. and by the Indian Council of Agricultural Research (ICAR). A project engineer has been appointed by the ICAR. IRRI is in the process of recruiting an ergineer for the project.

As in the rest of the world, the economies of the Southeast Asian countries are in a depressed state and, in general, the farm equipment industry in these countries are affected. However, as indicated in the statistics of the country reports, the production of IRRI machines has been increasing. The implication is that the small privately-owned machine shops are expanding their production and able to fabricate equipment for the small rice farmer in his locale at a price the farmer can afford.

Headquarters Activities

Staffing

During 1982, Bart Duff, who was on study leave, returned to the department. Dr. Amir Khan, who had been stationed in Pakistan as project leader of the IRRI-Pakistan program, returned to Los Baños on September 1, 1982 to take responsibility for the development of fertilizer placement machinery. Mr. Marvin Nafziger returned to the United States on November 5, 1982. Mr. Henke departed for Sri Lanka to be part of a program supported by the German Government. Dr. B. J. Cochran, Visiting Scientist, returned to the U.S. on July 1, 1982; and Dr. J. Lingard, Visiting Scientist, returned to England on January 1, 1982. The staffing of the department presently is:

Dr. C. W. Bockhop, Head of Department, in charge of Design, and Project Leader of Industrial Extension.

Mr. M. Ariyoshi, Agricultural Engineer in charge of Test and Evaluation.

Mr. Bart Duff, Associate Agricultural Economist in charge of Economics Section.

Dr. John Wicks, Associate Agricultural Economist (appointment until April 30, 1983).

Dr. Amir Khan, Agricultural Engineer, Consultant for development of equipment for deep placement of fertilizer.

In addition to the staff changes indicated above, the Senior Staff in Agricultural Engineering were involved in the recruitment of Industrial Extension personnel for Egypt and Burma. Mr. Marvin Parker was appointed to the Egypt project effective October 1, 1982; and Mr. Malcolm Hammond, to the Burma project, effective as soon as funding is approved by the Canadian government.

Training

The department has two post-doctoral fellows in residence: Dr. Banshi D. Shukla, (appointed July 1, 1982) from India, has major responsibility in Rice Drying. Dr. Jeon Yong Woon, (appointed June 5, 1982) from Korea, has major responsibility in Rice Drying.

The departmental Senior Staff are/have been supervising the graduate programs of the following scholars:

Mr. T. R. Sharma, India, graduated from Asian Institute of Technology in February, 1982. Major subject: transplanter. Advisor: C. W. Bockhop.

Mr. Felipe Santos, Philippines, UPLB; major subject -- fertilizer placement. Adviser: C. W. Bockhop.

Mr. U Mya Thein, Burma, UPLB; major subject -- seedling preparation for transplanters. Advisor: C. W. Bockhop.

Mr. Mozzamil Haq, Bangladesh, UPLB; advisor: C. W. Bockhop.

Miss Blanquita Reyes, Philippines, UPLB; adviser: Bart Duff.

Mr. Eulito Bautista, Philippines, UPLB; major subject -- fertilizer metering. Adviser: C. W. Bockhop.

Mr. Yusuf Maamun, Indonesia, UPLB; adviser: Bart Duff.

Mr. Yusuf Saefuddin, Indonesia, UPLB; adviser: Bart Duff.

Mr. Guy Sharrock, Great Britain; adviser: John Wicks.

Mr. Dermot Shields, Great Britain; adviser: John Wicks.

There were two Agricultural Engineering courses held the past year at headquarters; and one each in Indonesia and Thailand in the native language. In addition there were three workshops and a training course held in the Philippine Outreach Program. The two-week Agricultural Engineering course was held December 6-17, 1981 and June 7-18, 1982. Attendance for the two courses was as follows:

Country	December 7-18, 1981	June 7-18, 1982
Philippines	10	5
Burma	2	
India	1	2
Indonesia	2	2
Sri Lanka		1
Thailand		3
Total	15	13

A copy of the program for the 2-week course is attached as Appendix A.

During a meeting of Industrial Extension engineers, November 2-5, 1982, in Los Baños, the training of ministry people by secondment to industry was discussed. All senior staff were of the opinion that the industrial companies could not yet provide the training needed by ministry people.

The training of engineers from industry at IRRI headquarters was also discussed. Presently, IRRI has been training extension engineers from Bangladesh and Korea. The engineers have been at IRRI for the 3 month period ending December 17, 1982. Their training was funded by the Bangladesh Rice Research Institute and by the Regional Network for Agricultural Machinery. This initial program has been experimental and we are not satisfied with results. The Industrial Extension group felt we should not utilize funds for this type of training until a better program is established. The principal reason for our dissatisfaction is that the department is not organized or equipped to provide a 3-month organized training program. We will study the results of the program for the last group and may develop a suitable 3-month course for 1983 and 1984.

Design and Development

The selection of machines that need improvement or development is based upon priorities established by a "Project Review Committee," and based upon priorities presented by Industrial Extension Engineers in the Outreach Program. The work for the past year in order of priority was:

1. The Reaper

The reaper is an adaptation of a design from China modified to fit the IRRI power tillers and improved to accommodate conditions in

the Philippines. A 1 meter and a 1.6 meter models were developed.

Prototype units have been sent to Indonesia, Thailand, India, Pakistan, and Egypt. Indonesia and Thailand are testing it for local conditions and introducing it to their manufacturers. The Pakistan project personnel tested the 1 meter model and designed a 2.2 meter unit for a 4-wheel tractor which has now been introduced to manufacturers. India has received a unit and is testing it under local conditions. The Philippines group introduced the reaper to manufacturers in a workshop in February 1982.

2. PT-5 Power Tiller

With the introduction of the 1 meter reaper, a 3 HP Power Tiller (PT-5) was introduced. The combination of the tiller and reaper provided a lightweight unit for the soft wet conditions found in many countries such as the Philippines.

3. Fertilizer Placement Machines

The development of fertilizer placement machines received top priority the latter part of 1981 and during 1982. This work will continue through 1983 since the problems in developing low-cost but effective machines are formidable. Several models have been developed to deep-place prilled urea, forestry grade urea, and urea supergranules. C. W. Bockhop and B. J. Cochran participated in a conference in Fuchou, China in April and May 1982, where fertilizer placement research was discussed and where we were able to study the machines the Chinese have developed.

4. Crop Drying

It is believed by many that the quality of rice could be improved if the farmers had improved facilities for drying their paddy. Drying has number 2 priority in 1983. Two approaches are being followed:

a. Dr. Stickney, Dr. Shukla and I. Manalili have developed a heated floor dryer. This unit, utilizing rice hulls for fuel, is undergoing tests at the PPC farms in Mindanao. Dr. Shukla has responsibility for the test and development of the unit.

b. A warehouse type dryer has been developed by Dr. Jeon utilizing a rice husk furnace and a vortex wind machine to move the air. This unit will not require any external power and can be used to dry other crops as well as rice.

5. Rotary Injection Planter

This original design came from the International Institute of Tropical Agriculture. The planter was originally designed for minimum tillage conditions where considerable trash lies on the surface of the seedbed; however, it appears to have usefulness in prepared seedbeds.

Prototypes have been sent to Burma, Thailand and Indonesia for further testing.

6. The "Buffalo Plow" improved in Thailand was fabricated and tested at Los Baños. Plans for the unit were distributed to Indonesia.

7. The TH6 thresher is being modified to provide an improved version to new cooperators. A fabricator in the Philippines has developed an improved version and his unit is the model we are trying to emulate. Testing on the modified TH6 will continue into the first 6 months of 1983.

8. Since there is considerable interest in direct seeding, the department is initiating studies of direct seeders for wetland conditions.

9. V. R. Reddy from Indonesia proposed a 2 stage axial flow pump be developed. The department is designing a 2-stage unit and tests will be conducted by M. Aban.

Finance

A summary of expenditures for the project is included as Appendix B. To date the project has consumed 67% of the planned budget. Forty-three percent more than planned was spent in Indonesia while at all other locations expenditures were less than anticipated. However, very little has been spent in India since the project personnel have not yet been appointed.

Industrial Extension Meeting

A meeting of all Industrial Extension staff was held in Los Baños November 2-5, 1982. The meeting provided opportunity to discuss problems in the field and to exchange information between engineers at headquarters and outreach personnel. The meeting gave us opportunity to adjust our priorities in research being conducted at Los Baños. We plan to have a similar meeting in November, 1983 in conjunction with the "Technology for the People" Fair to be held in Manila November 21-27, 1983 (IRRI will have a display at the Fair).

Studies

The outreach group in Indonesia has been cooperating with USAID/Indonesia in a project in Sulawesi called the Luwu Mechanization project. A progress report of the work to date is included as Appendix C.

We are obtaining some excellent data. Presently all two-wheel tractors are still performing well and the operators wish to retain and purchase the power tillers. It is expected that power tillers and associated equipment will be fabricated locally.

Other Activities

In addition to the supervision of the Industrial Extension Outreach program, and the administration of the Agricultural Engineering Department, C. W. Bockhop was a member of the Technical Advisory Committee of the Regional Network for Agricultural Machinery which met in Japan October 13-19, 1982; and also Chairman of the Coordinating Committee for a meeting of the "Advisory Committee for Science and Technology for Development" sponsored by the UN Center for Science and Technology which met at IRRI December 13-16, 1982.

Philippine Outreach Program

The program in the Philippines is progressing well as planned. The institutional relationships are developing well and the technical capabilities of the Ministry personnel are improving. The progress made in the institutional development can be attributed in a large measure, to the excellent support from the Deputy Minister of Agriculture. He has accepted the chairmanship of the Advisory Committee and takes an active interest in the project.

Dr. Stickney has presented a need for some equipment for the shop of the Agricultural Engineering Division. These are to be purchased by the Ministry if funds are available at the end of the year.

The Ministry of Agriculture's engineers have all received training at IRRI. During the next two years, the project engineers will be given more responsibility for the field activities and contact with the small industries.

There has been a marked increase in interest from manufacturers in becoming IRRI cooperators. This was prompted, we believe, by the introduction of the IRRI reaper. The reaper was introduced through an organized training program attended by 56 manufacturers. Two training courses were held; one in February, 1982, the second in August. It is estimated that about 150 units were fabricated in 1982.

A workshop was held in July to introduce and establish field trials for the rotary injection planter. The planter, developed at the International Institute of Tropical Agriculture, has drawn considerable interest from other research people in the Philippines.

Two workshops were held to identify priorities and formulate research and development activities for the Philippines. A workshop on Small Farm Equipment R&D was held on December 3-4, 1981; and a workshop on Small Farm Equipment on June 2-3, 1982.

Although the economy in the Philippines is presently in a depressed state, it is noted that the fabrication of IRRI designed machines in 1981 was higher than in previous years. This confirms the fact that for the "small-farm" sector, the small shops are able to fabricate the needed equipment at a cost farmers can afford.

A detailed report for the Philippines is attached as Appendix D.

Indonesia Outreach Program

The project is operating in West Sumatra, South Sulawesi, South Kalimantan, and West Java. In addition, the project engineer and Director, V. R. Reddy, is providing leadership for a special project in the Luwu District of South Sulawesi. The project in Luwu is receiving funds from USAID/Jakarta. A project report of the Luwu activity is included as Appendix C.

The information from the Luwu project has provided evidence of the value of the small locally fabricated equipment. The farmers are very impressed with the small tractors and more than 50 farmers are interested in purchasing the equipment.

Demonstrations and extension contacts have been made in the South Kalimantan province but progress has been slow. The area is generally a "backward" community and they have not had sufficient guidance from the local center.

Lift irrigation, paddy drying, and threshing have been priority activities in West Java. The government is providing credit for 25 pump sets and the results are being monitored by project staff. Drying of paddy with the IRRI designed dryer has resulted in lowering of the quality of the rice. Further testing and training is needed.

A training program in the Indonesian language was conducted in Jakarta and training programs for operators have been held in the provinces.

With the exception of axial flow pumps, the fabrication of IRRI designed equipment has increased since 1979.

A counterpart engineer is now appointed to the project and it is hoped that he will take a more active role in the project.

A detailed report of the Indonesia project is enclosed as Appendix E.

Thailand Outreach Program

The project in Thailand has introduced several new machines which should be rapidly adopted by manufacturers if the economic situation is favorable.

A buffalo plow was redesigned and improved; and blueprints and prototype models have been given to manufacturers. The acceptance has been slow because farmers cannot comprehend the benefits of the improved plow. An extensive demonstration program is needed. Where the plow has

been demonstrated, it has been accepted by the farmers and produced in numbers; although the numbers have been small. The improved plow was introduced into a northern remote area. See report in Appendix F.

During the past year, two manufacturers began fabricating the improved buffalo plow; and seven, the axial flow thresher for the first time.

The paddy seeder, IRRI inclined plate planter, cyclone-type seeder, and the IRRI reaper, and the 3 HP power tiller were introduced. These machines will be promoted during the coming year. Because of considerable interest shown in a reaper imported from China (but too expensive) it is believed that the IRRI reaper will have good acceptance.

The project is trying to redesign the transplanter so that the traditional root-washed seedlings can be utilized. This constraint to the use of the transplanter is one that appears in many countries.

The farmer in Thailand is accustomed to riding behind a tractor and objects to walking behind a power tiller. The project engineers are designing a riding seat for the IRRI power tiller which will be tested during the coming year.

The agricultural economy is presently depressed in Thailand and this has resulted in a decrease in sales of farm equipment. A drought also hit the northeastern region and this may further depress sales.

The project is not adequately staffed by the Thai government at the present time. There needs to be additional commitment by the Thai government for the work to progress in the future.

The project will be thoroughly reviewed in February, 1983.to determine future direction of the work in Thailand.

An important part of the activity has been the translation of ASAE standards (American Society of Agricultural Engineers standards) into the Thai language. The manufacturers are at a stage where it is important that they follow some standards in their manufacturing. The use of standards will reduce their costs and facilitate interchangeability of parts and implements. Standards for auger flights, V-belts, and tractor and implement hitches have been translated.

A detailed report for Thailand is in Appendix G.

India Outreach Program

The Strategy Statement for India was approved by the Indian Council of Agricultural Research on 28 January, 1982; and, by USAID/Washington on 19 March, 1982.

The Director of the Central Institute of Agricultural Engineering, Dr. T. P. Ojha, who is also Director of the CIAR-IRRI project has recruited Mr. P. Datt, presently with the Central Rice Research Institute at Cuttack as project engineer.

IRRI has submitted a nomination to ICAR, India, for the IRRI consultant to the project but the approval has not yet been received.

A reaper and power tiller have been sent to Tamil Nadu University for testing and demonstration and a transplanter will be sent to them soon.

Burma Outreach Program

Although USAID does not provide funds for the program in Burma, two reports are included for information: "IRRI Designed Small-Scale Agricultural Machines in Burma" and "Experience in Burma with the IRRI-designed Manually Operated Rice Transplanter." Both are included in Appendix H.

Appendix A

PROGRAM SCHEDULE

Two-Week Agricultural Engineering Training Course
June 7-18, 1982

June 7 - Monday

8:00 - 8:15	Welcome (Seminar Room A, Chandler Hall)	M. D. Pathak
8:15 - 8:45	IRRI Agricultural Engineering and Industrial Extension Programs	C. W. Bockhop
8:45 - 9:15	Slide show on "The Rice of IRRI"	OIS/Visitors' Bureau
9:15 - 9:30	Preparation for Introduction of Trainees	Move to Agric. Eng'g. Conference Room
9:30 - 10:00	Introduction of trainees and IRRI staff	R. E. Stickney
10:00 - 10:30	Coffee Break	
10:30 - 12:00	Farm Economics: Typical costs and returns for different levels of technology	B. Duff
12:00 - 1:00	Lunch	
1:00 - 2:00	Farm Economics: Partial budget analysis of alternative technologies	G. Sharrock/P. Moran
2:00 - 2:45	IRRI Engineering Drawing System	F. C. Jalotjot
2:45 - 3:00	Coffee Break	
3:00 - 4:00	Shop Tools and Plant Layout	N. Langam
4:00 - 5:00	Overviews of Agricultural Equipment for Small Rice Farms (video tape)	S. A. Gutierrez/ R. E. Stickney

June 8 - Tuesday

8:00 - 12:00	Field Practice: Transplanter, Reaper and Power Tillers (with plow, rotavator, and harrow)	S. Labro
12:00 - 1:00	Lunch	
1:00 - 2:45	Manual Transplanter	I. Manalili/A. Vasallo
2:45 - 3:00	Coffee Break	
3:00 - 5:00	Transplanter: Shop Practice and Seedling Preparation	A. Vasallo/E. Dungo

June 9 - Wednesday

8:00 - 9:15	Farm Economics: Techniques for Investment Appraisal, including B/C, IRR, and BE	G. Sharrock/P. Moran
9:15 - 10:00	Transplanter: Economic Analysis	L. Ebron
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Threshers	M. Diestro/A. Caballes
12:00 - 1:00	Lunch	
1:00 - 5:00	Threshers: Shop and Field Work	A. Caballes/E. Dungo

June 10 - Thursday

8:00 - 9:00	Threshers: Economic Analysis	F. Juarez
9:00 - 10:00	Cost Estimating for Small and Medium Scale Equipment Manufacturers	H. Manaligod
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Power & Rotary Tillers	I. Manalili/E. Calilung
12:00 - 1:00	Lunch	
1:00 - 5:00	Shop Work	H. Manaligod/E. Dungo

June 11 - Friday		
8:00 - 9:00	*Tillers: Economic Analysis*	*C. Maranan*
9:00 - 10:00	*Reaper*	*V. Tiangco/M. Diestro*
10:00 - 10:15	*Coffee Break*	
10:15 - 12:00	*Reaper (continuation)*	
12:00 - 1:00	*Lunch*	
1:00 - 5:00	*Reaper: Shop Work*	*H. Manaligod/E. Dungo*
June 14 - Monday		
8:00 - 9:00	*Reaper: Economic Analysis*	*P. Moran*
9:00 - 10:00	*Jigs & Fixtures*	*L. Kiamco*
10:00 - 10:15	*Coffee Break*	
10:15 - 10:30	*Photograph of Course Participants*	*OIS, Photography*
10:30 - 12:00	*Axial-Flow Pumps*	*G. Salazar*
12:00 - 1:00	*Lunch*	
1:00 - 2:00	*Axial-Flow Pumps: Economic Analysis*	*C. Maranan*
2:00 - 5:00	*Axial-Flow Pumps: Shop and Field Work*	*E. Calilung/E. Dungo*
June 15 - Tuesday		
8:00 - 9:00	*Economics of Manufacturing*	*N. Langam*
9:00 - 9:45	*Machinery Safety*	*M. Ariyoshi*
9:45 - 10:00	*Coffee Break*	
10:00 - 11:00	*Testing and Evaluation*	*S. Labro*
11:00 - 12:00	*Rolling Injection Planter*	*M. Aban*
12:00 - 1:00	*Lunch*	
1:00 - 2:00	*Fertilizer Applicators*	*I. Camacho/G. Salazar*
2:00 - 3:00	*Small Engines for Farm Machinery*	*H. Manaligod*
3:00 - 3:15	*Coffee Break*	
3:15 - 5:00	*Rolling Injection Planter and Fertilizer Applicators: Shop and Field Work*	*M. Aban/G. Salazar/ I. Camacho*
June 16 - Wednesday		
	Field trip to cooperating manufacturers	*N. Langam*
June 17 - Thursday		
8:00 - 9:00	*Extension Program: Overview*	*C. W. Bockhop*
9:00 - 10:00	*Extension Program: Past Experiences in the Philippines*	*S. A. Gutierrez/ R. E. Stickney*
10:00 - 10:15	*Coffee Break*	
10:15 - 11:15	*Consequences of Mechanization Studies*	*B. Duff*
11:15 - 12:00	*How to Plan and Conduct a Field Demonstration*	*S. Labro*
12:00 - 1:00	*Lunch*	
1:00 - 2:15	*Rice Drying*	*L. Halos*
2:15 - 3:00	*Rice Milling*	*I. Camacho*
3:00 - 3:15	*Coffee Break*	
3:15 - 5:00	*Drying and Milling: Laboratory Work*	*I. Camacho/L. Halos*
June 18 - Friday		
8:00 - 9:45	*Course Examination*	*S. Gutierrez*
9:45 - 10:00	*Coffee Break*	
10:00 - 12:00	*IRRI Tour*	*Visitors' Bureau*
12:00 - 1:00	*Lunch*	
1:00 - 2:30	*Questionnaire on Course Evaluation; Free Time for Discussion of Machines of Particular Interest*	
2:30 - 3:00	*Closing Remarks* *Distribution of Certificates*	*C. W. Bockhop*
3:00 - 3:30	*Merienda*	*Trainees & Instructors*

PROGRAM SCHEDULE

Two-Week Agricultural Engineering Training Course
December 6-17, 1982

Dec. 6 - Monday

8:00 - 8:15	Welcome (Seminar Room A, Chandler Hall)	M. D. Pathak
8:15 - 8:45	IRRI Agricultural Engineering and Industrial Extension Programs	C. W. Bockhop
8:45 - 9:15	Slide show on "The Rice of IRRI"	Visitors' Bureau
9:15 - 9:30	Preparation for Introduction of Trainees	Move to Agric. Eng'g. Conference Room
9:30 - 10:00	Introduction of trainees and IRRI staff	R. E. Stickney
10:00 - 10:30	Coffee Break	
10:30 - 12:00	Farm Economics: Typical cost and returns for different levels of technology	B. Duff
12:00 - 1:00	Lunch	
1:00 - 2:00	Farm Economics: Partial budget analysis of alternative technologies	D. Shield/P. Kaiser
2:00 - 3:00	IRRI Engineering Drawing System	F. C. Jalotjot
3:00 - 3:15	Coffee Break	
3:15 - 4:00	IRRI Engineering Drawing System (continuation)	
4:00 - 5:00	Overviews of Agricultural Equipment for Small Rice Farms (video tape)	S. A. Gutierrez/ R. E. Stickney

Dec. 7 - Tuesday

8:00 - 12:00	Field Practice: Transplanter, Reaper, Thresher, Axial-Flow Pump, and Power Tillers (with plow, rotavator, and harrow)	S. Labro
12:00 - 1:00	Lunch	
1:00 - 2:45	Manual Transplanter	I. Manalili/G. Salazar
2:45 - 3:00	Coffee Break	
3:00 - 5:00	Transplanter: Shop Practice and Seedling Preparation	A. Vasallo/E. Dungo

Dec. 8 - Wednesday

8:00 - 9:15	Farm Economics: Techniques for Investment Appraisal, including B/C, IRR, and BE	D. Shield/P. Kaiser
9:15 - 10:00	Transplanter: Economic Analysis	L. Ebron
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Threshers	M. Diestro/A. Caballes
12:00 - 1:00	Lunch	
1:00 - 5:00	Threshers: Shop Work	M. Diestro/E. Dungo

Dec. 9 - Thursday

8:00 - 9:00	Threshers: Economic Analysis	F. Juares
9:00 - 10:00	Cost Estimating for Small and Medium Scale Equipment Manufacturers	H. Manaligod
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Power & Rotary Tillers	E. Calilung
12:00 - 1:00	Lunch	
1:00 - 5:00	Shop Work, Power and Rotary Tillers	H. Manaligod/ I. Manalili/ E. Dungo

Dec. 10 - Friday

8:00 - 9:00	Tillers: Economic Analysis	C. Maranan

(over)

9:00 - 10:00	Reaper	V. Tiangco/M. Diestro/ A. Caballes
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Reaper (continuation)	
12:00 - 1:00	Lunch	
1:00 - 5:00	Reaper: Shop Work	H. Manaligod/E. Dungo/ A. Caballes

Dec. 13 - Monday

8:00 - 9:00	Reaper: Economic Analysis	P. Kaiser
9:00 - 10:00	Jigs & Fixtures	L. Kiamco
10:00 - 10:15	Coffee Break	
10:15 - 10:30	Photograph of Course Participants	OIS, Photography
10:30 - 12:00	Economics of Manufacturing	N. Langam
12:00 - 1:00	Lunch	
1:00 - 4:00	Axial-Flow Pumps: Lecture and Shop Work	G. Salazar/E. Dungo
4:00 - 5:00	Axial-Flow Pumps: Economic Analysis	C. Maranan

Dec. 14 - Tuesday

8:00 - 9:00	Shop Tools and Plant Layout	N. Langam
9:00 - 9:45	Machinery Safety	M. Ariyoshi
9:45 - 10:00	Coffee Break	
10:00 - 11:00	Testing and Evaluation	S. Labro
11:00 - 12:00	Rolling Injection Planter	V. Tiangco
12:00 - 1:00	Lunch	
1:00 - 2:00	Fertilizer Applicators	Camacho/Kiamco/Salazar
2:00 - 3:00	Small Engines for Farm Machinery	H. Manaligod
3:00 - 3:15	Coffee Break	
3:15 - 5:00	Rolling Injection Planter and Fertilizer Applicators: Shop and Field Work	V. Tiangco/G. Salazar I. Camacho/L. Kiamco

Dec. 15 - Wednesday

	Field trip to cooperating manufacturers	N. Langam

Dec. 16 - Thursday

8:00 - 9:00	Extension Program: Overview	C. W. Bockhop
9:00 - 10:00	Extension Program: Past Experiences in the Philippines	S. A. Gutierrez/ R. E. Stickney
10:00 - 10:15	Coffee Break	
10:15 - 11:15	Consequences of Mechanization Studies	B. Duff
11:15 - 12:00	How to Plan and Conduct a Field Demonstration	S. Labro
12:00 - 1:00	Lunch	
1:00 - 2:15	Rice Drying	L. Halos
2:15 - 3:00	Rice Milling	I. Camacho
3:00 - 3:15	Coffee Break	
3:15 - 5:00	Drying and Milling: Laboratory Work	I. Camacho/L. Halos

Dec. 17 - Friday

8:00 - 9:45	Course Examination	N. Langam
9:45 - 10:00	Coffee Break	
10:00 - 12:00	IRRI Tour	Visitors' Bureau
12:00 - 1:00	Lunch	
1:00 - 2:30	Questionnaire on Course Evaluation, Free Time for Discussion of Machines of Particular Interest	
2:30 - 3:00	Closing Remarks Distribution of Certificates	C. W. Bockhop
3:00 - 3:30	Merienda	Trainees & Instructors

AID 492-CA-1707
Statement of Expenditures & Commitments
For the Two Years Ending August 31, 1982
(In US $)

	Expenditures	Commitments up to August 31, 1982	Expenditures & Commitments	Approved Budget*	Balance
Salaries & Wages	$403,473.63	$ 30,611.28	$434,084.91	$524,430.00	$90,345.09
Overhead	52,629.17	11,181.32	63,810.49	76,420.00	12,609.51
Fringe Benefits & Allowances	213,952.02	16,986.39	230,938.41	407,460.00	176,521.59
Travel & Transportation	113,196.42	9,835.77	123,032.19	203,770.00	80,737.81
Equipment, Materials & Supplies	107,891.17	9,086.02	116,977.19	176,000.00	59,022.81
Training	34,352.36	100.00	34,452.36	60,930.00	26,477.64
Studies	-	-	-	46,000.00	46,000.00
Workshop	-	-	-	-	-
	$925,494.77	$ 77,800.78	$1,003,295.55	$1,495,010.00	$491,714.45

*Total approved budget for the period September 1, 1980 to August 31, 1982.

AID 492-CA-1707 (Philippine Headquarters)
Statement of Expenditures & Commitments
As of August 31, 1982

	Expenditures	Commitments	Total Expenditures & Commitments	Approved Budget*	Balance
Salaries & Wages	$295,369.32	$ 21,937.46	$317,306.78	$360,030.00	$ 42,723.22
Overhead	39,671.46	6,972.64	46,644.10	52,900	6,255.90
Fringe Benefits & Allowances	196,427.05	12,865.34	209,292.39	339,240.00	129,947.61
Travel & Transportation	16,161.25	4,086.28	20,247.53	49,930.00	29,682.47
Equipment, Materials & Supplies	951.65	304.18	1,255.83	38,000.00	36,744.17
Training	21,950.01	-	21,950.01	12,000.00	(9,950.01)
Studies	-	-	-	10,000.00	10,000.00
Workshop	-	-	-	-	-
	$570,530.74	$ 46,165.90	$616,696.64	$862,100.00	$245,403.36

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* For the period September 1, 1980 to August 31, 1982.

AID 492-CA-1707
Philippine Headquarters
Schedule of Expenditures

Schedule 1 - Salaries & Wages

a) Senior Staff	
September, 1980 - August, 1981	$126,485.16
September, 1981 - July, 1982	150,343.54
b) Local Staff	
September, 1980 - August, 1981	3,283.19
September, 1980 - August, 1982	15,257.43
	$295,369.32

Schedule 2 - Overhead

September, 1980 - August, 1981	$ 19,075.95
September, 1981 - May, 1982 (Sr. Staff) June, 1982 (Support Staff)	20,595.51
	$ 39,671.46

Schedule 3 - Fringe Benefits and Allowances

a) Senior Staff	
Post differential, housing and utilities allowances	
September, 1980 - August, 1981	$ 39,693.59
September, 1981 - August, 1982	52,159.21
IIE Perquisite	
September, 1980 - August, 1981	33,720.83
September, 1981	36,559.74
Educational allowance	
September, 1980 - August, 1981	6,246.07
September, 1981	7,062.98
Educational Travel	
September, 1980 - August, 1981	4,638.00
September, 1981 - June, 1982	7,872.00
Insurance, miscellaneous	
September, 1980 - August, 1981	486.89
September, 1981 - August, 1982	240.96
	$188,680.27
b) Local Staff	
September, 1980 - August, 1981	$ 959.43
September, 1981 - August, 1982	6,787.35
	$ 7,746.78
	$196,427.05

Schedule 4 - Travel and Transportation

a) Local Travel expenses

September, 1980 - August, 1981	$ 19.80
September, 1981 - July, 1982	2,446.42
	$ 2,466.22

b) International Travel

Indonesia	Feb. 8-13, 1981]	
India	Feb. 22 - March 6, 1981]	$ 2,986.90
Indonesia	May 16-24, 1981	1,478.25
US & India	June 21 - August 12, 1982	2,482.37
Indonesia	October 4-7, 1981	1,029.19
India	February 1-17, 1982	1,717.30
		$ 9,694.01

c) 1982 Home leave

Airtickets and per diem	$ 4,001.02
	$ 16,161.25

Schedule 5 - Equipment, Materials & Supplies

a) OIS charges for printing and photography	$ 222.30
b) Supplies issued by IRRI Supply Room May 21, 1981 - August 20, 1982	539.47
c) Various purchase orders	
PO 107280 - hardwares	114.00
106445 - film processing	8.49
107733 - film processing	3.40
0491 - uniforms	20.98
04935 - spare parts	39.26
Key duplication	3.75
	$ 951.65

Schedule 6 - Training

a) Two-week Training Course (July 6-17, 1981)	
Travel expenses	$ 613.05
FHS charges for dinner, cocktails, snacks	311.55
Training charges	5,800.00
Miscellaneous (photos)	32.21
	$ 6,756.81
b) Two-week Training Course (December 7-18, 1981	
Travel expenses	$ 635.23
Training charges	3,625.00
OIS charges for printing	140.33
	$ 4,400.56
c) Training Charges for Georgina Bordado December 7, 1981 to December 6, 1982	$ 8,700.00
d) Two-week Training Course (June 7-18, 1982)	
Travel expenses	$ 20.19
Training charges for 5 Filipino participants	1,812.50
OIS charges for printing	23.87
Medical examination - Ferdinand Caylao	25.88
10 kg. excess baggage for workshop materials to Guayaquil	210.20
	$ 2,092.64
	$ 21,950.01

AID 492-CA-1707
Philippine Headquarters
Schedule of Commitments

Schedule 1 - Salaries & Wages

Senior Staff - August, 1982	$ 21,937.46

Schedule 2 - Overhead

May to August, 1982	$ 6,972.64

Schedule 3 - Fringe Benefits & Allowances

Senior Staff

Housing allowances	$ 812.50
IIE Perquisite	6,192.84
Miscellaneous	400.00
Educational Travel	5,460.00
	$ 12,865.34

Schedule 4 - Travel & Transportation

a) Local Travel - August, 1982	$ 307.47
b) Attendance to ASAE Meeting	3,778.81
	$ 4,086.28

Schedule 5 - Equipment, Materials & Supplies

PO 00541	Solar Applicator in Agriculture	$ 25.00
00540	Psychrometrics	18.00
00539	Farm Machinery - India	30,00
00538	TCR pressure regulated cum trigger mechanism	60.00
06155	IBM type element	21.18
Miscellaneous - August, 1982		150.00
		$ 304.18

AID 492-CA-1707 (Philippine Outreach)
Statement of Expenditures & Commitments
As of August 31, 1982

	Expenditures	Commitments	Total Expenditures & Commitments	Approved Budget*	Balance
Salaries & Wages	$ 38,714.38	$ 2,558.82	$ 41,273.20	$ 65,800.00	$ 24,526.80
Overhead	5,297.58	769.58	6,067.16	9,700.00	3,632.84
Fringe Benefits & Allowance	11,669.49	-	11,669.49	27,920.00	16,250.51
Travel & Transportation	43,846.50	1,343.49	45,189.99	64,280.00	19,090.01
Equipment, Materials & Supplies	23,753.73	821.84	24,575.57	30,000.00	5,424.43
Training	-	-	-	14,000.00	14,000.00
Studies	-	-	-	8,000.00	8,000.00
	$123,281.68	$ 5,493.73	$128,775.41	$219,700.00	$ 90,924.59

* For the period September 1, 1980 to August 31, 1982.

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AID 492-CA-1707
Philippine Outreach
Schedule of Expenditures

Schedule 1 - Salaries & Wages

a) Local Staff

September, 1980 - August, 1981	$ 18,879.25
September, 1981 - August, 1982	15,831.36

b) Honoraria to BPI Personnel and Advisory Committee

October, 1981 - May, 1982	4,003.77
	$ 38,714.38

Schedule 2 - Overhead

September, 1980 - August, 1981	$ 2,775.25
September, 1981 - May, 1982	2,522.33
	$ 5,297.58

Schedule 3 - Fringe Benefits and Allowances

Local Staff

September, 1980 - August, 1981	$ 6,093.13
September, 1981 - August, 1982	5,576.36
	$ 11,669.49

Schedule 4 - Travel & Transportation

a) Local Travel

September, 1980 - August, 1981	$ 5,940.29
September, 1981 - July, 1982	14,821.83
	$ 20,762.12

b) Initial Travel

Airtickets, per diem, driving services	$ 6,486.98
Shipment of personal effects & car	13,790.86
Pre employment medical examination	496.25
Miscellaneous (photos)	3.97
	$ 20,778.06

c) Attendance to ASAE Meeting

Airticket and per diem	$ 2,306.32
	$ 43,846.50

Schedule 5 - Equipment, Materials, Supplies

PO 104249	Airconditioner (1)	$ 690.84
104248	IBM typewriter	1,366.89
107502	Lumber for crate	145.00
107014	Executive chair	148.75
107708	Clear glass for office cabinet	48.75
107727	5 pcs. IBM type element	112.50
107699	4 drawer filing cabinet (1)	110.00
108123	Office tray	7.94
108431	Cage wheel, mold bord plow	196.25
107279	1 Sharp calculator	75.94
108272	hardwares	201.56
108278	hardwares	342.75
109387	films	82.50
107015	1 office desk	353.66
109810	5 axial flow pump w/out engine	1,189.02
109755	2 pcs. megaphone	207.32
	one unit 8 HP gas engine	280.49
109387	film processing	10.10
0320	1 TH-6 portable thresher	628.05
108275	3 office desks	595.73
109811	1 PT-5 power tiller	847.56
109811	2 power tiller	1,695.12
0442	Calling cards	7.32
1228	3 cabinets	347.56
109811	power tillers	1,695.12
1225	1 thresher	487.80
0047	tools	124.50
02331	thresher	843.37
02330	Telephone post	2,079.29
02895	3 rotary injection planter	350.00
02332	mold bord plow	114.29
03481	3 power tiller	1,607.14
00366	hot water boiler, cost iron grates, combustion blower	2,563.00
Miscelllaneous (OIS, GSR stocks, film processing, shipping cost of machines, office supplies)		4,197.62
		$23,753.73

AID 492-CA-1707
Philippine Outreach
Schedule of Commitments

Schedule 1 - Salaries & Wages

Honoraria to BPI Personnel & members of Advisory Committee July & August, 1982	$ 2,558.82

Schedule 2 - Overhead

June to August, 1982	$ 769.58

Schedule 3 - Travel & Transportation

Local Travel	
July and August, 1982	$ 1,343.49

Schedule 4 - Equipment, Materials & Supplies

Office supplies (BPI) for July & August, 1982	$ 537.84
PO 00508 - Techniques & Tools	30.00
06324 - Filing cabinet	104.00
Miscellaneous	150.00
	$ 821.84

AID 492-CA-1707 (Thailand)
Statement of Expenditures & Commitments
As of August 31, 1982

	Expenditures	Commitments	Total Expenditures & Commitments	Approved Budget*	Balance
Salaries & Wages	$ 31,072.08	$ 3,353.00	$ 34,425.08	$ 35,760.00	$ 1,334.92
Overhead	3,390.99	1,669.50	5,060.49	4,900.00	(160.49)
Fringe Benefits & Allowances	1,418.53	3,901.05	5,319.58	15,280.00	9,960.42
Travel & Transportation	16,844.31	1,206.00	18,050.31	20,450.00	2,399.69
Equipment, Materials & Supplies	17,112.44	1,960.00	19,072.44	17,000.00	(2,072.44)
Training	2,700.08	-	2,700.08	8,830.00	6,129.92
Studies	-	-	-	8,000.00	8,000.00
	$ 72,538.43	$12,089.55	$ 84,627.98	$110,220.00	$ 25,592.02

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*** For the period September 1, 1980 to August 31, 1982.**

AID 492-CA-1707
Thailand
Schedule of Expenditures

Schedule 1 - Salaries & Wages	
Local Staff	
September, 1980 - August, 1981	$ 15,060.32
September, 1981 - June, 1982	16,011.76
	$ 31,072.08
Schedule 2 - Overhead	
September, 1980 - August, 1981	$ 2,213.87
September, 1981 - March, 1982	1,177.12
	$ 3,390.99
Schedule 3 - Fringe Benefits & Allowances	
Local Staff	
September, 1980 - August, 1981	$ 224.76
September, 1981	1,193.77
	$ 1,418.53
Schedule 4 - Travel & Transportation	
a) Local Travel	
September, 1980 - August, 1981	$ 4,531.85
September, 1981 - June, 1982	4,582.83
	$ 9,114.68
b) Vehicle maintenance & insurance	
September, 1980 - August, 1981	$ 128.25
September, 1981	417.87
	$ 546.12
c) Expenses for Machinery Training Course (Oct. 27-31, 1980)	$ 806.50
d) 1981 Home leave Airtickets	$ 3,605.91
e) Trip to Los Baños (Sept. 13-18, 1982) Airticket & per diem	$ 576.80
f) Storage charges for household goods (April 1, 1982 - April 1, 1983)	$ 285.60
g) Attendance to ASAE Meeting - 1982 Airticket	$ 1,908.70
	$ 16,844.31

Schedule 5 - Equipment Materials & Supplies

a) Share in Bangkok Office expenses

September, 1980 - August, 1981	$ 4,500.74
September, 1981 - June, 1982	4,841.94
	$ 9,342.68

b) Office and field expenses

September, 1980 - August, 1981	$ 3,802.85
September, 1981	1,878.11
	$ 5,680.96

c) Others

- 2 units ventilator fan	$ 128.08
- Maintenance of 3 units airconditioner	51.72
- Service maintenance of IBM typewriter (June 16, 1981 - December 31, 1982)	76.27
- 2 units 4 drawer filing cabinet	157.89
- 2 pcs. waste basket	4.78
- one unit Kubota diesel engine	478.26
- Cost of shipping one unit power tiller to Thailand from Los Baños	745.42
- 4 pcs. tractor tire; 1 pc pick up tire	153.91
- 2 pcs drafting lamp	245.87
- 1 drafting stool	38.26
- 2 pcs tires for car	91.30
- IBM type element	23.04
- Various refund	(106.00)
	$ 2,088.80
	$ 17,112.44

Schedule 6 - Training

a) Two-week Training Course (June 7-18, 1982)

Cheraurat Mankit
Boonsoom Suwanaruk
Charoon Komcomphunt

Driving services	$ 19.97
Airtickets	1,292.61
Pre & post departure allowance	300.00
Training charges	1,087.50
	$ 2,700.08

AID 492-CA-1707
Thailand
Schedule of Commitments

Schedule 1 - Salaries & Wages

Local Staff - July & August, 1982	$ 3,353.00

Schedule 2 - Overhead

April to August, 1982	$ 1,669.50

Schedule 3 - Fringe Benefits and Allowances

Medical Benefits Plan	$ 456.05
RSP	3,445.00
	$ 3,901.05

Schedule 4 - Travel & Transportation

Local Travel - July & August, 1982	$ 1,206.00

Schedule 5 - Equipment, Materials & Supplies

Share in Bangkok Office expenses July & August, 1982	$ 1,060.00
Office & field supplies - July & August, 1982	900.00
	$ 1,960.00

AID 497-CA-1707 (Indonesia)
Statement of Expenditures & Commitments
As of August 31, 1982

	Expenditures	Commitments	Total Expenditures & Commitments	Approved Budget*	Balance
Salaries & Wages	$ 38,317.85	$ 2,762.00	$ 41,079.85	$ 28,920.00	($ 12,159.85)
Overhead	4,269.14	1,769.60	6,038.74	3,940.00	(2,098.74)
Fringe Benefits & Allowances	4,436.95	220.00	4,656.95	12,360.00	7,703.05
Travel & Transportation	36,344.36	3,200.00	39,544.36	25,370.00	(14,174.36)
Equipment, Materials & Supplies	64,814.02	6,000.00	70,814.02	27,000.00	(43,814.02)
Training	6,210.27	-	6,210.27	10,100.00	3,889.73
Studies	-	-	-	10,000.00	10,000.00
	$154,392.59	$ 13,951.60	$168,344.19	$117,690.00	($ 50,654.19)

* For the period September 1, 1980 to August 31, 1982.

AID 492-CA-1707
Indonesia
Schedule of Expenditures

Schedule 1 - Salaries & Wages

a) Local Staff

September, 1980 - August, 1981	$ 6,967.90
September, 1981 - June, 1982	6,971.04
	$ 13,938.94

b) DITPROD Personnel

September, 1980 - August, 1981	$ 12,922.66
September, 1981 - June 19, 1982	11,456.25
	$ 24,378.91
	$ 38,317.85

Schedule 2 - Overhead

September, 1980 - August, 1981	$ 3,044.44
September, 1981 - January, 1982	1,224.70
	$ 4,269.14

Schedule 3 - Fringe Benefits and Allowances

a) Local Staff

September, 1980 - August, 1981	$ 2,345.79
September, 1981 -	2,091.16
	$ 4,436.95

Schedule 4 - Travel & Transportation

a) Local Travel

September, 1980 - August, 1981	$ 10,538.95
September, 1981 - June 3, 1982	14,525.00
	$ 25,063.95

b) Repair and maintenance of vehicle

September, 1980 - August, 1981	$ 154.36
September, 1981 -	1,772.22
	$ 1,926.58

c) Trips to Los Baños

April 26 - May 5, 1981	$ 1,361.95
September 13-20, 1981	1,243.03
	$ 2,604.98

d) 1981 Home leave

Mrs. Reddy and Madhu	$ 2,080.00

e) Trip to US	$ 3,703.85
f) Others (Visa fees, registration and insurance of vehicle, others)	$ 965.00
	$ 36,344.36

Schedule 5 - Equipment, Materials and Supplies

a) Office rent, supplies and other expenses

September, 1980 - August, 1981	$ 8,967.76
September, 1981	10,423.19
	$ 19,390.95

b) Machines, raw materials and shop supplies

September, 1980 - August, 1981	$ 24,817.30
September, 1981	17,412.26
Chargeable to Luwu Project	(17,351.16)
	$ 24,878.40

c) Subscriptions, books, publications

September, 1980 - August, 1981	$ 680.77
September, 1981	829.22
	$ 1,509.99

d) Shipping and delivery charges for various machines	$ 6,009.74
e) Others	
Stopwatches and thermometers	$ 96.00
1 Movie projector with sound	1,520.70
1 Knox screen	173.57
2 units 4 drawer filing cabinet	191.08
1 hand tachometer	67.68
Repair of electrical system of DITPROD Building	792.86
Repair of 5 room - airconditioners	595.24
1 unit Pedding Haus cutting machine	1,746.03
1 drilling machine	595.24
1 electrical hand grinder	139.88
1 writing table	164.06
1 rack	198.44
1 book shelf	350.00
1 tachometer	84.20
Miscellaneous	6,309.96
	$ 13,024.94
	$ 64,814.02

Schedule 6 - Training

a) Two-week Training Course (July 6-17, 1982)	
Tabran Lando	
Koes Sulistiadji	
- Pre & Post departure allowance	$ 200.00
- Airtickets	1,550.30
- Board and lodging for Koes June 1-27, 1982	278.91
- Training charges for Koes May 10, 1981 - June 26, 1981	1,135.90
	$ 3,165.11
b) Two-week Training Course Post departure allowance of Hartono	$ 50.00
c) Two-week Training Course (June 7-18, 1982)	
Zaidir Said	
Ahmad Deny Suan	
- Departure allowance	$ 200.00
- Driving services	12.29
- Airtickets	1,216.07
- Training charges	725.00
	$ 2,153.36
d) Local training expenses	$ 841.80
	$ 6,210.27

AID 492-CA-1707
Indonesia
Schedule of Commitments

Schedule 1 - Salaries & Wages	
Local Staff - July & August, 1982	$ 1,262.00
Honoraria of DITPROD Personnel June 19 - August 31, 1982	1,500.00
	$ 2,762.00
Schedule 2 - Overhead	
July & August, 1982	$ 1,769.60
Schedule 3 - Fringe Benefits & Allowances	
Local Staff - July & August, 1982	$ 220.00
Schedule 4 - Travel & Transportation	
Local Travel - July & August, 1982	$ 3,200.00
Schedule 5 - Equipment, Materials & Supplies	
Local Purchases - July & August, 1982	$ 6,000.00

AID 492-CA-1707
India
Schedule of Expenditures

Schedule 1 - Equipment, Materials & Supplies

PO 04050 - 1 unit IRRI designed reaper	$ 1,202.38
04544 - Lumber for crating	56.95
	$ 1,259.33

Schedule 2 - Training

Two-week Training Course
(June 1-18, 1982)

Maniam Ranagasamy
Karunanithi Rajamaniakam

- Post departure allowance	$ 100.00
- Training charges	725.00
- Airtickets	2,667.00
	$ 3,492.00

AID 492-CA-1707
India
Schedule of Commitments

Schedule 1 - Training

Pre departure allowance for:	$ 100.00
Karunanithi Rajamanickam	
Maniam Rangasamy	

Revised November 1982

PROGRESS REPORT

LUWU MECHANIZATION SUBPROJECT*

The Luwu project is located in Sulawesi, one of the four largest islands comprising the Indonesian archipelago. The area is currently the target for intensive integrated development activity including infrastructure and institutional development and technological transfer and adaptation.

A small farm mechanization subproject has been undertaken as a component of this comprehensive program to increase and improve the agricultural potential of the area. While there is some diversity in cropping patterns, lowland rice is the most important single crop. In contrast to Java, land is abundant on Sulawesi and supports a lower population density. The stock of animal power is also limited. To permit crop intensification and more efficient use of available water water supplies, supplemental power for tillage in the form of small machinery has been introduced. Small Japanese 12 horsepower (hp), 4-wheel drive "mini" tractors were first introduced to the area in 1977. While coverage has been constrained by the limited number of machines available, there has been interest in expanding their availability and utilization. Since 1980, there have been three factors which have mitigated against further proliferation in the number of imported machines. First, the initial investment cost for tractors has increased 30 to 40% during the period, which clearly puts them out of reach of most farmers without access to

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* A joint project of the Directorate of Food Crops, Government of Indonesia and the Industrial Extension Section of the Agricultural Engineering Department of the International Rice Research Institute. Funding support for the project has been provided by USAID/Jakarta under subproject agreement No. 497-0244.

special credit programs. A second factor has been the complexity of the machines and their susceptibility to frequent breakdowns. As is noted later in the report, lack of spare parts and the associated high maintenance costs have resulted in rising operating costs and inability to employ the machines near their potential field capacity. A third factor has been the introduction of a low-cost alternative, the 2-wheel walking tractor. Based on a simple design originating from the International Rice Research Institute, this machine can be fabricated in Indonesia and sold and serviced by onsite machine shops equipped with only rudimentary tools and skills. Most parts can be produced locally or purchased through hardware supply companies. The low initial cost puts the machine within the investment potential of the small farmer.

To test the efficacy and comparative economics of the 2-wheel tractor with other alternatives available in the Luwu area, ten basic 2-wheel units were acquired in 1981. Six machines, equipped with diesel engines, harrows, moldboards plows, puddling wheels and heavy duty trailers were distributed to selected farmers. The remaining four machines were retained as demonstration units by the cooperatives. Each of the farmers/ operators was trained in maintenance and handling procedures.

The Survey Design

A small team of field enumerators were hired to monitor use of the machines. Records were maintained for a purposively selected sample consisting of 6 farmer-cooperators managing the 2-wheel tractors plus an additional seven 4-wheel tractor owners, 10 tractor users and 10

farmers using traditional techniques of land preparation. The objectives of the monitoring activity are:

1. To assess the economic viability of mechanical land preparation in the Luwu project area.
2. To compare the technical and economic characteristics of alternative land preparation systems (both mechanized and non-mechanized).
3. To evaluate the technical support services required for each system.
4. To investigate the efficacy of private versus joint (cooperative) ownership and use of land preparation equipment.
5. To determine the potential impact of mechanized land preparation on employment, incomes and crop production in the Luwu project area.

Results and Discussion

Table 1 contains a demographic and socio-economic description of the 33 farmer respondents included in the study. The 2-wheel tractor owning group had the smallest average farm size (0.80 has) while the 4-wheel tractor group was the largest (2.36 has), while the tractor hiring group,[1] (0.86 ha) and the traditional farms (1.09 has) were intermediate in this size grouping.

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[1] Composed of farmers hiring both 2- and 4-wheel tractors.

None of the four groups varied significantly from others in educational attainment or family size. The 2-wheel tractor owners were the youngest among the groups at 27 years on the average, and had the fewest years in farming (6 years). Traditional farmers were the oldest (45 years old), and also had the longest experience in farming (22 years) among the farm groups. The latter statistic reflects the relatively recent settlement of the area and the continuing immigration of settlers during the past 2 decades.

The farm characteristics for each category are summarized in Table 2. The average land value for 2-wheel tractor owning farms was Rp 1,153,000/ha while the 4-wheel tractor using farms owned the most valuable land (Rp 2,427,000/ha).

The low land value for two-wheel tractor owners is partially attributed to the lower productivity of these farms as reflected in the different soil qualities shown in Table 2. In the Luwu area, standard land values are as follows: first class land is Rp. 3 million/ha, second class is Rp 2 million/ha and third class is valued at Rp 1 million/ha.

Changes in the farm and farming practices. All farmers planted IR-42. Two wheel tractor owners also planted IR-48 C4-63 was grown by both 2- and 4-wheel tractor owners. Straight row planting was common to all respondents (Table 3).

Some changes in machine use and farming practices which took place during the period between adoption of mechanization and the survey year are summarized in Table 4. Among the respondents within the three tractor using groups, i.e., 2-wheel tractor owners, 4-wheel tractor owners, and

tractor hirers, all had used the tractor continuously after initial introduction on their farms. None of the two-wheel tractor owning farms had previously used tractors. Four-wheel tractor users began to mechanize in 1981. The tractor hirer group had first used mechanization in 1977. The most recent being in 1982.

Some of the most important reasons given for using tractors were (1) quality tillage, (2) timeliness in planting, and (3) use of the tractor permits the farmer to do other jobs. Minor reasons cited were (1) easier method of land preparation, (2) tractor use less costly, (3) can be used for transport, and (4) enables expansion of cultivated area. No respondents however, indicated a change in cropping pattern resulting from mechanization. A majority felt the machine provided better quality tillage than traditional techniques. There is also no evidence to support a tillage effect on the yields obtained from mechanized contrasted to non-mechanized farms. Improvements in the water supply system, such as installation of water gates was implemented in 1978 and 1979.

Table 5 lists the factors considered in the farmer's tractor purchase decision. A majority of the respondents indicated buying a 4-wheel tractor was a family decision. Purchase of 2-wheel tractors was initially influenced by the extension worker, in this case a member of the Luwu project staff. Organizations appear to have little influence on the purchase decision.

Of the 10 respondents under the traditional farm category, 8 reported having financial liabilities, while all respondents in the three mechanized

groups had debt obligations. Most loans were for 6 months or less except those belonging to the 4-wheel tractor owning group, wherein 5 of the 7 respondents also reported loan maturities of up to 6 years and one among the 2-wheel tractor owners had a loan of up to 1 year.

The most commonly cited collateral used for loans were land titles (Table 6). Some also used buildings as security. All borrowed money for seasonal farm expenses. Most loans were provided by government programs through banks. A few cited friends and relatives as another source. Interest rates charged were all 12% per year. The 4-wheel tractor owners had the highest total indebetedness per farm of Rp589,557 while the other three groups had loans averaging Rp20,200 for 2-wheel tractor owners[1], Rp 22,390 for the tractor hirers and Rp 23,450 for traditional farms.

All farmers in all four categories owned draft animals such as oxen and/or cattle: 27 by traditional farmers, 10 by 2-wheel tractor owners, 8 by the 4-wheel tractor group, and 25 by the tractor hiring group. Each also owned implements such as plows and harrows (Table 7).

Material inputs. To compare the farming practices of the respondents by category, farm inputs such as seeds, fertilizers and chemicals were compared.

Table 8 shows the degree of adoption of modern technology by the farmer-respondents within each group. No distinctive pattern could, however, be deduced from the results.

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[1]Does not include financial obligation to acquire the machine after the first year of use. This condition is an optional choice under the agreement entered into at the time the 2-wheel machines were initially distributed.

Fertilizer application was highest among tractor hirers and lowest for the 2-wheel tractor owners.

Pest control chemicals including insecticides, weedicides/herbicides and rodenticides were most generously used on the traditional farms but used least on the 4-wheel tractor owning farms.

Production and disposal of products. The highest average total production was reported by the tractor hirers at 2.9 tons/ha while the 2-wheel tractor owners reported the lowest yields at 2.3 tons/ha. (Table 9). The very low yield of the latter is attributed to the poor soil quality which even higher seeding rates could not offset. The relatively low level of fertilizer used by this group is also another factor contributing to low yields. All farming groups paid 1/7th of the gross harvest to the thresher-harvesters and retained about 50% for home consumption, seed requirements, and future sales. Tractor hiring farms sold the largest amount of paddy, averaging 1.16 tons per ha. Traditional farms and 2-wheel tractor owning farms marketed only .44 and .43 tons per ha., respectively. They also retained a smaller portion of the total crop for other purposes. The average price of paddy was Rp. 100 per kilogram.

Labor and Power Inputs

Records of labor and power inputs were maintained for each operation from seedbed preparation through harvest. Human labor hours were also distinguished by source between family and hired.

Family vs. hired labor input. Table 10 provides a disagrregation of total labor by different farm operations and source. The 4-wheel tractor farms used less total and hired labor than the other categories.

A substantial reduction is evident in the land preparation activities--plowing, harrowing, levelling and puddling. The large difference in labor required for transplanting is not explainable with the data currently available. There is no notable difference between total labor use by either traditional or tractor hiring farmers, although those contracting for custom service employ a higher proportion of hired labor than other categories. The 2-wheel tractor group used somewhat less total labor than either the traditional or the tractor hiring group.

Among the three groups, the tractor hiring farmers had the highest percentage of hired labor (73%). Four-wheel tractor owners had the lowest percentage hired labor. Plowing and harrowing operations are both performed by the farmer and his family (Table 10). Levelling and puddling operations, however, which are generally done using craft animals do emplo hired labor. Hired labor was utilized for transplanting for all farm categories.

In Table 11 power inputs are segmented by source into 3 major categories: (1) land preparation, (2) transplanting and plant care, and (3) harvesting and other post-harvest operations. Tasks involving animal and tractor power are seedbed preparation, plowing, harrowing, levelling and puddling. Only one respondent reported transporting paddy from the field.

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[1]The finding that the harvesting, threshing, cleaning operations utilize entirely hired labor may have some implications for mechanization of these activities in the future.

Sources of power inputs. Table 11 also shows the source of power for land preparation and other farm activities. Both the 2- and 4-wheel tractor owning farms had relatively lower manpower requirement/ha for land preparation than the other 2 farm categories. Four-wheel tractor owning farms completed land preparation activities using 34 man-hours, 10 animal-hours and 16 tractor-hours/ha. Two-wheel tractor owners used 92 man-hours, 14 animal hours and 48 tractor hours/ha for the same operations. Traditional farms had the highest man and animal hours/ha for similar operations, followed by tractor hiring farms. The total man-power inputs needed to complete all farm operations did not differ appreciably for the traditional farm, 2-wheel tractor owning farms and the tractor hiring farms. Four-wheel tractor farms had the lowest total manpower requirements.

Tractor utilization. Two- and four-wheel tractor utilization for the wet season are summarized in Figs. 1 and 2. Both tractor types were used predominantly for custom work. The average area serviced by each of the six 2-wheel tractors was 23.4 hectares during the 1981-82 wet season.[1] Twenty one hectares were custom services and the remaining 2.4 hectares were on their own farms. Similarly, the seven 4-wheel tractors contracted an average of 14 hectares and prepared 2.4 hectares on their own farms for a total of 16.4 hectares for the same season.

[1] This figure represents the entire area cultivated and includes, plowing, harrowing, puddling and levelling operations. It is not directly comparable with the area covered by 4-wheel tractors which normally utilize a rotary tiller and accomplish plowing and harrowing in one operation.

One possible reason for the relatively low average utilization of the 4-wheel tractors is the difficulty these machines have in accessing interior fields and crossing irrigation channels. Figure 2 summarizes the information from Figure 1 and also shows the percent utilization by location of activity, i.e. custom work and own farm. No significant difference was noted between the two tractor types with regard to percent distribution of activities by location.

Repairs and maintenance. Repairs and maintenance expenses for the 2-wheel tractors were minor since the machines are all new. Costs were mainly for minor parts such as belts. Thus, the average repair and maintenance cost for each tractor was a low Rp 258/ha for the season.

In contrast, the mini tractors with an average age of 2.6 years, had several major breakdowns. Table 12 provides the seasonal repair and maintenance costs for each tractor from the year of purchase up to 1981-82 (the survey year). Average repair and maintenance costs for each tractor per season are summarized at the bottom of the table. Also shown is the average area serviced since the year of purchase. The average total repair and maintenance (R & M) cost per hectare are calculated from these figures.

Figure 3 presents the relationship of R & M costs to tractor age. This figure illustrates that as tractors age, annual repair and maintenance costs rise steeply.

Cost Analysis of Two-wheel and Four-wheel Tractors

A profitability analysis of the two- and four-wheel tractors is presented in Table 13 giving financial benefits from owning these machines.

Two-wheel tractors were estimated to have a 4-year life (8 seasons) and 4-wheel tractors had 6 years (or 12 seasons). Initial investment costs were calculated at Rp 1.6 million for the 6-hp power tiller. Two initial investment levels are given for 4-wheel tractors, Rp 3.2 million for units purchased in 1977 and Rp. 4.6 million for those acquired in 1981. Annual fixed costs consisted of seasonal depreciation and the interest on capital investment. Depreciation was computed using a straight line method with the salvage value of the machine estimated at 10% of initial cost. Interest on average capital investment was 12% per annum.

Variable costs consisted of fuel and oil, repair and maintenance costs and the driver's fee. Fuel consumption was calculated at 24 l/ha for 2-wheel tractors and 35 l/ha for 4-wheel tractors. The driver's fee was computed at 15% and 15.5% of gross income for 2-wheel and 4-wheel tractors, respectively.

Although the initial cost of two-wheel tractor was only half that of the 4-wheel tractor, the seasonal fixed costs for each were not proportionately different because of the assumed difference in useful life (4 years for 2-wheel and 6 years for 4-wheel tractors).

Average repair and maintenance costs for the 2-wheel tractors were relatively low compared to the 4-wheel units. The reasons could be the older age of the latter, the age of the 4-wheel machines was 2.6 years on the average. Two wheel tractors were all less than one year old.

Total variable cost per hectare for the 2-wheel tractor was Rp 9,458 which is considerably lower than the 4-wheel tractor at Rp 13,904. With an average utilization of 23.4 ha (total area including 1 plowing and 3 harrowings) for 2-wheel and 16.4 ha (doing rotavation) for 4-wheel tractors, the total costs per season were computed. Contract rate charged per hectare by the 4-wheel tractor owners is Rp 40,000, that is for rotavation, while the 2-wheel tractor owners charged Rp 25,000/h for plowing, Rp 10,000/ha for 1st harrowing, and Rp 5,000/ha for 2nd harrowing. Adding the three operations, the total contract rate/ha would also be Rp 40,000/ha. The average value derived from its actual utilization gives a contract rate of Rp 22,357/ha per operation. Net benefits were derived from these values, giving the 2-wheel tractor an average seasonal benefit of Rp 126,600 and 4-wheel tractors Rp 77,400. The payback period for the 2-wheel tractor would be about 13 seasons while the 4-wheel tractor requires 41 seasons in order to recover the initial investment of Rp 3.2 million. Machines purchased for Rp 4.6 million are not economically viable at this level of seasonal use.

Break-even points for 2- and 4-wheel tractors were computed at 15.25 ha and 13.4 ha per season, respectively.[1] Benefit-cost ratios were also calculated. Two-wheel tractors had a ratio of 1.3 and 4-wheel tractors 1.1.

If the current contract rate of Rp 40,000/ha were increased to Rp 50,000, the payback period for the four-wheel tractor investment of Rp 3.2 million would be shorter, from 41.1 to 13.1 seasons. The breakeven point or area operated per season required to recover the capital invested for 4-wheel tractor type would also be lowered from 13.4 ha to 9.6 ha/season. However, decreasing the present contract rate/ha to Rp 30,000 raised the breakeven levels. The 2-wheel unit is, however, less sensitive to this reduction than the mini-tractors and would still prove profitable at current seasonal utilization levels (23.4 has).

Machine owners have the option of either increasing their contract rate per ha or seasonal utilization. Competition from both traditional and other mechanical technologies will be the determining factor in establishing the final equilibrium.

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[1] Refers to 4-wheel tractors purchased for Rp 3.2 million. At the 1981 price, (Rp 4.6 million), the mini-tractors are unprofitable at current utilzation levels and contract rates.

SUMMARY AND RESULTS

With only a single season of field data available, the impact of an innovation cannot be assessed comprehensively. The preliminary findings from use of the 2-wheel tractors are, however, encouraging:

1) During the 1981-82 wet season, all six 2-wheel tractors included in the project have been used intensively and were operated near their effective field capacity.
2) Repair and maintenance problems have been minimal during this early phase of the project, reflecting the new condition of the equipment, the value of operator training and the availability of adequate maintenance services.
3) The machines are clearly a profitable investment for those farmers managing them.
4) The 2-wheel tractor shows a clear advantage over both traditional methods and the 4-wheel mini tractors in land preparation.
5) Major limitations of the 4-wheel tractors are (a) high initial cost, (b) high cost and lack of spare parts, (c) limited mobility and access to interior fields.
6) The impact on labor requirements has been a reduction in family and an increase in hired labor employed for land preparation. Total labor requirements for rice production are, however, only slightly less than for farms using traditional land preparation techniques.

7) There have been no perceived yield or cropping intensity effects for those owning or using the tractors.

8) There exists a large latent demand for mechanical land preparation in the Luwu project if these services can be made available at or near current contract rates (Rp 40,000/ ha).

RECOMMENDED SUPPLEMENTARY ACTIVITIES

During the next phase of the project it will be necessary to continue to monitor the machines and farmers included in the initial phase. As a supplement, we suggest the following activities:

1) Gather and/or obtain records on the use and performance of four- and two-wheel tractors owned by the cooperative. The contrast between institutional and individual ownership and management may provide some insights regarding the most efficient mechanism for making tractor services available to small rice farmers.

2) Carefully assess potential demand patterns for 2-wheel tractors in the project area. Provide a normative analysis of the market profile considering sensitivity to (a) changes in the initial cost of the machines, (b) changes in the cost of fuel, (c) changes in contract rates and (d) availability of credit at alternative interest rates and maturity dates.

Table 1. Socio-economic characteristics of 33 sample farms, 1981-82 wet season, Luwu, South Sulawesi, Indonesia.

	Farm category			
	Traditional farms	2W Tractor farms	4W Tractor farms	Tractor hirers
No. of observations	10	6	7	10
Farm size (has)	1.09	0.80	2.36	0.86
Age of household head (yrs)	45	27	36	39
Education (yrs)	5	5	8	8
Years in farming (yrs)	22	6	14	17
Family size (nos.)	4	5	5	4

Table 2. Farm characteristics of 33 farmer respondents, 1981-82, wet season, Luwu, South Sulawesi, Indonesia.

Items	Farm category				
	Traditional farms	2W tractor owners	4W tractor owners	Tractor hirers	All farms
No. of respondents	10	6	7	10	33
Ave. farm size, has	1.09	0.80	2.86	0.82	1.24
Total no. of parcels	20	13	21	19	73
Ave. parcel size, has	0.547	0.36	.786	.454	0.559
Ave. land value/ha (Rp.000)	2239	1153	2427	2018	2142
Land tax/ha/yr (Rp.000)	45	45	45	48	46
			no. reporting (parcels)		
Soil texture					
clay	-	-	-	1	1
clay-loam	6	-	6	5	17
silt	9	8	9	6	32
silt loam	4	2	5	4	15
sandy	1	-	-	1	2
sandy loam	-	3	1	2	6
Total	20	13	21	19	73
Soil topography					
flat	20	10	18	13	61
terraced	-	3	3	6	12
Total	20	13	21	19	73
Irrigation source, by parcel					
technical irrigation system	3	-	-	-	3
simple irrigation system	17	13	21	19	70
Total	20	13	21	19	73
Tenure status by parcel					
owned	17	11	20	19	70
share-cropped	-	2	1	-	3
Total	17	13	21	19	73

Table 3. Farming practices for the 33 respondents, 1981-82 wet season, Luwu, South Sulawesi, Indonesia.

Items	Farm Category			
	Traditional farms	2W tractor farms	4W tractor farms	Tractor hirers
No. of respondents	10	6	7	10
		no. reporting		
Variety planted	IR-42	IR-42	IR-42	IR-42
		IR-48	C4	
		C4		
Planting method				
Straight-row	10	6	7	10
Main crop planted				
Rice	10	6	7	10

Table 4. Machine use and changes in farm practices summarized by parcel, comparing year before mechanization with survey year (1982), 33 respondents, Luwu, South Sulawesi, Indonesia.

Item	Farm category		
	2W tractor	4W tractor	Tractor hirers
No. of respondents	6	7	10
		no. reporting	
Used machine continuously on this parcel	13	21	19
Year machine first used for land preparation			
1982	13	-	6
1981	-	10	6
1980	-	9	6
1977	-	2	1
Total	13	21	19
Reasons for using machine:			
1. less costly	4	1	-
2. enables farmer to plant on time	9	20	19
3. no human/animal labor available	-	1	-
4. provides better quality tillage	13	18	17
5. eases physical burden	-	-	2
6. available for transport	4	2	-
7. permits farmer to do other job	9	19	19
8. expand area cultivated	-	2	-
Total	39	63	57
No. reporting change in the cropping pattern of this parcel	none	none	none
No. reporting changes in the irrigation/ water supply for parcel	13	21	19
Changes in the water supply/irrigation			
- construction of water gates	13	21	18
- construction of brush diversion dam	-	-	1
Total	13	21	19
Year changes in the irrigation system took place:			
1978	13	21	13
1979	-	-	6
Total	13	21	19

Table 5. Factors considered in decisions to purchase tractors, Luwu, South Sulawesi, Indonesia, 1982.

Item	Farm category	
	2W tractor	4W tractor
No. of respondents	6	7
Machine horsepower	6	12
Fuel type	diesel	diesel
Implement attached	plow & harrow	rotovator
Persons involved in decision to buy machine:	no. reporting	
- family member	-	4
- extension worker	3	1
- farmer's organization	-	2
- no answer	3	-
Total	6	7
Advantages of owning machine considered in purchase decision:		
1. less costly	2	-
2. enables farmer to plant on time	4	7
3. provides better quality tillage	6	5
4. eases physical burden	-	1
5. available for transport	6	1
6. saves time, farmer may do other jobs	-	5
7. allows expansion of cultivated area	-	2
Total no. reporting	18	21

Table 6. Financing characteristics of 33 respondents, 1981-82, wet season, Luwu, South Sulawesi, Indonesia.

	Farm Category			
	Traditional	2W tractor	4W tractor	Tractor hirer
No. of respondents	10	6	7	10
No. of household with financial liabilities	8	6	7	10
Duration of liabilities (months):		no. reporting		
1-6	8	5	7	10
7-36	-	1	-	-
37-96	-	-	5	-
Security or collateral:				
personal note	-	1	-	-
land title	7	3	5	8
building	1	2	2	2
Purpose of the loan:				
seasonal farm expenses	8	6	7	10
Sources of loan:				
government through banks	8	4	7	9
friends/relatives	-	2	-	-
others		-	-	1
Interest rate/year:				
12%/yr	8	6	7	10
Ave. amount of liability, (Rp.00):	234.5	202	5895.6	223.9

Table 7. Ownership of power source and implements by type of farm, 1981-82 wet season, Luwu, South Sulawesi, Indonesia.

	Farm Category			
	Traditional	2W tractor	4W tractor	Tractor hirers
No. of respondents	10	6	7	10
		no. of unit reported		
Machine owned:				
2-wheel tractor	-	6	-	-
4-wheel tractor	-	-	7	-
Draft animals owned:				
oxen/cattle	27	10	8	25
Implements owned:				
Plow	12	2	3	6
Rotavator	-	-	7	-
Harrow	27	15	18	19

Table 8. Material inputs by farm category, 1981-82, wet season, Luwu, South Sulawesi, Indonesia.

Ave. farm size, has.	Farm category				
	Traditional farms 1.09	2W tractor 0.80	4W tractor 2.36	Tractor hirers 0.86	All farms 1.24
No. of respondents	10	6	7	10	33
			Rp/ha		
Seeds (kgs)	3908 (28)	5535 (40)	2606 (20)	4031 (43)	3598 (30)
Fertilizers (kgs)	7665 (108)	3874 (54)	6129 (105)[a/]	8479 (122)[a/]	6774 (103)
Insecticides	6685	4872	3066	4108	4370
Herbicides	734	540	886	1968	1033
Total	18992	14821	12687	18586	15775

Rupiah 625 = $US1.

Figures in parentheses are amount in kilograms per hectare.

[a/] Some four-wheel tractor owners and tractor hirers used compost fertilizers on their farms although there was no value indicated.

Table 9. Production and disposal of products by 33 respondents, 1981-82 wet season, Luwu, South Sulawesi, Indonesia.

	Farm category				
	Traditional farms	2W Tractor owners	Tractor hirers	4W Tractor owners	All farms
No. of observations	10	6	10	7	33
Ave. farm size, has.	1.09	0.80	0.86	2.36	1.24
			t/ha		
Total production	2.35	2.25	2.88	2.48	2.50
Paid to harvesters/threshers	0.34	0.32	0.41	0.36	0.35
Paid to other debts	0.17	0.25	0.25	0.24	0.23
Retained for home consumption, seeds, etc.	1.31	1.20	1.02	1.24	1.21
Amount sold	0.43	0.44	1.16	0.61	0.66
Retained for other purposes	0.10	0.04	0.04	0.03	0.05
Average price/kg (Rp)	100	100	100	100	100

Table 10. Labor utilization by operation, power source and farm category, 1981-82 Wet Season, Luwu, South Sulawesi, Indonesia.

Item		Farm category			
		Traditional	2 WT	4 WT	Tractor hirers
No. of respondents		10	6	7	10
Average farm size, ha.		1.09	0.80	2.86	1.24
No. using draft animals		10	3	7	9
			hrs/ha		
Seedbed preparation	Man	55 (72)	37 (0)	14 (79)	63 (60)
	Animal	13	5	1	26
	Tractor	-	11	1	-
Plowing	Man	39 (11)	25 (31)	8 (0)	20 (59)
	Animal	81	-	-	15
	Tractor	-	17	8	6
Harrowing/levelling	Man	36 (14)	30 (30)	12 (33)	31 (68)
	Animal	67	9	9	34
	Tractor	-	20	7	6
Transplanting	Man	121 (98)	130 (88)	46 (93)	126 (93)
	Animal	-	-	1	5
Irrigation, drainage dikes	Man	31 (12)	47 (28)	34 (62)	37 (22)
Weeding	Man	89 (84)	54 (65)	41 (96)	60 (86)
Fertilizer/chemical application	Man	43 (0)	32 (0)	33 (6)	52 (26)
Harvesting/Threshing cleaning	Man	75 (100)	87 (100)	65 (100)	109 (97)
Transport/Bag/Pack/ drying	Man	7 (47)	14 (50)	6 (24)	11 (24)
	Animal	-	-	-	-
	Tractor	-	-	2	-
Total hrs/ha	Man	496 (64)	456 (60)	259 (57)	509 (73)
	Animal	161	14	11	80
	Tractor	-	48	18	12
Total 8-hr-day/ha	Man	62	57	32	64
	Animal	20	2	1	10
	Tractor	-	6	2	1.5

Figures in parentheses are percent hired labor.

Table 11. Power inputs (hrs/ha) by farm category, 33 respondents, 1981-82 wet season, Luwu, South Sulawesi, Indonesia.

Item	Farm category				
	Traditional farms	2W tractor farms	4W tractor farms	Tractor hirers	All farms
No. observations	10	6	7	10	33
Ave. farm size, ha	1.09	0.80	2.36	0.86	1.24
No. using draft animals	10	3	7	9	
			hrs/ha		
Land preparation[a/]					
Man	130	92	34	114	83
Animal	161	14	10	75	65
Tractor	-	48	16	12	16
Transplanting and Plant Care					
Man	284	263	154	275	228
Animal	-	-	1	5	1
Tractor	-	-	-	-	-
Harvesting, threshing, and other post/harvest operations					
Man	82	100	71	120	88
Animal	-	-	-	-	-
Tractor	-	-	2	-	1
Total					
Man	496	456	259	509	399
Animal	161	14	11	80	66
Tractor	-	48	18	12	17

[a/] Land preparation includes seedbed preparation, plowing, harrowing, levelling, and puddling.

[b/] Transplanting and plant care include weeding, fertilizer and chemical application and irrigation, drainage and cleaning dikes.

Table 12. Repair and maintenance costs for four-wheel and two-wheel tractors and total area serviced from year of purchase to present, Luwu, South Sulawesi, Indonesia.

CROP YEAR	Season no.	4-wheel tractor 101	102	119	120	121	122	123
					Rupiah			
1977 - 78	1	-	-					
1978	2	18,500	7,000					
1978 - 79	3	37,500	22,500					
1979	4	58,000	12,300					
1979 - 80	5	29,750	a/					
1980	6	34,000	34,000					
1980 - 81	7	43,400	a/		11,750	21,500		
1981	8	43,500	14,900	13,000	42,250	50,000	15,000	12,800
1981 - 82	9	18,000	14,500	42,000	72,400	71,000	66,000	74,000
Average total cost, Rp/season		35,331	17,533	27,500	42,133	47,500	40,500	43,400
Average area served, ha/season		8.65	3.05	25.45	18.14	9.75	16.62	22.87
Total cost Rp/ha		4,084	5,749	1,081	2,322	4,872	2,436	1,898

CROP YEAR	2-wheel tractor 116	117	118	134	135	136
				Rupiah		
1981 - 82	5,000	6,000	5,000	6,750	6,500	7,000
Total area served, ha	15.67	31.96	25.06	20.82	25.72	20.67
Average total cost Rp/ha	310.6	187.7	199.5	324.2	252.72	338.7

a/ Tractor was not used for cultivation.

Table 13. Cost analysis for two and four-wheel tractors, 1981-82, Wet Season, Luvu, South Sulawesi, Indonesia.

Item	Tractor-type		
	Two-wheel	Four-wheel[e]	
No. of respondents		I	II
No. of respondents	6	7	7
Size of machine (hp)	6	12	12
Ave. age (years)	1	2.6	2.6
Initial cost, Rp. 000	1625	3200	4600
Fixed cost per season, Rp. 000			
Depreciation, 10% salvage value[a]	183	240	345
Interest on average capital investment at 12% per year	54	106	152
Total fixed cost/season	237	346	497
Variable cost/ha, Rp			
Diesel fuel[b]	2880	4200	4200
Oil[b]	320	570	570
Repair and maintenance	258	3134	3134
Operator's fee[c]	3353	6200	6200
Total variable cost/ha	6811	14104	14104
Total utilization/season, effective area, ha	23.39 (7.80)[f]	16.35	16.35
Total variable cost per season, Rp (000)	159.3	230.6	230.6
TOTAL COST Rp (000)	396.3	576.6	727.6
TOTAL BENEFITS[d] Rp (000)	522.9	654	654
NET BENEFITS, Rp (000)	126.6	77.4	-73.6
Payback period, seasons	12.8	41.3	-
Break-even point, has/season	15.2 (5.07)[f]	13.4	19.2
Benefit-cost ratio, undiscounted	1.3	1.1	0.9

[a]Depreciation was computed using straight line method, salvage value of machine at 10%, 2-wheel tractor having a 4-year life (or 8 seasons) and 4-wheel tractor, 6 year-life (or 12 seasons).

[b]Diesel fuel consumption was 21 l/ha for 2-wheel tractor and 35 l/ha for 4-wheel tractor. Price per liter was Rp. 120. Oil consumption was 0.32 l/ha and 0.57 l/ha for 2-wheel and 4-wheel tractors, respectively. Price was Rp 1000/l.

[c]Operator's fee was averaged at 15% of gross income per hectare for 2-wheel tractor and 15.5% for 4-wheel tractor.

[d]Contract rate for 4-wheel tractor types is Rp. 40,000/ha (complete land preparation) done with one operation. Two-wheel tractors, however, generally do 1 plowing and 2 harrowings: Rp. 25,000/ha for plowing, Rp 10,000/ha for 1st harrowing and Rp. 5,000/ha for 2nd harrowing, averaging to Rp. 22,357/ha per operation.

[e]Four-wheel tractors were calculated at two alternative initial investment levels reflecting the difference in costs to those who purchased machines in 1977 (I) and 1981 (II).

[f]Total area cultivated including plowing and harrowing. Figure in parenthesis represents the approximate net area representing complete land preparation.

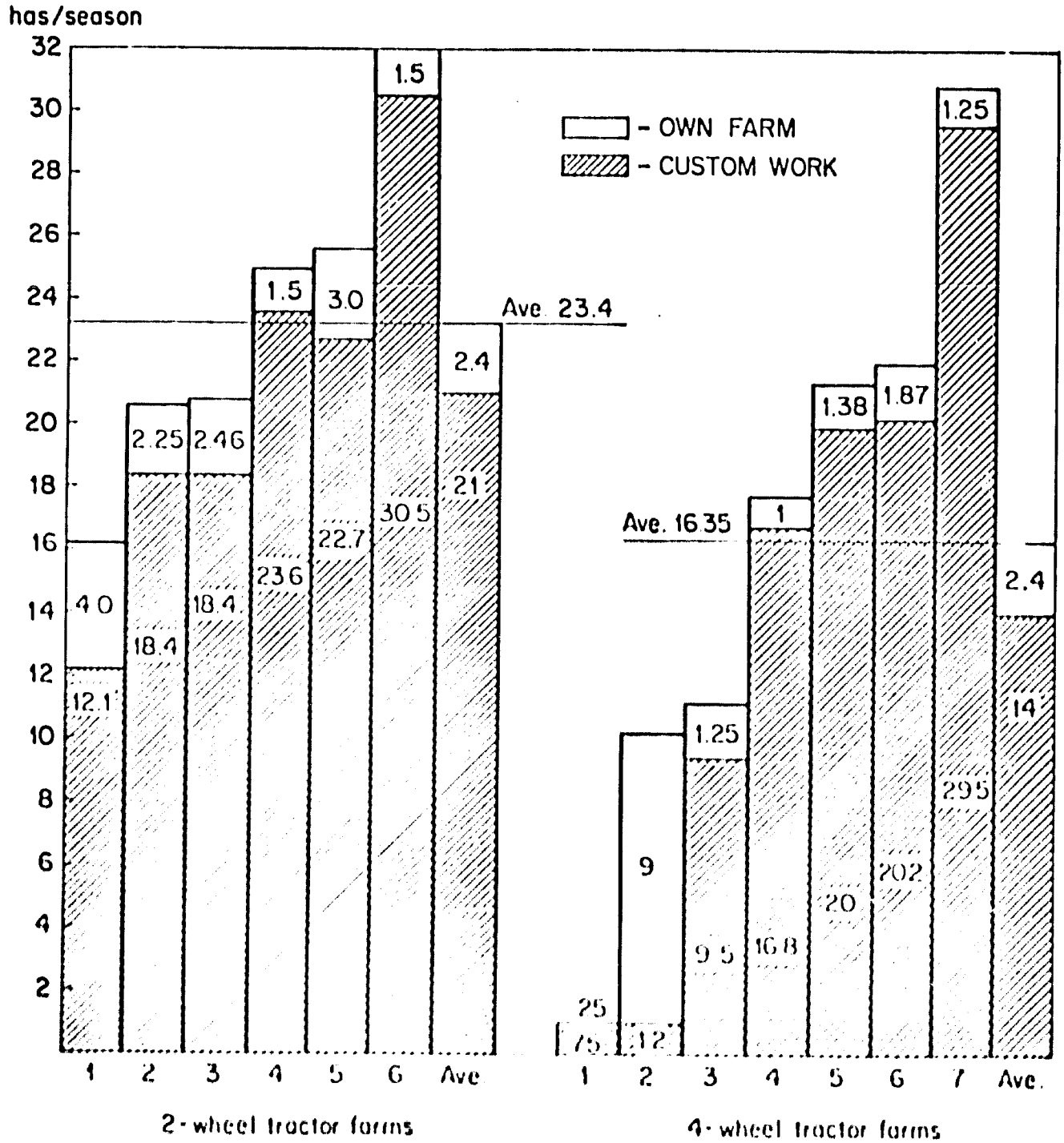

Fig. 1. Tractor utilization by tractor type for 1981-1982, wet season , Luwu, South Sulawesi, Indonesia.

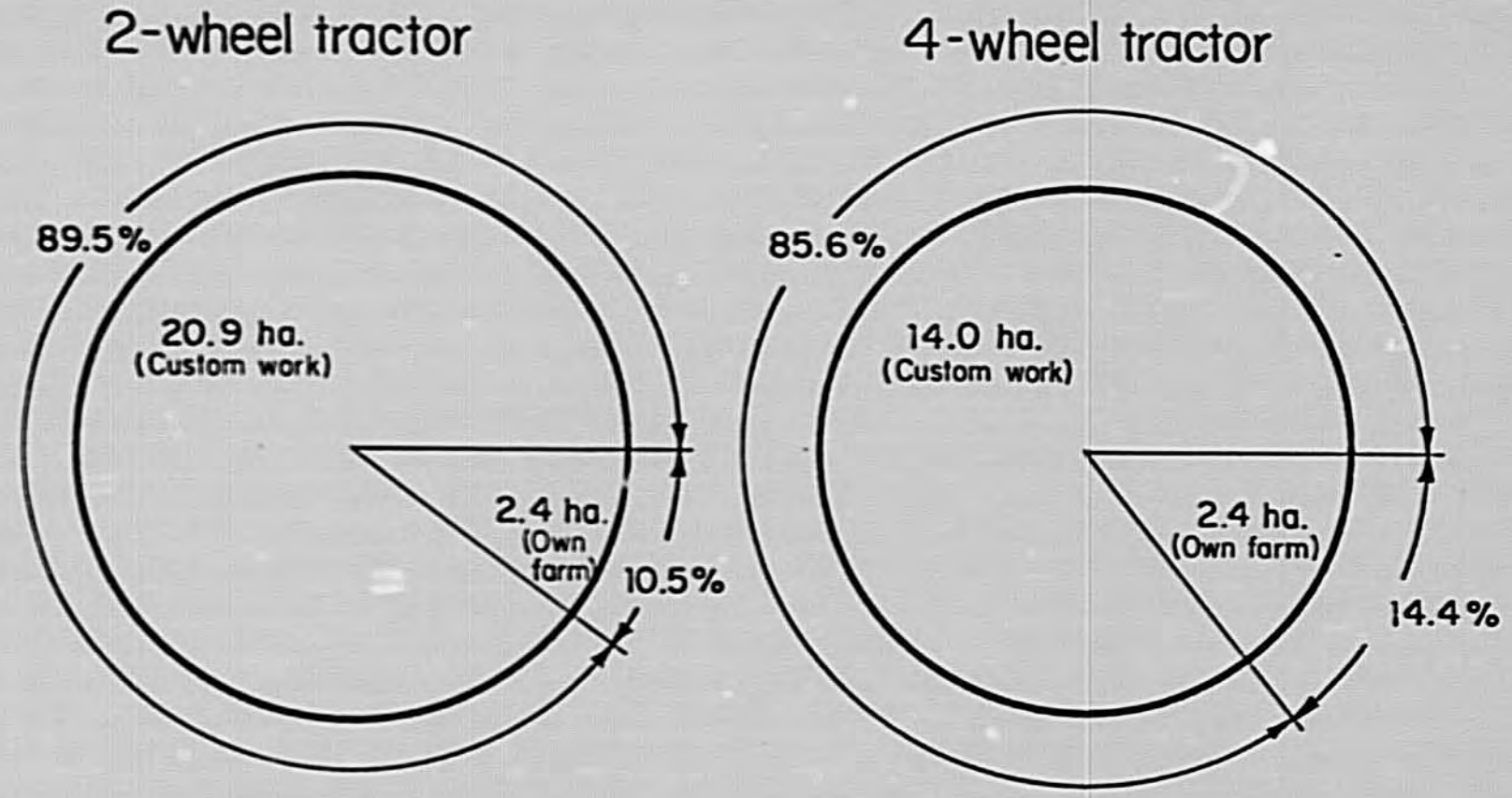

Fig. 2. Comparative utilization by tractor type and location of activity, 1981-1982, wet season, Luwu, South Sulawesi, Indonesia.

NOTE:

The 6 2-wheel tractors each cultivated an average total area of 23.39 hectares including plowing and 2-harrowings while the 7 4-wheel tractors serviced 16.4 hectares having rotavation only which is equivalent to both plowing and harrowing with the 2-wheel tractor.

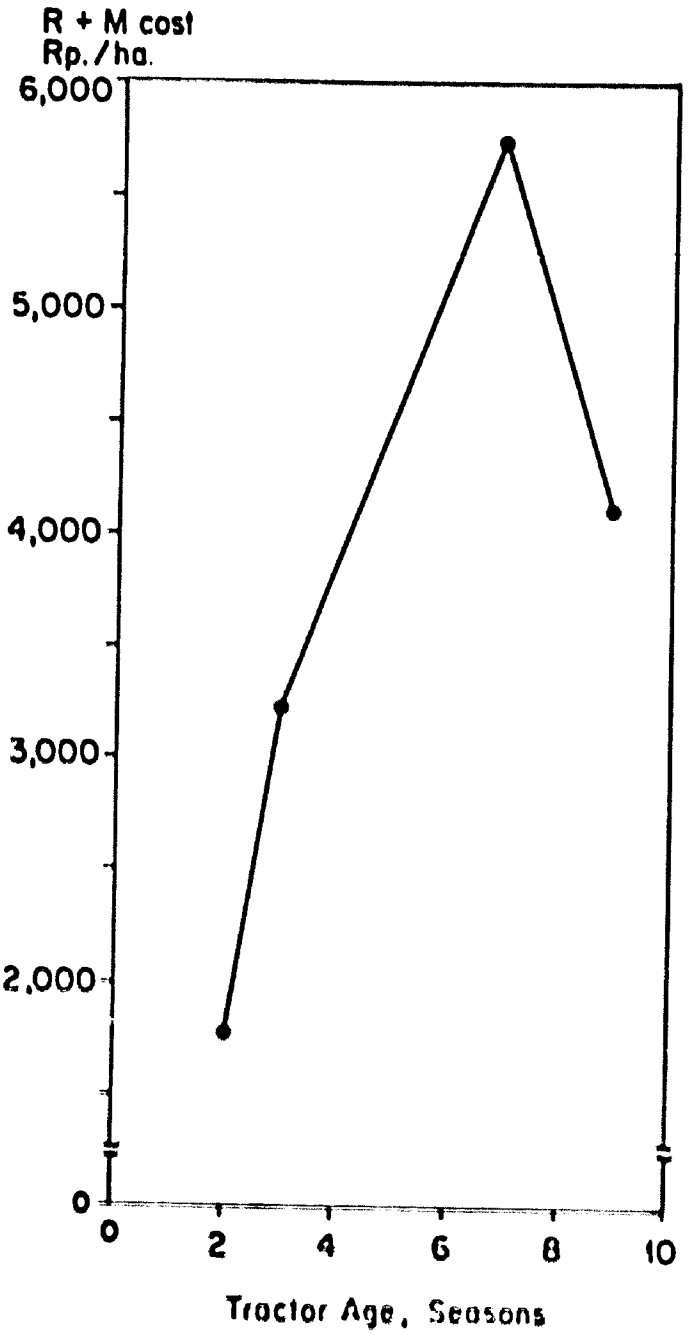

Fig. 3. Repair and maintenance cost per hectare by tractor age, four-wheel tractor, Luwu, South Sulawesi, Indonesia.

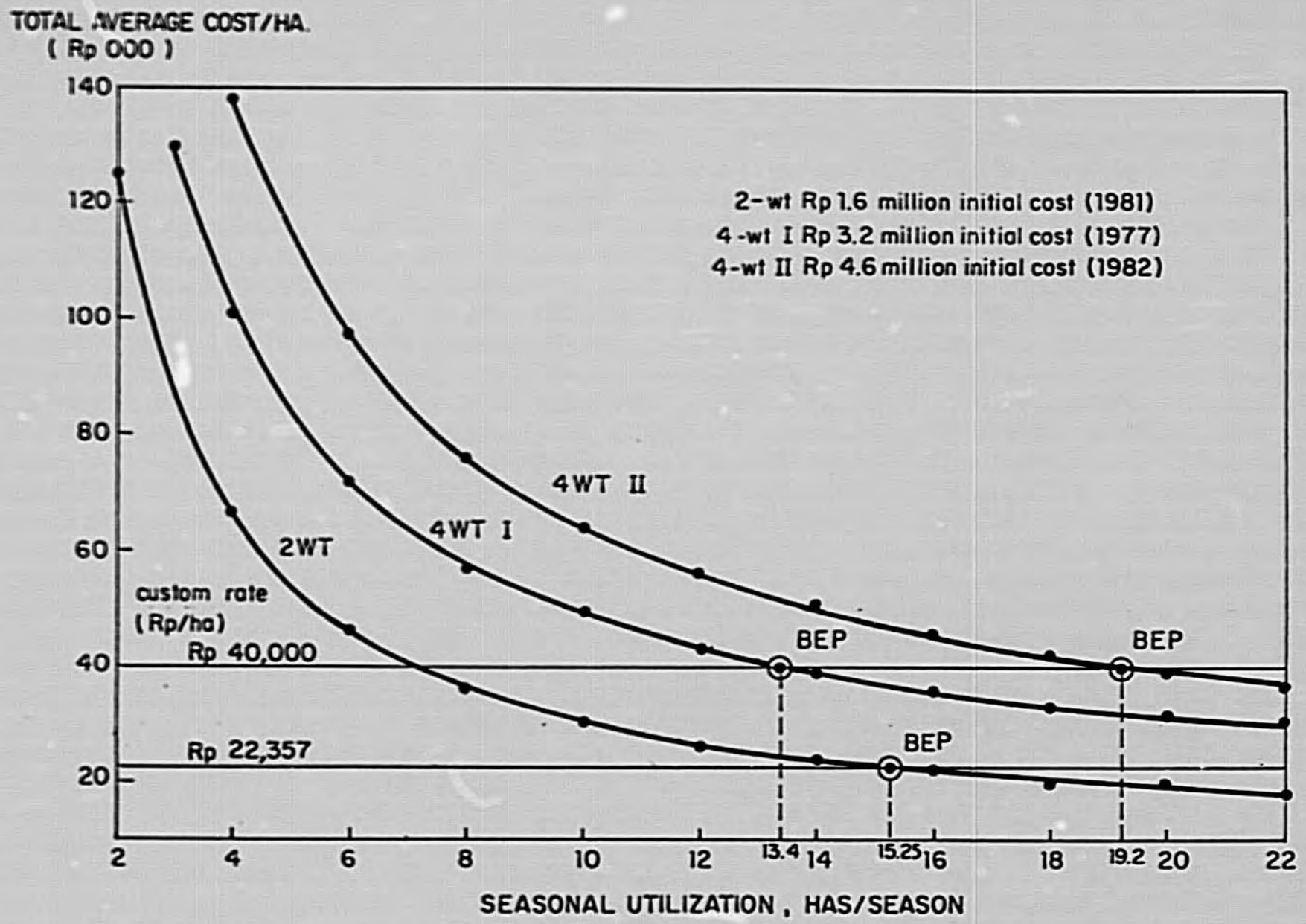

Fig. 4. Break-even analysis for 4-wheel tractor at two alternative investment costs and 2-wheel tractor, Luwu, South Sulawesi, Indonesia.

Report No. IEP-5
October 12, 1982

MA-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT
Agricultural Engineering Division
Bureau of Plant Industry
San Andres Street, Malate
Metro Manila

ANNUAL REPORT

(September 1981-September 1982)

and

PROPOSED WORKPLAN

(September 1982-September 1983)

I. INTRODUCTION

In broad terms, the goal of this Program is to increase the profitability and output of small farms* in the Philippines through the utilization of appropriate agricultural equipment, ranging from hand tools and animal-drawn implements to small engine-powered machines.

It is proposed that this objective may best be achieved by means of an extension program directed primarily towards small manufacturing shops** located in agricultural areas. The principal advantage of such shops is that their business requires them to provide equipment which is highly attractive to farmers with respect to price, performance, durability, and service. Since the reputation of a local shop is communicated rapidly among neighboring farmers, shop owners are very responsive to the desires, suggestions, and complaints of their customers. This factor, together with keen competition between shops, promotes rapid innovations on improving equipment performance and reducing production costs. Small rural shops now found in the Philippines generally utilize labor-intensive methods to minimize capital investments; this situation facilitates the proliferation of competing shops and contributes to rural employment.

Although the Program will concentrate primarily on small rural shops, assistance will also be provided to larger, urban-based manufacturers in the case of equipment or components which require costly or complex fabrication techniques, mass production, or other factors beyond the capabilities of small shops.

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*The size of a "small farm" is difficult to define because productivity is highly dependent upon water availability and other factors. In areas with irrigation throughout the year, a 1 ha. farm may be above the subsistence level, while in rain-fed areas the equivalent size may be 2 to 5 ha., depending upon the duration of the rainy season (which influences cropping intensity).

**In this discussion the term "small shop" denotes one with low capital investment; the number of employees need not be small.

The Program's activities will be directed towards assisting shops to be largely self-sufficient with respect to financial backing, marketing, and technical innovations relating to new or modified equipment designs and fabrication methods. The reason for this emphasis is to prevent the shops from being weakened by over-dependence upon heavily subsidized credit, sales generated primarily by government programs, and excessive technical assistance. R&D institutions will be encouraged to concentrate on those tasks which generally are beyond the capabilities of small shops, such as: searching for innovative designs developed in other countries; developing and testing prototypes based on highly scientific concepts or on high-risk ideas; developing special materials or processes, when necessary (e.g., hardened steel reaper blades).

From the outset, the Program will be implemented in close collaboration with the shop owners and technicians themselves in a manner that both encourages and benefits from their ideas derived from practical experience and familiarity with local conditions, as well as from their pragmatic approach based more on "learning-by-doing" than on scientific knowledge and project planning methodologies. A principal responsibility of the Program staff will be to identify and facilitate the cooperation of institutions which may assist the shops in ways that are consistent with the objectives. For example, these may be private or public institutions associated with developing small-scale industry, promoting innovations and inventions, assisting small farmers, developing agricultural equipment, etc. As will be illustrated below, the form of institutional cooperation will vary markedly from one type of equipment to another, thereby precluding the possibility of establishing a single inter-institutional structure which could serve for all activities and phases of the Program. On the contrary, rigid structures should be avoided in order to encourage the adoption of flexible arrangements tailored to fit the particular characteristics of a given implement. The Program's Advisory Committee will play a vital role with respect to formulating and facilitating these institutional arrangements.

A crucial aspect of the Program is to communicate with small farmers on the question of what types of equipment would be most beneficial and acceptable to them. Although agricultural equipment often relates to the problem of reducing the peak (or seasonal) demands for labor, the Program will not limit its focus solely to labor-saving implements. High priority will be given to equipment which increase cropping intensity (e.g., small pumps for irrigation), reduces losses (e.g., dryers), and improves the effectiveness of agricultural inputs (e.g., implements for seeding and deep placement of fertilizer). At present, however, equipment of this type is extremely limited or still in the R&D stage. Consequently, the Program will attempt to identify and stimulate the development of implements suitable for use in extension efforts of subsequent years.

The progress and impact of Program activities will be monitored in order to detect problems and undertake corrective actions, as well as to guide the formulation of priorities and plans for subsequent years. A comprehensive evaluation of the socio-economic benefits and costs of each

implement is not feasible within this Program due to its high cost and to the limitations of available methodologies. Consequently, the evaluation will rely on available data plus a simplified survey of selected basic indicators (e.g., profit, production, and employment levels of small farms and shops), together with historical and case study information obtained through interviews and observation.

II. INSTITUTIONAL RELATIONSHIPS

A primary purpose of the Program is the establishment of institutional relationships and technical capabilities which will lead to a national capacity for developing, manufacturing, and marketing agricultural equipment appropriate for small farms. At the end of the 5-year period of this Program, an institutional structure similar to that shown in Figure 1 should exist and be functioning in an effective and sustained manner.

Although Figure 1 presents a highly simplified picture of the institutional relations affecting the Program, it helps us to describe several of the principal factors. The main component is the FARMERS*, who in this case are primarily rice or corn farmers with small land holdings (1 to 5 ha.). The FARMERS purchase agricultural equipment from MANUFACTURERS, who in this Program are small and medium-size local firms, rather than large or foreign firms. Both the FARMERS and the MANUFACTURERS are influenced by EXTENSION & CREDIT INSTITUTIONS which promote certain types of equipment by various means, such as by training courses, field days, accreditation, and loans. There is a wide variety of EXTENSION & CREDIT INSTITUTIONS in the Philippines, including the Bureau of Agricultural Extension, Regional Development Projects, National Food and Agriculture Council, National Food Administration, National Irrigation Authority, Ministry of Agrarian Reform, Farm Systems Development Corporation, Area Marketing Cooperatives, Samahang Nayon cooperatives, Small Business Advisory Center, National Cottage Industry Development Authority, KKK Livelihood Projects, and banking institutions.

The principal role of the MA-IRRI PROGRAM is to provide the EXTENSION & CREDIT INSTITUTIONS and the MANUFACTURERS with information on: the types of small farm equipment which should be given highest priority; comparative advantages and disadvantages of different equipment; appropriate equipment designs and fabrication procedures; proper utilization of equipment by farmers; testing, maintenance, and repair of equipment. The MA-IRRI PROGRAM also has direct contact with MANUFACTURERS through promotional and technical assistance visits, training courses, field days, and feedback sessions to learn from manufacturers about specific problems or innovations relating to equipment design, fabrication, or performance. It is also essential for the MA-IRRI PROGRAM to have direct communication with the FARMERS regarding their views on deficiencies

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*The components of Figure 1 are typed in capital letters for emphasis.

of existing equipment and on priorities for new equipment. This communication is accomplished through workshops, field days, and informal surveys, including farm visits and meetings with leaders of farmer cooperatives.

The success of the MA-IRRI PROGRAM depends largely upon its ability to find appropriate designs of equipment which will be acceptable to both FARMERS and MANUFACTURERS. Initially, the MA-IRRI PROGRAM will rely primarily on selecting (and adapting) appropriate equipment designs from the pool of designs developed by IRRI. However, IRRI and the MA-IRRI PROGRAM are not capable of developing the quantity or variety of equipment needed to sustain a dynamic extension program in the future. One of the objectives of the MA-IRRI PROGRAM is to help promote the growth of a national capacity for developing appropriate equipment for small farms. The main groups are the R&D INSTITUTIONS (universities; government agencies, such as NAPHIRE, PCARR, and ARO; and regional organizations, such as SEARCA and RNAM) and the INVENTORS & INNOVATORS, who may be independent (e.g., students, farmers, or professional inventors) or employees of manufacturing firms or R&D institutions. The MA-IRRI PROGRAM will promote the R&D INSTITUTIONS and INVENTORS & INNOVATORS through workshops, field days and fairs, and contests, - and it will also encourage national and international organizations to provide funds to these institutions for R&D on appropriate equipment.

The MA-IRRI PROGRAM is guided by an ADVISORY COMMITTEE whose members are the Deputy Minister of Agriculture, the head of the IRRI Agricultural Engineering Department, the director of the Bureau of Plant Industry, the director of the Institute for Agricultural Engineering and Technology (University of the Philippines at Los Baños), and representatives of the Central Bank, the Ministry of Industry and Trade, and the Agricultural Machinery Manufacturers' and Distributors' Association. This committee meets quarterly to review progress and plans, recommend corrective actions, and ensure that their institutions provide the necessary collaboration.

The Government of the Philippines is now considering a proposal for the creation of a NATIONAL AGRICULTURAL MECHANIZATION COUNCIL which would be responsible for policies and analyses relating to agricultural machinery. If the proposal is approved, the ADVISORY COMMITTEE will assist in defining collaborative relationships between the MA-IRRI PROGRAM and the NATIONAL AGRICULTURAL MECHANIZATION COUNCIL.

III. PROGRESS REPORT: SEPTEMBER 1981-SEPTEMBER 1982

This period represents the first full year of operation of the MA-IRRI Program. The central office of the Program was established in remodeled facilities of the Agricultural Engineering Division at the Bureau of Plant Industry (BPI), Ministry of Agriculture, in Manila. The office is occupied by the IRRI co-leader of the Program, a secretary/bookkeeper (IRRI employee), and one full-time agricultural engineer (BPI employee). The MA co-leader of the Program is the head of the

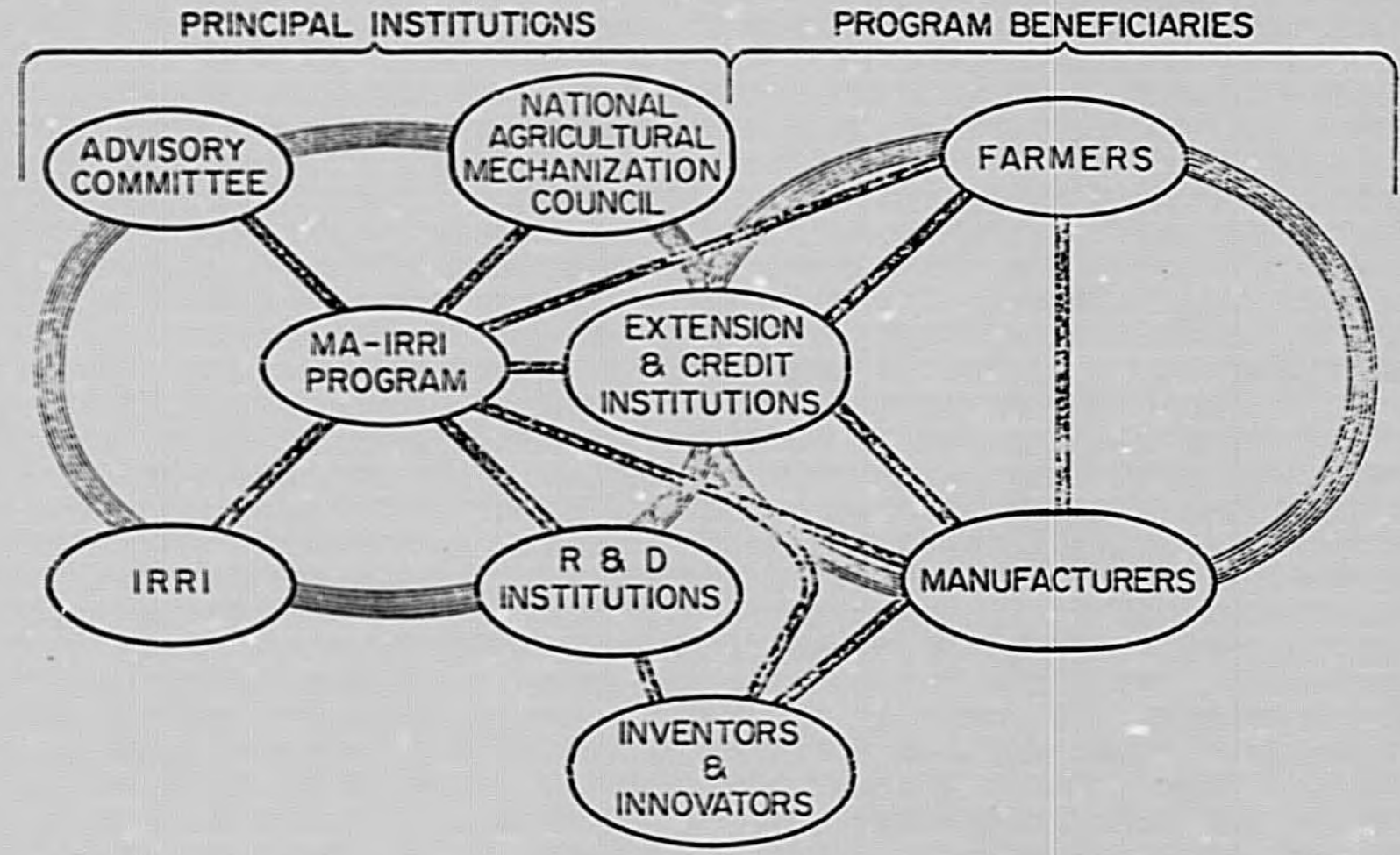

FIGURE 1:

PROPOSED INSTITUTIONAL RELATIONSHIPS FOR THE MA-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT.

Agricultural Engineering Division at BPI, and he devotes approximately 25% of his time to the Program. One other BPI engineer devotes 75% of his time to the Program. Therefore, the total manpower contributed by BPI is approximately 2 man-years/year, which is insufficient to handle all of the proposed activities. BPI was not able to hire new personnel during 1982 because the Ministry of Agriculture experienced a freeze on hiring. This problem has been discussed with the Advisory Committee and several alternatives are being explored. Meanwhile, an agricultural engineer has been contracted temporarily with Program funds to coordinate the development of a plow-mounted planter and fertilizer applicator for corn, sorghum, and legumes.

The central office was organized and equipped during the past year, and it received a project vehicle (1975 Ford sedan) as a donation from IRRI. A driver is provided by BPI. Final arrangements have been made for installation of a telephone in the central office. A remaining problem is that the BPI machine shop lacks some of the basic equipment needed for fabricating prototypes. The Ministry is being requested to purchase a welder, lathe, and tinsmith equipment with funds which may be available at the end of the year.

One BPI engineer from each of the 12 regions has received a two-week training course at IRRI on small farm equipment. At present, 7 of these engineers are actively participating in activities of the Program, such as: recruitment of local manufacturers to be new "cooperators" in the Program; technical assistance to new and existing cooperators; field days for demonstrating equipment promoted by the Program; field testing of new equipment. The initial emphasis has been on regions which are major producers of rice but have shortages of both farm labor and local manufacturers of small farm equipment (e.g., Mindanao and Cagayan Valley).

The Industrial Extension Office at IRRI has 3 engineers, each of whom is devoting approximately 75% of their time to the MA-IRRI Program. They have carried the major responsibility for the two-week training course on small farm equipment, which is offered twice per year at IRRI for participants from developing countries. They have also provided on-the-job training to BPI engineers by collaborating in field demonstrations, prototype testing, technical assistance to cooperating manufacturers, and short (2-day) training courses for manufacturers. The participation of IRRI engineers will be reduced each year as the BPI engineers become responsible for more of the Program's activities.

As may be seen in Figure 2, there has been a marked increase in the number of manufacturers who have joined the Program as cooperators during the past 12 months. This increase is the result of two factors: (a) the active recruitment of new cooperators by BPI and IRRI engineers; and (b) the introduction of the CAAMS-IRRI reaper which has attracted manufacturers to the Program. It is expected that increase of this magnitude cannot be sustained in the future, and the present challenge is to provide these new cooperators with an adequate level of technical assistance during their difficult initial period of fabricating and selling the first units.

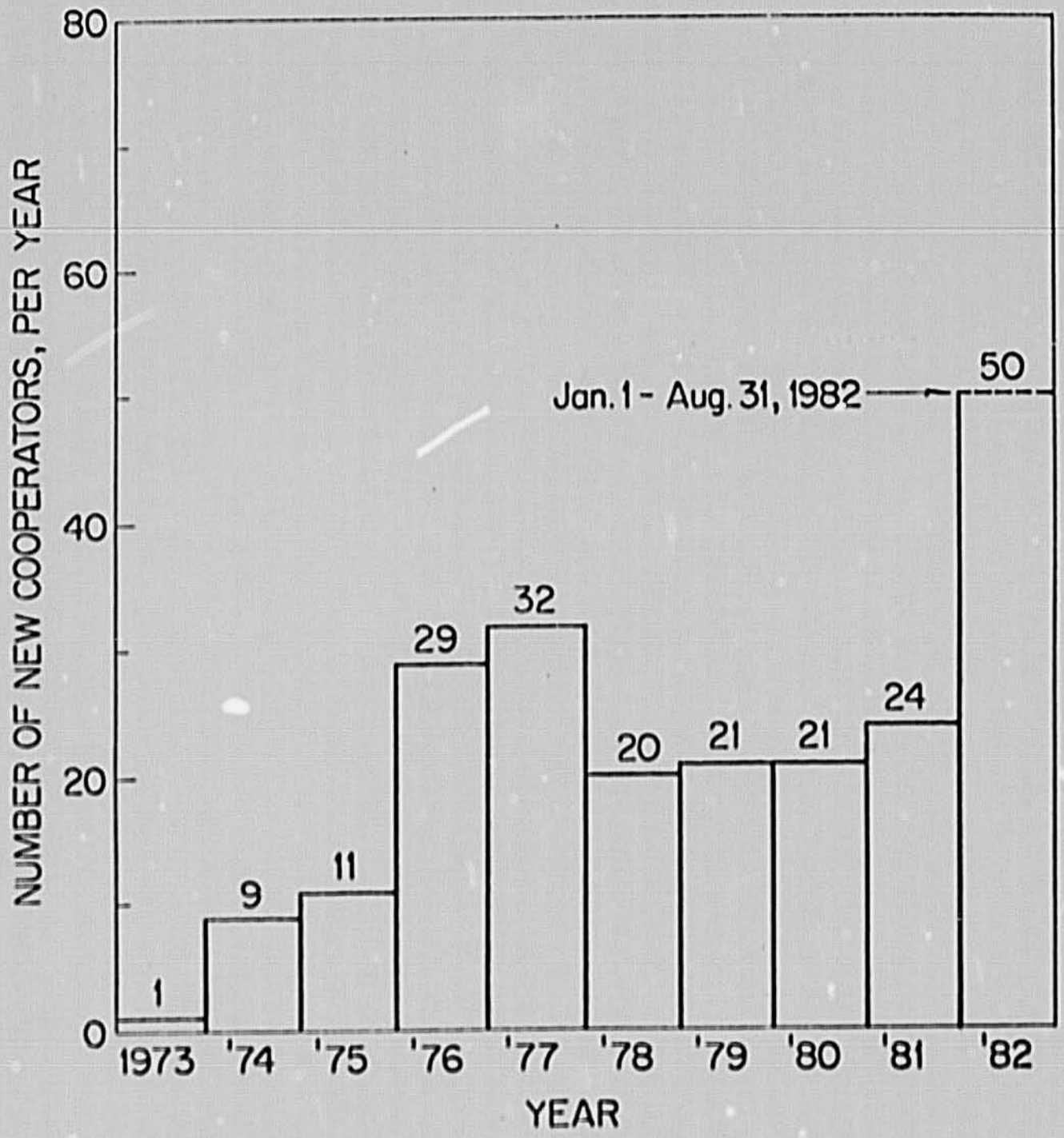

Figure 2: Annual registration of new cooperating manufacturers.

One of the main objectives during the past 12 months was to initiate the extension effort in a manner that would quickly gain the confidence and collaboration of small shops, farmers, and cooperating institutions, while also providing the Program staff with practical experience which will be most useful in planning and implementing subsequent phases. Consequently, it was decided to begin immediately with three agricultural implements which are expected to offer one or both of the following advantages:

- High acceptability by small shops and farmers
- Diversity of practical experience on extension.

The proposed implements were:

1. Portable Axial Flow Thresher (IRRI Model TH6). Past sales statistics for this thresher provide convincing evidence of its acceptability in several areas of the Philippines, and the proposed extension activity for 1981-82 was to promote production of the unit in areas where the potential demand is not yet being met by local manufacturers. Although this was expected to be a rather straightforward extension activity, it turned out to be difficult because the original IRRI design is no longer competitive with improved designs developed by manufacturers in several areas of the Philippines. It was therefore necessary to update and improve the original design before disseminating it to new potential manufacturers. After a thorough review of existing designs of threshers, we formulated an improved design, and an experimental prototype will now be fabricated for test and evaluation. We have also performed on-farm tests of different combinations of threshers and reapers, and the results illustrate that the capacity of axial flow threshers is reduced markedly (e.g., by 400%) due to the longer straw length of rice harvested by reapers rather than by hand (sickle). Various alternatives for alleviating this problem are being considered.

2. One-meter Reaper and Small Power Tiller. This implement provides an interesting contrast to the thresher in that it had not been produced in the Philippines before 1982, and importation of similar reapers from China and Japan has commenced. Moreover, on the basis of demonstrations of the reaper to farmers, its acceptability is expected to be as high as that of the thresher, while also serving to stimulate thresher sales as a result of the complementarity of the two machines. The extension effort has been a relatively easy process which has helped the Program to establish strong relations with shops, farmers, and extension agencies. Training courses were conducted in February and August, 1982, to acquaint manufacturers with fabrication and marketing of the reaper and tiller. Fifty six manufacturers and 11 BPI engineers attended the courses, and 8 have produced their first prototype units which were tested and evaluated by Program engineers. We estimate that over 150 units will be produced during 1982. Since manufacturing and sales are depressed by the current economic slump existing in the Philippines, the introduction of the reaper will not be so rapid and widespread that it will lead to an acute increase in unemployment among landless agricultural laborers. Preliminary studies of the labor effects of the reaper have been conducted, and more detailed evaluations are being planned.

3. Axial Flow Pump. Extension of this apparatus provides a significantly different challenge than in the cases of the thresher and reaper because: (a) the acceptability (i.e., sales) has been disappointingly low in the Philippines despite the fact that it appears to be a device which is both economically and technically appropriate; and (b) the extension activity should be highly area-specific; i.e., the pump is applicable only in localities where irrigation is deficient yet water sources exist at less than 3 to 4 m below the level of the fields. At present, centrifugal pumps are widely used for low-lift applications (e.g., lifts less than 4 m), although the axial pump would be more economical. A test was performed to compare the technical and economic characteristics of centrifugal and axial pumps, and the results were reported at the annual meeting of the Philippine Society of Agricultural Engineers. This report will be used to promote the axial pump to public and private institutions and manufacturers. The Program has demonstrated the axial pump at field days in 6 provinces, including a special demonstration at the Libmanan Project of the National Irrigation Authority, which led to the purchase of 7 units.

The Program also devoted time to the following equipment which might be appropriate for extension in the future:

1. Transplanter. In 1980, IRRI released the design of a manually-operated transplanter of rice seedlings. This implement was not accepted by farmers because: (a) it requires a special seedling preparation which is far more costly than the traditional method; and (b) it does not perform well under certain soil and water conditions. The Program has collaborated with IRRI and with the PPC Rice Farm to overcome these two problems, though there still exists the need to simplify further the seedling preparation procedures. We suspect that acceptance of the transplanter will be limited by the fact that direct seeding (broadcasting) is gaining widespread use at a remarkable rate. One possibility for increasing acceptance is to add a fertilizer applicator (i.e., a deep placement device) to the transplanter, thereby combining two operations into one. IRRI has developed an experimental unit of this type, and our Program will collaborate in an intensive test at the PPC Rice Farm.

2. Rolling Injection Planter (RIP). This implement is attractive because it may be appropriate for rain-fed upland areas, which are often the poorest and most neglected areas. The RIP is a simple, hand-pushed device for placing seeds (corn, sorghum, legumes) into the soil at the desired spacing without requiring any previous preparation (i.e., plowing and harrowing) of the soil. Being a "zero-tillage" implement, it conserves residual soil moisture, reduces soil erosion, and increases cropping intensity by avoiding the time and labor associated with conventional land preparation. The Program organized a workshop in July to: (a) establish communication between groups who have been testing the RIP in the Philippines; and (b) formulate a collaborative effort to carry out field trials of the RIP in areas having different soils, rainfall patterns, and cropping systems. This effort will serve as the basis for future extension of the RIP.

3. Dryer. Since dryers were identified in two workshops as being among the highest priorities of equipment for small farms (see Annex A), the Program carried out a brief study to determine what types of dryers

are needed and what types are available. The results are summarized in Report No. IEP-4, which includes a proposed workplan for developing and testing the concept of heating a covered section of a sun-drying floor so that pre-drying of grain (rice, corn, etc.) may be carried out when clouds or rain prevent sun-drying. The floor section would be heated by flue gases and/or hot water from a low-cost furnace which uses rice straw or hulls as fuels.

4. Plow-mounted Planter and Fertilizer Applicator. Since this type of equipment was among the highest priorities identified by a workshop (see Annex A), we have initiated the development of a design which will be acceptable to farmers and may be manufactured by small shops in rural areas. The design is based on existing equipment plus improvements, and it attaches easily to an animal-drawn plow to provide accurate metering of seeds and fertilizer. After the design has been tested and improved, it will be included in the Program's extension activities.

5. Low-Volume Sprayer. The need for a low-volume sprayer was identified in the workshop on equipment priorities (Annex A) and also is an important component of zero-tillage applications of the rolling injection planter (RIP). Consequently, we have initiated a study to determine: what types of sprayers are now available in the Philippines; are these imported or locally manufactured; what design characteristics are most important to farmers; would it be technically and economically feasible to promote local manufacturing of an appropriate sprayer? When the results to this study have been obtained and analyzed, it will then be possible to propose specific activities relating to sprayers (e.g., R&D, field tests, and/or extension).

6. Fertilizer Applicators. The President of the Philippines has created an immediate project to develop techniques and equipment that farmers may use to increase the efficiency of fertilizers. The Fertilizer and Pesticide Authority is responsible for coordinating the project, and it requested the collaboration of both IRRI and the MA-IRRI Program. We have participated in the initial planning sessions and provided a BPI engineer to work full-time in the field trials of an IRRI prototype applicator of urea. A meeting will be held to review the results of these trials and to formulate plans for the next phases of the project.

The proposed workplan for this period also included the following activities:

1. Training Course on Small Farm Equipment. This two-week course has been held twice per year, as planned. A copy of the program of the course is included in Annex B. Fifteen of the BPI engineers have attended the course, together with 6 field engineers of the Small Business Advisory Centers (Ministry of Industry), 1 engineer from NACIDA (National Cottage Industry Authority), and 4 employees of cooperating manufacturers. A set of lecture notes has been prepared for distribution to the course participants.

2. Program Monitoring/Evaluation. The objective of this activity is to assess the progress and impact of the MA-IRRI Program. A one-day workshop was held in December, 1981, for the purpose of designing this activity with the assistance of IRRI economists who have experience with studies of the consequences of agricultural mechanization. The USAID project manager, G. Argento, participated in the workshop. The IRRI Economics Department has designated a person to work on the evaluation of several types of equipment included in our Program, but the details have not yet been defined. We have collected data on the number of new cooperators (Figure 2 on page 7) and on the annual production of equipment by active cooperators, which is summarized in Table 1 and illustrates that the current economic recession has affected production since 1980. We have also completed our collaboration with a doctoral student from Yale University in conducting a survey of farm equipment manufacturers.

3. Promotion of R&D on Small Farm Equipment. The workplan for this period proposed that one workshop be held for the purpose of bringing farmers, extension technicians, and researchers together to determine what types of small farm equipment should be identified as the highest priorities for the MA-IRRI Program and for R&D efforts. In response to the suggestion of the Deputy Minister of Agriculture, two workshops were held rather than one because it seemed advantageous to focus one on rice-based farms and the other on corn-based farms. (Corn production is a current priority of the Ministry, and it is the subject of a massive extension program.) The results of these workshops have been of great practical value to the MA-IRRI Program with respect to defining equipment priorities. (See Annex A.) The next step is to promote work on these equipment priorities by R&D institutions.

4. Development of Innovation and Invention Capacities Relating to Small Farm Equipment. The purpose of this activity is to increase the quantity and quality of innovations and inventions of small farm equipment by persons who may not be employed in R&D institutions and, therefore, may not be reached by the preceding activity. This includes the personnel of manufacturing firms (ranging from blacksmiths to professional engineers), as well as to students and instructors of technical schools, amateur and professional inventors, and farmers. We have arranged to carry out three different annual contests in which prizes will be awarded for the best designs of small farm equipment. To minimize the cost of organizing these contests, we have arranged for these to be included in the established annual contests of the Philippine Inventors' Commission and of the Science Foundation of the Philippines. The first contest was held this year in collaboration with the Inventors' Commission. Over 500 announcements (see Annex C) of the future contests have been distributed, and funds for awards are being solicited from manufacturers and distributors of agricultural equipment and supplies.

5. Assistance for Formulation of Policies on Farm Equipment. The MA-IRRI Program should collaborate with appropriate institutions in assessing both the beneficial and the detrimental consequences of existing and potential policies influencing farm equipment. We had

expected to collaborate with the National Agricultural Mechanization Council, but its creation by the government has been delayed for over a year. Consequently, this activity has been limited to a partial review of the available literature and the initiation of a study of thresher policies in collaboration with the IRRI Economics Department.

6. Preparation of Quarterly Progress Reports and Workplans. These reports and workplans have been prepared according to the original time-table.

7. Meetings of Advisory Committee to Review Progress and Plans. The Advisory Committee has met quarterly, as planned, and has been very effective in helping to resolve problems. Deputy Minister Lim presided at each meeting and provided complete support on all matters, ranging from policy issues to details of design and implementation.

IV. EVALUATION OF PROGRESS

The workplan for 1981-82 contains a time-phased schedule of activities which may be used to compare actual progress with proposed progress. Ten activities are included in the schedule, and we conclude that all but the following four have progressed satisfactorily:

- Extension of Thresher: As stated in Section III, this activity has been reprogrammed because we found that it was necessary to update the original design of the TH6 thresher. However, progress has continued to be slow with regard to the design and fabrication of a prototype at IRRI. This problem will be discussed at the next meeting of the Advisory Committee.

- Extension of Axial Flow Pump: Implementation of this activity has fallen behind schedule because we decided that extension would continue to be ineffective until we could provide convincing evidence on the economic and technical advantages of axial flow pumps over centrifugal pumps for low-lift irrigation. (See Section III.) The comparison has been completed and progress should be satisfactory in the future.

- Promotion of R&D on Small Farm Equipment: The original workplan for this activity was expanded to include two workplans rather than one. (See Section III.) Although this has delayed initiation of subsequent steps, we believe that two workshops were needed and that progress will now move ahead as planned.

- Assistance to Formulation of Policies on Farm Equipment: As stated in Section III, this activity has been delayed because the Government has not yet approved the formation of the National Agricultural Mechanization Council proposed

TABLE 1. PRODUCTION STATISTICS: PHILIPPINES

MACHINES	YEAR							
	1975	1976	1977	1978	1979	1980	1981	TOTAL
1. Power Tiller (PT3)	2178	2566	856	795	1337	978	1107	9837
2. Axial Flow Thresher (TH8)	275	552	494	689	1850	1059	1417	6336
3. Portable Thresher (TH6)	-	-	827[1/]	1746	2290	1218	1275	7356
4. Batch Dryer (BD1)	33	93	64	34	47	66	102	439
(BD2)	-	-	-	-	-	16[2/]	16	32
5. Seeder (RS2)	56	57	57	-	-	-	-	170
(RS3)	-	-	-	-	-	1	1	2
6. Power Weeder WE1)	-	-	-	-	-	-	-	-
7. Chemical Applicator (CA2)	-	141	-	-	-	-	-	141
(CA6)	-	-	-	-	-	-	36	36
8. Axial Flow Pump (PU4)	-	-	-	-	13[3/]	55	66	134
9. Grain Cleaner (GC7)	-	-	10	10	-	-	2	22
10. Transplanter (TR1)	-	-	-	-	-	17[4/]	82	99
TOTAL	2542	3429	2308	3274	5537	3410	4104	24604
No. of manufacturers	14	19	17	20	21	31	33	

1/Portable thresher released later part of 1976.

2/ Vertical-bin batch dryer released later part of 1979.

3/ Axial flow pump released during 1979

4/ Transplanter released later part of 1979.

last year by the Ministry of Agriculture. Deputy Minister Lim is fully aware of this problem and is promoting approval.

Even with these delays, we believe that the Program has made substantial progress during the past 12 months, especially with respect to: (a) recruitment of new cooperating manufacturers (Figure 2); (b) training of BPI engineers and cooperating manufacturers; (c) field demonstrations of small farm equipment to over 500 farmers, manufacturers, and extension workers in 5 of the major rice-producing areas in the Philippines; and (d) identifying the equipment priorities on the basis of workshops involving farmers, researchers, and extension personnel.

As emphasized in Section III, future progress will be satisfactory only if the Ministry can add at least 2 qualified engineers to the MA-IRRI Program staff at BPI/Manila. It is also essential that the proposed efforts to develop new equipment (see Sections II and III) will begin to supply the Program with appropriate designs which will be accepted by both farmers and manufacturers. These two factors should be the primary objectives of the next 12 months.

V. PROPOSED WORKPLAN: SEPTEMBER 1982 - SEPTEMBER 1983

The proposed workplan is presented in the following "Schedule of Activities: September 1982 - September 1983". It is based on the information reported in the preceding sections, and we suggest that it be used as the framework for monitoring progress in the quarterly meetings of the Advisory Committee and in the annual evaluation.

MA-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT

SCHEDULE OF ACTIVITIES: SEPTEMBER 1982-SEPTEMBER 1983

ACTIVITIES	1982				1983							
	9	10	11	12	1	2	3	4	5	6	7	8
1. EXTENSION OF REAPER & POWER TILLER:												
- Provide technical assistance to manufacturers on fabrication, testing, and marketing the reaper and tiller												
- Improve original designs, according to feedback from manufacturers and farmers												
- Conduct additional training courses, if demand is sufficient												
- Collaborate with IRRI in developing and testing implements for tiller (e.g., off-set plow, cage wheels, for upland conditions, combined harrow-leveler, trailer)												
2. EXTENSION OF AXIAL FLOW PUMP:												
- Revise report comparing axial and centrifugal pumps												
- Meetings with agencies which are potential promoters of axial pump												
- Formulation and implementation of extension efforts with collaborating institutions												
3. DEVELOPMENT & EXTENSION OF THRESHER:												
- Fabricate prototype of improved TH6 thresher												
- Design improved cleaning mechanism												
- Conduct preliminary test at IRRI and intensive test at PPC Farm, making improvements as needed												

- CONTINUED -

ACTIVITIES	1982				1983							
	9	10	11	12	1	2	3	4	5	6	7	8
EXTENSION OF THRESHER (cont'd.)												
- Develop final design: blueprints, instruction manual, promotional materials												
- Initiate extension of improved thresher by means of a workshop for manufacturers and field demonstrations in regions												
4. DEVELOPMENT OF TRANSPLANTER:												
- Continue to collaborate with IRRI in tests at PPC Farm, including new tests of transplanter with injector of fertilizer and systemic insecticide												
- Assist IRRI in developing simplified method of seedling production; e.g., methods of PPC Farm and of Burma												
- If results of preceding steps are favorable, assist IRRI to develop extension materials												
5. DEVELOPMENT OF ROLLING INJECTION PLANTER (RIP):												
- Collaborate in conducting trials of RIP in different areas of Philippines												
- Assist IRRI in development of appropriate sprayer of herbicides neeeded for utilization of RIP under zero-tillage conditions												
- Conduct second workshop on RIP to review results of 1982-83 trials and plan 1983-84 trials and extension												
- Preparation of materials for trials and extension												

- CONTINUED -

ACTIVITIES	1982				1983							
	9	10	11	12	1	2	3	4	5	6	7	8
6. DEVELOPMENT OF DRYER:												
- Test experimental model of heated floor dryer (HFD) at IRRI and PPC Farm	—											
- Design HFD prototype and test it at PPC Farm, making modifications as needed	—	—	—	—	—	—	—	—	—	—	—	—
- Meetings for monitoring progress and evaluating performance of HFD prototype			-			-			-			-
- Formulation of improved design and of materials and mechanisms for extension				—	—	—	—	—	—	—	—	—
- Demonstration of HFD to R&D and extension institutions							-					
- Initiate extension, if test results and feasibility studies indicate that the HFD is viable									—	—	—	—
7. DEVELOPMENT OF PLOW-MOUNTED PLANTER & FERTILIZER APPLICATOR (PPFA):												
- Demonstrate prototype to farmers, manufacturers, and agricultural technicians in South Cotabato	-											
- Improve prototype and conduct on-farm trials to compare with farmers' present practices for corn, sorghum, soybeans, and mungbeans		—	—									
- Develop materials for extension of PPFA and plan extension activities with appropriate public and private institutions				—	—	—						
- Implement extension of PPFA, in collaboration with other institutions (e.g., NFAC, Maisagana, seed producers, equipment manufacturers and distributors)							—	—	—	—	—	—

- CONTINUED -

ACTIVITIES	1982				1983							
	9	10	11	12	1	2	3	4	5	6	7	8
8. DEVELOPMENT OF LOW-VOLUME SPRAYER:												
- Conduct a study of present and potential markets for sprayers in the Philippines, with emphasis on the feasibility of local production of low-volume sprayers												
- If results of preceding study indicate that local production is feasible, formulate a proposed workplan for designing and testing a suitable low-volume sprayer												
- Discuss proposal with institutions which may be willing to collaborate in the R&D work or provide financial support												
- Collaborate in the implementation of the proposed workplan												
9. DEVELOPMENT OF FERTILIZER APPLICATORS:												
- Continue to collaborate with IRRI, MA, and FPA in evaluating fertilizer applicators												
10. PROMOTION OF R&D ON SMALL FARM EQUIPMENT:												
- Collaborate with ARO and PCARRD in promoting R&D on priority equipment by agricultural colleges and R&D institutions												
- Assist in the organization and implementation of a meeting of R&D institutions to promote specific activities on small farm equipment (perhaps following the annual meeting of PSAE)												
11. DEVELOPMENT OF INNOVATION & INVENTION CAPACITIES RELATING TO SMALL FARM EQUIPMENT:												
- Coordinate three annual contests on the design of small farm equipment (PIC, SFP, BPI)												

- CONTINUED -

ACTIVITIES	1982				1983							
	9	10	11	12	1	2	3	4	5	6	7	8
12. ASSISTANCE TO FORMULATION OF POLICIES ON FARM EQUIPMENT:												
- (To be programmed after the formation of the National Agricultural Mechanization Council)												
13. TRAINING COURSE ON SMALL FARM EQUIPMENT:												
- Assist IRRI with the two-week ag. engineering course, presented twice per year				—							—	
14. PROGRAM MONITORING/EVALUATION:												
- Maintain on-going monitoring of progress												
- Annual survey of cooperating manufacturers			—	—	—	—						
- Annual evaluation of MA-IRRI Program												—
15. PREPARATION OF QUARTERLY PROGRESS REPORTS AND WORKPLANS			—			—			—			—
16. MEETINGS OF ADVISORY COMMITTEE TO REVIEW PROGRESS AND PLANS			-			-			-			-

ANNEX A

MA-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

Agricultural Engineering Division
Bureau of Plant Industry
San Andres, Malate
Manila

PROPOSED PRIORITIES FOR R&D ON SMALL FARM EQUIPMENT

Two workshops involving farmers, extension technicians, and researchers have been held for the purpose of:

- Identifying priorities regarding the types of agricultural equipment which would be most useful on small farms in the Philippines;

- Formulating R&I activities for each of the identified equipment priorities.

These considerations concentrated primarily on rice and corn, together with other crops (e.g., legumes, sorghum) which are also planted on rice or corn farms.

The recommendations of the two workshops are described in detail in published reports.* After studying these recommendations, the MA-IRRI Program has come up with the proposal presented in the attached table. The first column lists the ten equipment priorities identified by the workshops. The current status of each of these equipment priorities is summarized in the second column, and the actions proposed for each are described in the third column. Since the actions are for the immediate future, it will be necessary to revise them each year or so.

This proposal is tentative and open for discussion. The MA-IRRI Program would appreciate receiving suggestions on how the proposal may be improved.

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*1. Report on the Workshop on Small Farm Equipment R&D, held at Maligaya Rice Research and Training Center, Muñoz, Nueva Ecija, December 3-4, 1981 (Report No. IEP-1, July 16, 1982, MA-IRRI Industrial Extension Program for Small Farm Equipment).

2. Report on the Workshop on Small Farm Equipment for Corn Production and Processing, held at Regional Health Training Center, Cagayan de Oro City, June 2-3, 1982 (Report No. IEP-2, July 16, 1982, MA-IRRI Industrial Extension Program for Small Farm Equipment).

PROPOSED ACTIONS ON EQUIPMENT PRIORITIES IDENTIFIED BY TWO WORKSHOPS

EQUIPMENT	CURRENT STATUS	PROPOSED ACTIONS
A. Rice Equipment		
1. Reaper	MA-IRRI Program is promoting the CAAMS-IRRI reaper and providing technical assistance to manufacturers. IRRI Ag. Eng. will modify reaper design according to feedback from the field.	The efforts of the MA-IRRI Program and of the IRRI Ag. Eng. Department should be sufficient for the immediate future. Additional R&D on reapers is not considered to be a high priority at present.
2. Dryer	Many institutions, including the MA-IRRI Program, are carrying out R&D on dryers. However, a dryer acceptable to small farmers has not been demonstrated. A special contest on dryers has been initiated by the MA-IRRI Program.	The MA-IRRI Program should undertake dryer R&D as a high priority. It should also help promote dryer R&D by other institutions, perhaps by organizing a meeting of PCARR, UPLB, IRRI, SEARCA, NAPHIRE, etc. to stimulate and coordinate efforts.
3. Rotary Weeder	UPLB is developing improved designs of two-row rotary weeders. The MA-IRRI Program arranged for a test of the UPLB weeder at the PPC Rice Farm, and one of the wooden weeders used at PPC has been brought to UPLB for evaluation.	Since the potential market for weeders has been reduced markedly by the increasing adoption of direct seeding and herbicides, it is believed that a multi-institutional effort on weeder R&D is not needed. The UPLB project should be sufficient, and the MA-IRRI Program will continue to collaborate in testing prototypes.
4. Broadcaster (of seed, fertilizer, and pesticides)	There is insufficient information for assessing the potential demand and benefits of broadcasters. It appears that R&D on broadcasters is not being performed in any national institutions.	The MA-IRRI Program should meet with PCARR to discuss the possibility of that organization financing a study of the potential market and benefits of broadcasters. The results would provide the basis for planning future R&D on broadcasters.

(continued)

EQUIPMENT	CURRENT STATUS	PROPOSED ACTIONS
5. Transplanter	The MA-IRRI Program has demonstrated the IRRI transplanter at field days, and the farmers have expressed only moderate interest because: (a) the seedling preparation differs from the most common practice (e.g., washed-root or wet bed method) and appears to them to be more costly; (b) there is an increasingly wide-spread trend towards direct seeding in order to avoid the high labor cost of transplanting. The MA-IRRI Program has collaborated with IRRI Ag. Eng. and the PPC Rice Farm to develop a modified transplanter and seedling preparation method which have been adopted by that farm. A simplified method for seedling preparation has also been developed recently in Burma.	It is believed that the transplanter will not be accepted unless the seedling preparation method is simplified to reduce cost. Consequently, the seedling preparation methods of PPC and Burma should be tested and adapted to local conditions. It is suggested that a fertilizer applicator be added to the transplanter to increase its utility. IRRI Ag. Eng. is working on these tasks, and the MA-IRRI Program will collaborate in promoting tests and feedback. It is suggested that no efforts other than these are needed at this time.
B. Corn Equipment		
6. Planter-fertilizer	Several manufacturers have fabricated planter-fertilizers for sorghum and corn, but sales have been very limited. The MA-IRRI Program has designed an experimental unit which combines the best features of existing models and adds several new modifications. This unit will be tested, improved, and then disseminated through the Program.	The planter-fertilizer development by the MA-IRRI Program should continue to receive high priority. Testing and promotion should be planned with NFAC and its collaborating institutions in the Maisagana Program. Similar efforts should be encouraged in agricultural colleges, perhaps through funding by PCARR, ARO, or others.

(continued)

EQUIPMENT	CURRENT STATUS	PROPOSED ACTION
7. Weeder-cultivator	A wide variety of designs of weeder-cultivators exists in the technical literature and many have been tested in the Philippines. However, the majority of the corn farmers continue to use the traditional plow which has limited effectiveness and often damages the roots.	The Ma-IRRI Program should collaborate with PCARR to promote R&D on weeder-cultivators by agricultural colleges. The Program will also initiate its own effort if personnel becomes available.
8. Sprayer	The MA-IRRI Program has begun a study to determine: what types of sprayers are available; are these imported or locally made; what design characteristics are most important; would it be technically and economically feasible to promote local manufacture of an appropriate sprayer?	A definite proposal will be made after having the results and recommendations of the study now being carried out by the MA-IRRI Program.
9. Sheller	A wide variety of corn shellers are fabricated by small shops in many areas of the country. To our knowledge, no study has been made to compare the advantages and disadvantages of these shellers.	It is recommended that the MA-IRRI Program and PCARR collaborate in promoting a comparative study of shellers in order to determine: which designs are most appropriate for small farmers; is there a need to improve these designs for dissemination through the MA-IRRI Program and/or other programs?
10. Dryer	Many institutions, including the MA-IRRI Program, are carrying out R&D on dryers for palay and, less frequently, for corn. However, a dryer acceptable to small farms has not yet been demonstrated.	The MA-IRRI Program should undertake R&D on dryers for corn as well as rice. It should also attempt to promote dryer R&D by other institutions (see above discussion under item #2).

ANNEX B

PROGRAM SCHEDULE

Two-Week Agricultural Engineering Training Course
June 7-18, 1982

June 7 - Monday

8:00 - 8:15	Welcome (Seminar Room A, Chandler Hall)	M.D. Pathak
8:15 - 8:45	IRRI Agricultural Engineering and Industrial Extension Programs	C.W. Bockhop
8:45 - 9:15	Slide show on "The Rice of IRRI"	OIS/Visitors' Bureau
9:15 - 9:30	Preparation for Introduction of Trainees	Move to Agric. Eng'g. Conference Room
9:30 - 10:00	Introduction of trainees and IRRI staff	R.E. Stickney
10:00 - 10:30	Coffee Break	
10:30 - 12:00	Farm Economics: Typical costs and returns for different levels of technology	B. Duff
12:00 - 1:00	Lunch	
1:00 - 2:00	Farm Economics: Partial budget analysis of alternative technologies	G. Sharrock/P. Moran
2:00 - 2:45	IRRI Engineering Drawing System	F.C. Jalotjot
2:45 - 3:00	Coffee Break	
3:00 - 4:00	Shop Tools and Plant Layout	N. Langam
4:00 - 5:00	Overviews of Agricultural Equipment for Small Rice Farms (video tape)	S.A. Gutierrez/ R.E. Stickney

June 8 - Tuesday

8:00 - 12:00	Field Practice: Transplanter, Reaper, Thresher & Power Tillers (with plow, rotavator, and harrow)	S. Labro
12:00 - 1:00	Lunch	
1:00 - 2:45	Manual Transplanter	I. Manalili/A. Vasallo
2:45 - 3:00	Coffee Break	
3:00 - 5:00	Transplanter: Shop Practice and Seedling Preparation	A. Vasallo/E. Dungo

June 9 - Wednesday

8:00 - 9:15	Farm Economics: Techniques for Investment Appraisal, including B/C, IRR, and BE	G. Sharrock/P. Moran
9:15 - 10:00	Transplanter: Economic Analysis	L. Ebron
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Threshers	M. Diestro/A. Caballes
12:00 - 1:00	Lunch	
1:00 - 5:00	Threshers: Shop and Field Work	A. Caballes/E. Dungo

June 10 - Thursday

8:00 - 9:00	Threshers: Economic Analysis	F. Juarez
9:00 - 10:00	Cost Estimating for Small and Medium Scale Equipment Manufacturers	H. Manaligod
10:00 - 10:15	Coffee Break	
10:15 - 12:00	Power & Rotary Tillers	I. Manalili/E. Calilung
12:00 - 1:00	Lunch	
1:00 - 6:00	Shop Work	H. Manaligod/E. Dungo

(continued)

June 11 - Friday

8:00 - 9:00	Tillers: Economic Analysis	C. Maranan
9:00 - 10:00	Reaper	V. Tiangco/M. Diestro
10:00 - 12:00	Reaper (continuation)	
12:00 - 1:00	Lunch	
1:00 - 5:00	Reaper: Shop Work	H. Manaligod/E. Dungo

June 14 - Monday

8:00 - 9:00	Reaper: Economic Analysis	P. Moran
9:00 - 10:00	Jigs & Fixtures	L. Kiamco
10:00 - 10:15	Coffee Break	
10:15 - 10:30	Photograph of Course Participants	OIS, Photography
10:30 - 12:00	Axial-Flow Pumps	G. Salazar
12:00 - 1:00	Lunch	
1:00 - 2:00	Axial-Flow Pumps: Economic Analysis	C. Maranan
2:00 - 5:00	Axial-Flow Pumps: Shop and Field Work	E. Calilung/E. Dungo

June 15 - Tuesday

8:00 - 9:00	Economics of Manufacturing	N. Langam
9:00 - 9:45	Machinery Safety	M. Ariyoshi
9:45 - 10:00	Coffee Break	
10:00 - 11:00	Testing and Evaluation	S. Labro
11:00 - 12:00	Rolling Injection Planter	N. Aban
12:00 - 1:00	Lunch	
1:00 - 2:00	Fertilizer Applicators	I. Camacho/G. Salazar
2:00 - 3:00	Small Engines for Farm Machinery	H. Manaligod
3:00 - 3:15	Coffee Break	
3:15 - 5:00	Rolling Injection Planter and Fertilizer Applicators: Shop and Field Work	G. Salazar/N. Aban/ I. Camacho

June 16 - Wednesday

	Field trip to cooperating manufacturers	N. Langam

June 17 - Thursday

8:00 - 9:00	Extension Program: Overview	C. W. Bockhop
9:00 - 10:00	Extension Program: Past Experiences in the Philippines	S. A. Gutierrez/ R. E. Stickney
10:00 - 10:15	Coffee Break	
10:15 - 11:15	Consequences of Mechanization Studies	B. Duff
11:15 - 12:00	How to Plan and Conduct a Field Demonstration	S. Labro
12:00 - 1:00	Lunch	
1:00 - 2:15	Rice Drying	L. Halos
2:15 - 3:00	Rice Milling	I. Camacho
3:00 - 3:15	Coffee Break	
3:15 - 5:00	Drying and Milling: Laboratory Work	I. Camacho/L. Halos

June 18 - Friday

8:00 - 9:45	Course Examination	S. Gutierrez
9:45 - 10:00	Coffee Break	
10:00 - 12:00	IRRI Tour	
12:00 - 1:00	Lunch	
1:00 - 2:30	Free Time for Discussion of Machines of Particular Interest	
2:30 - 3:00	Closing Remarks Distribution of Certificates	C. W. Bockhop
3:00 - 3:30	Merienda	Trainees & Instructors

ANNEX C

AMA-IRRI EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT

1982 special contest

Search for improved technology for drying palay

JOIN & WIN

- CASH PRIZES
- TROPHIES
- TRIPS

THEME: THE DESIGN AND DEVELOPMENT OF BETTER DRYING PROCEDURES AND EQUIPMENT FOR SOLVING THE CRITICAL PROBLEM OF DRYING PALAY HARVESTED DURING THE RAINY SEASON. THE PRIORITY IS ON PROCEDURES AND EQUIPMENT WHICH, TO THE DEGREE POSSIBLE, WILL HAVE THE FOLLOWING CHARACTERISTICS:

- APPROPRIATE FOR USE ON SMALL FARMS (OR GROUPS OF SMALL FARMS)
- SIMPLE DESIGNS ACCEPTABLE TO FARMERS WITH RESPECT TO COST, OPERATION, ETC.
- LOCALLY AVAILABLE MATERIALS AND FABRICATION TECHNIQUES
- RENEWABLE ENERGY SOURCES (E.G., SUN, WIND, STRAW, HULLS, ETC.)

SPONSORING AGENCIES:

BUREAU OF PLANT INDUSTRY, MINISTRY OF AGRICULTURE
THE INTERNATIONAL RICE RESEARCH INSTITUTE
AGRICULTURAL MACHINERY MANUFACTURING & DISTRIBUTION ASSOCIATION
PHILIPPINE SOCIETY OF AGRICULTURAL ENGINEERS
SCIENCE FOUNDATION OF THE PHILIPPINES

(FOR DETAILED INFORMATION, SEE REVERSE SIDE)

RULES & CRITERIA: SFP-MA-IRRI CONTEST

Introduction

It is our pleasure to announce the initiation of a contest on the design of innovative equipment for small farms. The general purpose of this contest is to promote the widespread development of equipment that will help increase the profitability and productivity of small farms which are the basic producers of food supplies for the RP. The equipment should be low-cost, respond to the primary needs of small farms, be suitable for fabrication in small workshops, and preferably utilize locally-available materials and renewable fuels. Specific themes will be selected each year in order to focus the competition on problems which are considered to be important, timely, and within the capacity of a wide range of participants.

The theme selected for the first contest is the "Search for Improved Technology for Drying Palay". Drying is the process whereby moisture is removed from the harvested palay to reduce the growth of molds and micro-organisms that cause spoilage. The traditional method of drying palay in the sun is highly effective when the harvest occurs during clear and dry weather; however, for harvests during cloudy and rainy periods, modified or new drying procedures or equipment are needed to reduce spoilage which occurs if the grain remains moist. Consequently, the goal of this contest is to promote the search for appropriate procedures or equipment for drying palay during cloudy and rainy periods.

1. The contest is open to those students who participate in the annual SFP-sponsored Science Fair Contests and have projects relating to palay drying.

2. This contest will be held only at the national-level Science Fair. Consequently, only those participants who advance to the national contest by winning in the regular contests at regional-level Science Fairs will qualify for this special contest.

3. There will be one award of P2,000.00 to be given to the winner of the special contest. Contestants with projects on palay drying will be included for this contest and the regular contest of the Science Fair, and they have the possibility of winning awards in both. There is also the possibility for a non-winner in the Science Fair Contest to receive the MA-IRRI award.

4. A panel of judges selected by the Philippine Society of Agricultural Engineers will select the winner of the special contest. The criteria for judging are the same as for the regular Science Fair Contest, with the following additions with respect to projects on palay drying:

   a. Originality and creativeness
   b. Renewable energy sources (e.g., sun, wind, straw, hulls, etc.)
   c. Locally available materials and fabrication techniques
   d. Simple designs acceptable to farmers with respect to cost, operations, etc.
   e. Appropriate for use on small farms (or groups of small farms)
   f. Economic viability to farmer and fabricator

5. For additional information, please contact the regional NEC or SFP offices (listed in the "Announcement of the 1982 Science Fairs"), or contact the SFP Central Office.

ANNEX C

M.A.-IRRI Engineering Program for Small Farm Mechanization

1982 - 1983 CONTEST

Search for Improved technology for drying palay

JOIN & WIN

CASH PRIZES

TROPHIES

TRIPS

THEME: THE DESIGN AND DEVELOPMENT OF BETTER PROCEDURES AND EQUIPMENT FOR SOLVING THE CRITICAL PROBLEM OF DRYING PALAY HARVESTED DURING THE RAINY SEASON. THE PRIORITY IS ON PROCEDURES AND EQUIPMENT WHICH, TO THE DEGREE POSSIBLE, WILL HAVE THE FOLLOWING CHARACTERISTICS:

- APPROPRIATE FOR USE ON SMALL FARMS (OR GROUPS OF SMALL FARMS)
- SIMPLE DESIGNS ACCEPTABLE TO FARMERS WITH RESPECT TO COST, OPERATION, ETC.
- LOCALLY AVAILABLE MATERIALS AND FABRICATION TECHNIQUES
- RENEWABLE ENERGY SOURCES (E.G., SUN, WIND, STRAW, HULLS, ETC.)

CALL TO: ALL FILIPINOS, REGARDLESS OF AGE, SEX, PROFESSION OR EDUCATIONAL LEVEL, INCLUDING STUDENTS, INSTRUCTORS, FARMERS, FABRICATORS, INVENTORS, ETC.

SPONSORING AGENCIES:

BUREAU OF PLANT INDUSTRY, MINISTRY OF AGRICULTURE
THE INTERNATIONAL RICE RESEARCH INSTITUTE
AGRICULTURAL MACHINERY MANUFACTURING & DISTRIBUTION ASSOCIATION
PHILIPPINE SOCIETY OF AGRICULTURAL ENGINEERS
PHILIPPINE INVENTORS COMMISSION

(FOR DETAILED INFORMATION, SEE REVERSE SIDE)

RULES & CRITERIA: PIC CONTEST

Introduction

It is our pleasure to announce the initiation of a contest on the design of innovative equipment for small farms. The general purpose of this contest is to promote the widespread development of equipment that will help increase the profitability and productivity of small farms which are the basic producers of food supplies for the RP. The equipment should be low-cost, respond to the primary needs of small farms, be suitable for fabrication in small workshops, and preferably utilize locally-available materials and renewable fuels. Specific themes will be selected each year in order to focus the competition on problems which are considered to be important, timely, and within the capacity of a wide range of participants.

The theme selected for the first contest is the "Search for Improved Technology for Drying Palay". Drying is the process whereby moisture is removed from the harvested palay to reduce the growth of molds and micro-organisms that cause spoilage. The traditional method of drying palay in the sun is highly effective when the harvest occurs during clear and dry weather; however, for harvests during cloudy and rainy periods, modified or new drying procedures or equipment are needed to reduce spoilage which occurs if the grain remains moist. Consequently, the goal of this contest is to promote the search for appropriate procedures or equipment for drying palay during cloudy and rainy periods.

1. The contest is open to all Filipinos, regardless of age, sex, profession or educational level, including students, instructors, farmers, fabricators, inventors, etc. There will be two competitions; one in collaboration with the Science Fair of the Science Foundation of the Philippines (SFP) and the other with the National Inventors Week of the Philippine Inventors Commission (PIC). In the latter case of the PIC contest, participants should follow the PIC rules and criteria which may be obtained from PIC (address given below).

2. This is a special contest for project entries relating to small farm equipment.

3. There will be only one category in this contest, and it includes inventions, innovations, and creative research.

4. At the National Inventor's Week, contestants shall report, display, and demonstrate to the Panel of Judges the working models, illustrations, drawings, and samples of products described in the entries together with the description of the raw materials used and the various steps involved.

5. Deadline for submission of entries will be the same date as for the PIC contest, which is expected to be January 1983. Entries should be submitted to PIC (address given below).

6. The amount of the cash prizes will be determined later. First prize will be no less than ₱2,000.00.

7. Judgement shall be based on the following:

   a. Originality and creativeness
   b. Renewable energy sources (e.g., sun, wind, straw, hulls, etc.)
   c. Locally available materials and fabrication techniques
   d. Simple designs acceptable to farmers with respect to cost, operation, etc.
   e. Appropriate for use on small farms (or groups of small farms)
   f. Economic viability to farmer and fabricator.

   Special consideration will be given to entries which display working prototypes at the Inventor's Week.

8. A Panel of Judges chosen by the Philippine Society of Agricultural Engineers will select the winners. Decision of the Panel shall be final.

9. Prizes will be awarded during the National Inventor's Week in Manila, February 1983.

10. Address for all communications: PHILIPPINE INVENTORS COMMISSION
    2nd Floor PSBI Bldg., NSTA Compound
    Gen. Santos Ave., Bicutan, Taguig, Metro Manila.

ANNEX C

MA-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT

Republic of the Philippines
Ministry of Agriculture
BUREAU OF PLANT INDUSTRY
Manila

August 1982

To : BPI Regional Engineers

Subject : Contest for BPI Regional Engineers on Innovative Small Farm Equipment

The Ministry of Agriculture and the International Rice Research Institute have a cooperative program known as MA-IRRI Industrial Extension Program with the objective of increasing the profitability and productivity of small farms by introducing low cost agricultural equipment, such as hand tools, animal drawn implements and small powered machines for operations ranging from crop production to post harvest including processing and storage.

The Program is in need of new ideas on innovations which might be included in the extension program. In connection with this, the Program is sponsoring another contest which is "Best Farm Equipment in the Region" exclusively for the BPI regional engineers. The criteria for this contest are the following: 1) the equipment should be a local innovation which is not yet well-known; 2) it should be a simple design acceptable to small farmers with respect to cost and operation; 3) as much as possible it should use renewable energy sources (e.g., sun, wind, straws, hulls, etc.; 4) it can be made locally from available materials, and 5) it should be appropriate for the MA-IRRI Extension Program.

The regional engineers will look for local innovations in the region which are not yet well known. They should submit a brief report describing the best innovation they have found, including information on materials, capacity, and illustration and drawings. The report should be submitted at our office not later than December 1, 1982. The prize will be a trip to Manila to receive the award certificate on January 14, 1983 during the BPI Anniversary.

(over)

If you wish to have more information, please communicate to:

MA-IRRI Industrial Extension Program
Agricultural Engineering Division
Bureau of Plant Industry
San Andres St., Malate, Manila

We will appreciate very much if you will join the said contest.

Sincerely yours,

BENITO C. GONZALO
BPI Project Co-Leader

ROBERT E. STICKNEY
IRRI Project Co-Leader

ANNUAL * REPORT OF IRRI-INDONESIA INDUSTRIAL EXTENSION PROJECT
FOR THE YEAR SEPTEMBER 1981 THRU AUGUST 1982

Number of prototpes built, modification and preliminary testing work carried out in Jakarta workshop are as under:

No.	Description		Remarks
1.	Hand Tractors (6 HP)	2	Field tested & are used for training purposes here.
2.	Hand Tractors (4 HP with gasoline)	1	Preliminary field tests are being conducted with various attachments.
3.	Hand tractors (4HP with diesel)	1	Under completion
4.	Axial Flow Pump 6"	2	Shorter length with the possibility of attaching second propeller for higher heads is completed, but yet to be tested thoroughly.
5.	Thresher TH6	3	Several new features incorporated to increase the cleanliness of threshered paddy
6.	Transplanters	8	were field tested & two pieces each were despatched to W.Sumatera, S.Sulawesi and S.Kalimantan
7.	Rolling Injection Planters	4	Several models with new features are being field tested.

* Quarterly reports submitted during this year are enclosed herewith

8.	Fertilizer applicator manual	1	Push type IATA design. Presently is being tested.
9.	Reaper 1 meter	1	Just completed the prototype & is under functional test.
10.	Pedal theresher ITB Type	1	Tested and found too heavy
	Dian Desa Type	2	Improving the local design by using bicycle sprocket & chain

Progress of Our Field Extension Activities in Four Provinces is as following :

West Sumatera:

As on August '82 end, total number of threshers produced are 145 by local manufacturers, as reported by their Agricultural Department. In this depts workshop, 4 transplanters, one 6 HP diesel hand tractor and 3 threshers have been built during this year and are presently being used for demonstrations in various districts.

One of the local manufacturer has been assisted to manufacture our smaller hand tractor with 4/5 HP gasoline engine and is presently testing in the field with plough & harrow. There seems a greater enthusiasm for this type of machine in this province. He is also being encouraged to take up the manufacture of 6" axial flow pump and hire it out along with the above hand tractor to nearby farmers so that he can create his own market around that area. This strategy has worked out well in case of TH6 threshers, as he has already produced and sold twenty threshers during this year.

On August 14, 1982, a seminar on the progress of our project work was organised by the provincial Government at Padang which was well attended by the senior provincial & central Government staff, representatives of Bank Indonesia and BRI and local manufacturers of

IRRI - type equipment, samples of whose produce were also exhibited on this occasion. At the conclusion, very useful recommendations have been made to further accelerate the tempo of local manufacture of small farm equipment. Local press has given a fairly good coverage to the deliberations of this seminar.

This province, having made such good progress in the local manufacture of IRRI - type equipment, is being used as a model for the other provinces. Infact GOI is considering to provide extra budget (as per the recomendation of the above seminar) for the next year to equip their workshop and facilities to make it into a regional centre for Sumatera.

South Sulawesi :

We have despatched two sets of 6HP diesel Hand Tractors, TH6 threshers, Transplanters and One vertical bin drier to their agriculture Deaprtment for demonstration and training purposes. One week long training course was conducted in the month of March '82, assisted by one of our counterpart staff engineer from Jakarta. sixteen participants mainly from the extension wings of Agriculture, industry departments of the province attended this course. So far 3 demonstrations have been conducted in three districts by the above equipment.

However, our major input in this province has been in the L. Luwu district with the additional funding support from US AID-Jakarta mission. The copy of first six monthly progress report is enclosed(for the details) in this regard. It may be noted that due to successful functioning of the ten IRRI - type hand tractors

there, more than 50 farmers from that area have so far expressed their keen desire to purchase them through commercial bank credit. We are coordinating with BRI at Palopo and Ujung Pandang to provide the above credit facilities to the farmers in that area. Meanwhile we have taken the initiative to identify three manufacturers in this province and assist them in the manufacture of first sets of hand tractor and TH6 thresher by each of them. We are providing them with the cost of raw materials and engines only with the understanding that they will use this equipment for hiring and demonstration to the nearby farmers for a period of one year and later they will surrender them to the provincial agricultural department for their further demonstration cum training purposes. This starter mechanism we feel should enable them to manufacture to meet the rising local demand of such equipment as in West Sumatera.

South Kalimantan :

With the two sets of hand tractors, transplanters, axial flow pump & TH6 threshers and one vertical bin drier despatched to their agricultural deaprtment last year, they have so far been able to conduct twelve demonstrations in 4 districts.

With the local agricultural department budget, orders have been placed on one local manufacturer for 3 TH6 Threshers, 5 axial flow pumps,& 5 weeders. They are yet to be field tested thoroughly and to be used for their further demonstrations in various districts. There seems a good potential for axial flow pumps and paddy threshers in this province.

However, due to general backwardness of the province and lack of sufficient guidance & inputs from the centre, the progress and

results of our field extension work so far in this province is rather meager.

West Java :

This province has been added to our field extension work by GOI from the financial year '82/'83 (April to March).

We have identified and are engaged in the following priorities of work and equipment in this province :

i) Monitoring lift irrigation thru axial flow pumps in the upland areas of Jati Luhur canal system. About 5000 Ha are said to be above the canals and World Bank has funded initially 25 pumpsets which are being purchased from our cooperative manufacturers and our project staff is being involved in monitoring of this project.

ii) During the harvesting months of january, February and March which are still rainy months, drying of paddy is being experienced as one of the major problems. We have taken the initiative during the last season to try out two driers in two villages of Kerawang district. Due to the defective functioning of equipment and non uniformity of drying resulted in lowering of the quality of milled rice, our above experiment was a failure. Please refer to our qaurterly report (April - June 1982), we feel this major defective performance of our drier needs to be thoroughly investigated at Los Banos, preferably in combination with husk furnace. Meanwhile we have plans to try out with minor modifications in the coming months again.

iii) Threshing and winnowing is still one of the problems in this province. Due to the controversy of introducing labour - displacing machines, we are hesitating to introduce TH 6 threshers in this province. However, we feel there is a need and scope for an efficient pedal thresher/winnower in this province. We have picked up a local indeneous design using bicycle parts for rotating threshing drum.and costing less than $ 60 but increases the productivity by 3 to 4 times. However this concept needs some more engineering input to improve the quality of threshed. paddy by incorporating winnowing features (or build another winnower with similar drive mechanism) and making it portable by adding bicycle wheels. If the engineering staff at Los Banos can assist us in this regard. we feel we can come up/ an improved model with lot faster.

iv) We have been approached by the Government seed farm authorities at Sukamandi to provide them with the IRRI equipment technology. This farm is endowed with 3000 Ha but at present is able to cultivate only 750 Ha using imported big tractors and combines and is leasing another 750 Ha on contract for land preparation, harvesting, threshing operations etc. They are generally finding shortage of labour and due to the unsuitability and high cost of maintenance of imported equipment, they are seriously interested in trying out with our technology. We are planning to try out first during the coming season with two sets of equipment consisting of hand trac-

tors, transplanters, weeders, reapers, threshers and driers. If found suitable and economical, they propose to use this technology for their entire 3000 Ha during their 4th five year plan, starting from the year '84. This will be another opportunity and challenge for us to monitor and prove the appropriateness of our technology compared to the imported to the policy makers of this country.

Training Programmes:

Conducted one training programme in Jakarta from May 31st to April 4th. 17 provincial staff engaged in the extention work from the above 4 provinces participated. Please refer to quarterly report for the period of April thru May '82 for the details.

In the provinces, one training programme each mainly for the operators and mechanics of small workshops have been conducted as under :

Provinces	Place	Number of participants	from	upto
1. S.Kalimantan	Banjar Baru	20	Nov.16th	22nd'81
2. W.Sumatera	Bukit Tinggi	19	Jan.24th	28th'82
3. S.Sulawesi	Maros	16	Mar.25th	28th'82

Training as mentioned above has become one of our regular and successful annual activity.

The list of local manufacturers and the equipment manufactured by them as on June '82 is enclosed herewith.

PROGRESS OF MANUFACTURE OF IRRI SMALL FARM EQUIPMENT IN INDONESIA

No.	MANUFACTURERS	Hand Tractors up to		Threshers up to		Axial flow pumps upto		Driers up to		Transplanters up to		Other implements up to		Remarks
		79/81	81/82	79/81	81/82	79/81	81/82	79/81	81/82	79/81	81/82	79/81	81/82	
1.	PT.BUMA SAKTI Bandung	11	-	43	105	-	4	27	52	20	25	52	-	
2.	PT. MUSUHAMA,Tegal	30	-	60	-	-	-	9	-	-	-	135*	-	*Weeder
3.	PT.MARTANI,Palembang	11	16	-	-	-	-	-	-	-	-	-	-	
4.	PT.KUBOTA,Semarang	6	-	-	-	-	-	-	-	-	-	-	-	
5.	PT.KARYA HIDUP SENTOSA Yogyakarta	190	750*	35	200	-	-	-	-	-	-	-	-	*Thai type
6.	PT.SURATMAN,Solo	10	50	34	60	-	6	-	-	-	-	1000*	500*	* Weeder
7.	PT.TUGAS,Jakarta	16	10	-	5	1	2	-	1	-	1	-	-	
8.	PT.NEW RUHAAK INDO-nesia, Jakarta	15	85	-	-	1235	300	-	20	-	-	-	-	
9.	KERANISAPUTRA,Jakarta	-	-	-	-	-	-	-	-	-	-	-	13*	*10 trailers,3 Puddle
10.	PT.SUTAN KASIM,Padang	-	-	24	30	-	-	-	-	-	-	10*	-	* Weeder
11.	PT.SARASHA,Padang	1	-	34	36	-	-	-	-	-	-	55*	-	* Weeder
12.	Bengkel DIPERTA Bukit-tinggi, West.Sumatera	-	2	2	1	1	2	-	-	-	4	200*	-	* Weeder
13.	Tembok Jaya (Agam) W.Sumatera	-	-	5	18	-	-	-	-	-	-	-	-	
14.	Bengkel GADOT(Agam) W. Sumatera	-	-	6	12	-	-	-	-	-	-	-	-	
15.	MUKHTAR,Bukit tinggi W. Sumatera	-	-	6	9	-	-	-	-	-	-	-	-	
16.	Others,W.Sumatera	-	-	15	19	-	-	-	-	-	-	50*	-	* Weeder
17.	Bengkel H.SABRI,Banjar masin,S.Kalimantan	-	1	2	4	4	5	-	-	-	-	2*	-	* Weeder
18.	Bengkel Tanjung Barat Jakarta	3	4	7	2	8	2	-	-	5	3	5	-	
	T o t a l	293	918	273	501	1249	321	36	73	25	33	1509	513	
	Cumulative Total	1211		774		1570		109		58		2022		
	Grand Total													= 5,744

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VRR.

IRRI-DITPROD INDUSTRIAL EXTENSION PROJECT
P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

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September 22, 1982

To : Dr.R.J.Cowan

From : V.R.Reddy

Subject : Quarterly Report

(July through September 1982)

T r i p s

June 24th - July 6th	:	ASAE meeting at Madison, and World Bank, ATI & VITA in Washington D.C.
July 7th - July 31st	:	Home leave
Aug. 8th - Aug. 12th	:	With Bart Duff to Luwu project
Aug. 13th - Aug. 15th	:	With Bart Duff & Dr.Rudy Sinaga to W.Sumatera for a seminar
Sept. 6th - Sept. 9th	:	With Ir.Zaidir Said to attend Ratek - Ditprod in Jogjakarta

During this summer meeting of ASAE at Madison from June 27th to July 1st, I had presented a paper with the title " Small Farm Equipment Technology Transfer to Developing Countries" (Experiences gained in Indonesia). Dr.Bockhop, Bob Stickney, Ray Fisher and Marvin Nafzinger also attended this meeting, and we together visited "Briggs & Stratton" works and had useful discussions with their R & D staff.

At Washington, World Bank has taken the initiative to organise seminar on my work here which was attended by representatives from USAID, ATI & VITA in addition to the Bank's staff. While in Washington, I was not able to meet Dr.Gerrit Argento as he was leaving the next day to Ceylon, but did talk to him over phone about the progress of our project work here.

As soon as I returned from my home-leave, visited project Luwu area with Bart Duff. Ploughing season was coming to an end and all farmer's tractors except one (which needed repair) were working in the field. However, REC tractors were not being fully utilized partly due to the lack of budget provision for operators & fuel during the financial year '82/'83. With the help of Yusuf Mamun (who traveled along with us) & Bart Duff, all the remaining doubts were clarified with regard to record-keeping. In fact code-sheet upto July end was completed and given to Bart Duff for further processing at Los Banos. Our second season's report in this regard is being submitted separately to Project Luwu/USAID authorities.

At Padang on Aug 14th a day's seminar on the progress of our pilot project in W.Sumatera was organised by Diperta there. In addition to the representatives of Pemda Bappenas, Industries Department,

Sumatera Agricultural Research project, Banks and local manufacturers from the province, Pak Jafri jamaluddin (Director of Ditprod) 3 staff members of Subdit one from secretary cabinet, Head of Agricultural Engineering IPB, representative from USAID and Dr. Rudy Sinaga, Bart Duff along with me from Jakarta attended this seminar. 4 papers were submitted and discussed in depth from Diperta, Perindustrian, Bank of Indonesia & Local manufacturer. At the end of it a list of recommendation was prepared to be sent to the concerned departments for future follow up. Equipment samples of local manufacturers were displayed at the place of seminar. Subsequent to the seminar, the Governor of W.Sumatera has sent a *letter to the Director General of Food Crop Production, stating the useful role of our project work in his province and at the same time requesting to continue this programme on a bigger scale, which means more inputs both in terms of money and men.

Presently we are concentrating on the promotion of hand-tractors and axial flow pumps in this province. Already one private manufacturer has been assisted to manufacture 4 HP hand tractor which is being field tested/demonstrated.

For the first time I have been invited to participate in their annual budget prepartaion meeting (RATEK) held at Jogjakarta. All the representatives of DIPERTA staff from provinces attend this meeting to discuss their previous performance and formulate the budget for the coming year. Indeed it was a very good opportunity for me not only to meet and discuss with the counterpart staff in the provinces specially where we are working, but also to get an opportuni-

* English Translation is enclosed

ty to emphasise the need to sychronise the efforts between centre and provincial staff and also the need to focus on few priority areas/activities until the results are produced. Specially with our encouraging achievements in West Sumatera, I felt this point was well driven home.

Meanwhile at our Tanjung Barat workshop, during this period they built two more proto-types of modified axial flow pump with two propellors, two 4 HP hand tractors with gasoline engine and one with diesel engine, 4 single & double row injection planters, and one 1.0 meter reaper. Most of these are at the various stages of testing.

cc: Dr.Bockhop

Translation of letter # 521/3592/SWD/82

Padang, August 18, 1982

Subject: Activity Development of IRRI type farm machineries in West Sumatera

General Director of Crop Agriculture
Jakarta

Dear Sir,

With regard to the increase crop production in W.Sumatera, mechanisation/farm machinery activities holds an important role. The main constraint at present is shortage of manpower that is resulting in high wages for farm labour. Further:there is great potential for increasing cropping intensity, bringing more land into cultivation, decreasing post harvest losses.

Therefore we are realising the important role of farm machinery in W.Sumatera.IRRI designs have been introduced in this province which are being,thresher, transplanter, axial flow pump, weeder and hand tra tor which are producted by our Diperta workshop at Bukit Tinggi and also by several manufacturers in this province under our guidance.

The development of local manufacturing, specially of threshers uptill now is very satisfactory.

However, this programme of IRRI needs to be intensified further, in order to cover other operations and make greater impact and West Sumatera can be developed into a regional center of Sumatera IRRI type farm equipment.

Hopefully, you will be able to fulfill our request and we really appreciate your help and attention in this regard.

Governor of Sumatera ,Barat Province

(Ir.Anwar Anas)

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IRRI - DITPROD INDUSTRIAL EXTENSION PROJECT

P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

June 22, 1982

To : Dr.J.R. Cowan

From : V.R. Reddy
Agricultural Engineering Consultant

Subject : Quarterly report April through May 1982

Trips:

March 31 - April 1	:	Bandung to visit MIDC, ITB and cooperative manufacture
April 9 - April 12	:	Padang with Ir. Zaidir for follow up of field extension work
April 20, 21, and 24	:	Bekasi with M. Nafzinger to test reapers
April 22 - April 23	:	Solo with M. Nafzinger to visit cooperative manufactures
May 13 -	:	Sukamandi to test reaper with Ir. Subrata
May 24 - May 28	:	Ujung Pandang with Ir. Subrata for follow up our project work in Luwu and South Sulawesi.

During this quarter we were able to assemble and successfully field test 1,6 meter and 1 meter reapers mainly with the help of Marvin Hofinger who has spent two weeks with us from April 7. Our engineers got trained and well acquainted with the performance and various adjustments required on reapers during the above field tests. Manufacture of the proto-types of these two types of reaper attachments has been undertaken in our Tanjung Barat workshop. Marvin Hofinger has also helped us in further modification work of rolling transplanters being presently fabricated and tested here. We have built first proto-type of a more efficient and less expensive paddy thresher which can be built by village carpenters. We are now building second proto-type with improved features like blower incorporated with bicycle wheels for their easy portability.

In Java, the second ploughing season started from May 3rd week and is expected to last until July end. All the hand tractors were serviced and kept ready before the season with the help of our staff and mechanic. Ten trailers that were sent in the last consignment were received and assembled and were being used for transport work. We have identified two local workshops at Palopo for the manufacture of Gelobok attachments for nine more hand tractors after successfully testing the first piece sent from Jakarta.

Record-keeping work is continuing quite systematically. We have received the assistance of Mr. Bahar (staff from Maros research station who had previously worked with our "Consequences of Mechanisation " project and is well-versed in record-keeping) for checking the quality of record-keeping and assisting the staff in the field for a period of one week.

His report is expected soon.

During this harvesting season one TH6 paddy thresher (that was loaned from DIPERTA, Ujung Pandang, who earlier received 2 sets of all IRRI equipment from our workshop for extension work) was demonstrated successfully and created sufficient interest among the farmers. Also one transplanter has been loaned and going to be demonstrated during the coming season.

As reported earlier, farmer's interest in procuring IRRI type hand tractors and new threshers is continuing to increase. From FCC we understand more than 50 farmers have indicated their interest in procuring them through credit.

Now the major obstacle facing these interested farmers is getting Bank Credit. In this regard we have initiated by meeting B.I. and B.R.I. bank officials and by providing them feasibility reports etc. They are taking measures to meet such a credit demand as in West Sumatera.

Meanwhile we are trying to identify manufacturers who can be assisted for their manufacture.

Further progress in the manufacture of thresher and weeders is reported from West Sumatera. The latest number of manufacaturers has risen to 11 and total number of threshers produced and sold has gone up to more than 200 pieces.

Meanwhile one manufacturer at Lubuk Basung has been assisted to take up the manufacture of small 4/5 HP hand tractor and axial pump. Further demonstrations and field tests are being carried out with regard to transplanter, axial pump and hand tractors.

One week training programme has been organised for 17 provincial staff starting May 31st. Detail list of the participants and training programme ~~is~~ are enclosed. Like the previous training programme this has also been useful experience for both the staff here and the participants for conducting field extension work in the provinces. We have noticed, particularly, the experiences gained by the participants of West Sumatera were found very useful and inspiring to the participants from other provinces. However, in the evaluation of the training programme, we got the feed back that one week was too short and should have more practical classes than theory sessions.

On May 17th. Dr.W.Fuller, director of USAID mission here in Jakarta along with his officers of Agricultural division and Dr.Tom Kessinger, chief of Ford Foundation paid a visit to our workshop when we were able to show our field extension work in three provinces though slides and 8 mm movie. It was followed up with a detail and useful discussion. The next day (May 18th) we had again visitors about 20 in number from WorldBank, United Nation Organisation, Harvard Institute for International Development group, who showed very keen interest in our programme and had indeed very useful exchange of information. It may be mentioned here that World Bank is collaborating with us in their pilot project of lift irrigation (installing IRRI type 25 axial flow pumpsets) in West Java.

PROGRAMME SCHEDULE OF FIVE DAY'S AGRICULTURAL MECHANISATION COURSE from May 31 to June 4 1982

Monday May 31, 1982

1.	07;30 - 08;15	Opening Ceremony (W.T.Ragunan)	Committee
2.	08;15 - 09;00	Welcome (do)	do
3.	09;00 - 09;45	Welcome (do)	do
4.	09;45 - 10;00	——B r e a k ——	
5.	10;00 - 10;45	Selection of Mechanisation Programme	Ir.Soebagyo W.
6.	10;45 - 11;30	Institution for Testing Agric.Equipment	R.Dadang Tarmana AE.
7.	11;30 - 11;45	——B r e a k ——	
8.	11;45 - 12;30	Criteria for extensioning Agric. Equipment	Dr.Soedjatmiko
9.	12;30 - 13;15		
10.	13;15 - 16;00	——B r e a k ——	
11.	16;00 - 16;45	Discussion	Soewardjo and
12.	16;45 - 17;30	Discussion	R.A. Hamid
13.	17;30 - 19;00	——B r e a k ——	
14.	19;00 - 19;45	Trip to Ancol	
15.	19;45 - 20;30	do	
16	20;30 - 21;15	do	

Tuesday June 1,1982

1.	07;30 - 08;15	Farm Economics: Techniques for investment-	Heradji Asmanu BSc.
2.	08;15 - 09;00	appraisal including B/C ; IRR	
3.	09;00 - 09;45	Workshop Management	Ir. Kees Sulistiadji
4.	09;45 - 10;00	——B r e a k ——	
5.	10;00 - 10;45	Testing for Adaptation to Agric. Equipment	Wiyanto BSc.
6	10;45 - 11;30	Field work on Axial Pump	Ir. Rudy Tjahjohutomo
7.	11;30 - 11;45	——B r e a k ——	
8.	11;45 - 12;30	Introduction & Demonstration in rural area	Ir. Zaidir Said
9.	12;30 - 13;15	do	do
10.	13;15 - 16;00	——B r e a k ——	
11.	16;00 - 16;45	Discussion	Suwardjo and
12.	16;45 - 17;30	Discussion	R.A. Hamid
13.	17;30 - 19;00	——B r e a k ——	
14.	19;00 - 19;45	Slide show on: Industrial Extension Programme	Ir.Zaidir Said and Ir.Rudy Tjahjohutomo
15.	19;45 - 20;30	do	
16.	20;30 - 21;15	do	

Wednesday 2 , 1982

1.	07;30 - 08;15	Manufacturing on "Small and Medium Scale-	Ir.B.Gultom
2.	08;15 - 09;00	Equipment of the Manufacturer"	
3.	09;00 - 09;45	Field work : Testing of Thresher	Ir.Subrata S.
4.	09;45 - 10;00	—— B r e a k ——	
5.	10;00 - 10;45	Manufacturing:"How to mode a weeder"	Wiyanto BSc.
6.	10;45 - 11;30	do	do
7.	11;30 - 11;45	—— B r e a k ——	
8.	11;45 - 12;30	Manufacturing:"How to make simple sprayers	I.W. Badra
9.	12;30 - 13;15	Field work : Testing of Sprayer	do
10.	13;15 - 16;00	—— B r e a k ——	
11.	16;00 - 16;45	Discussion	Soewardjo and
12.	16;45 - 17;30	Discussion	R.A.Hamid
13.	17;30 - 19;00	—— B r e a k ——	
14.	19;00 - 19;45		
15.	19;45 - 20;30	do	
16	20;30 - 21;15	do	

Thursday 3June 1982

1.	07;30 - 08;15	Manufacturing:"How to make a Pedal Thresher	Mulyoto BSc.
2.	08;15 - 09;00	do	do
3.	09;00 - 09;45	Manufacturing:"How to make an injection Planter"	do
4.	09;45 - 10;00	—— B r e a k ——	
5.	10;00 - 10;45	Manufacturing:"How to make a winower	do
6.	10;45 - 11;30	do	do
7.	11;30 - 11;45	—— B r e a k ——	
8.	11;45 - 12;30	Manufacturing:"How to make simple corn skeller"	do
9.	12;30 - 13;15	Contunued	do
10.	13;15 - 16;00	—— B r e a k ——	
11.	16;00 - 16;45	Discussion	Soewqardjo and
12.	16;45 - 17;30	Discussion	R.A.Hamid
13.	17;30 - 19;00	—— B r e a k ——	
14.	19;00 - 19;45	Discussion	do
15.	19;45 - 20;30	do	do
16.	20;30 - 21;15	do	dd

Friday 4 Jun, 1982

1.	07;30 - 08;15	Evaluation	Committee
2.	08;15 - 09;00	do	do
3	09;00 - 09;45	do	do
4.	09·45 - 10;00	—— B r e a k ——	
5.	10;00 - 10;45	Discussion	Soewardjo and
6.	10;45 - 11;30	do	R.A. Hamid
7.	11;30 - 11;45	—— B r e a k ——	
8.	11;45 - 12;30	Closing Ceremony	Committee
9.	12;30 - 13;15	do	do
10.	13;15 - 16;00		
11.	16;00 - 16;45		
12.	16;45 - 17·30		
13.	17;30 - 19;00		
14.	19;00 - 19;45		
15.	19;45 - 20;30		
16	20;30 - 21;15		

June 1982

1. 07;30 - 08;15
2. 08;15 - 09;00
3. 09;00 - 09;45
4. 09;45 - 10;00
5. 10;00 - 10;45
6. 10;45 - 11;30
7. 11;30 - 11;45
8. 11;45 - 12;30
9. 12;30 - 13;15
10. 13;15 - 16;00
11. 16;00 - 16;45
12. 16;45 - 17;30
13. 17;30 - 19;00
14. 19;00 - 19;45
15. 19;45 - 20;30
16. 20;30 - 21;15

IRRI - DITPROD INDUSTRIAL EXTENSION PROJECT
P.O. BOX 18/KBYPM PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

March 30, 1982

To : Dr. J.R. Cowan

From : V.R. Reddy
Agricultural Engineering Consultant

Subject : Quarterly report January through March 1982

Trips:

January 18 - 22 : Luwu with Jim Hooper to follow up the progress of work

January 27 - 29 : W. Sumatera with Douglas Tinsler of USAID, to follow up field extension work

February 2 - : Karawang with Ir. Soebrata and Ir.Hamid for the installation of paddy driers

February 17 - : Karawang with Ir. Koes Sulistiadji and Ir. Rudy for the follow up work on the field testing of driers

March 8 - 12 : Luwu with Dr. Cowan and Hooper to follow up the progress of work

March 23 - 25 : Kalimantan Selatan with Ir. Soebrata to follow up field extension work.

IRRI - DITPROD

In Luwu, during the ploughing season from December end to March first week, 6 hand tractors operated by farmers and 3 hand tractors by REC were successfully used throughout the season.

During the above period total area that was ploughed and harrowed comes to 67 Ha and 120 Ha respectively. The average performance of each tractor as recorded shows :

	No. of Hrs worked/tractor	Ha ploughed/ tractor	Ha harrowed/ tractor	Efficiency of operation	Field consumption litre/Tractor/Hr
Farmer Owner Tractor	400	8	15	70%	0.6
R E C Tractor	250	6	10	85%	0.6

It may be seen from the above table that farmer/owner has taken longer time for completing one Ha of land preparation compared to the standard and REC operator. It is expected by next season their efficiency will further improve. Simultaneously from 30 respondents the data is being collected by record keepers and coded sheet is expected to be sent to Los Banos in near future. Meanwhile 10 trailers have been despatched to Luwu to enable them to use for transport purposes during the off-season period. The next ploughing season is expected to start from late May and will last upto July.

Two sets of equipment which were sent to DIPERTA, S. Sulawesi were received. A training programme was conducted from March 25 to 28th to extension staff in Agricultural and industries depts of the province.

One Engineer from Jakarta has gone to help them in conducting above training programme and demonstrations.

During this quarter as reported earlier, two paddy driers were placed in two villages in Karawang district for field testing. Unfortunately due to more sunshine and less rain this year they were able to dry about 24 tons in 18 batches and further, the impression has developed in these two villages that the quality of rice has decreased due to mechanical drying due to flu-gasses. We were, however, not able to detect the differece as we conducted small test by asking 10 respondents if there is difference between the sun dried and mechanically dried cooked rice. It could have been psychological. However, need further investigation.

We are proposing to test these driers further during next month with a new husk-furnace that got built locally and compare the results.

In South Kalimantan, DIPERTA staff there, have organised so far 7 demonstrations in 4 districts. This has created interest specially for hand tractors, threshers and water pumps. However, they require credit facilities and more intensive demonstrations in two potential districts for creating initial orders. Meanwhile one workshop at Banjarmasin has built 3 threshers, 5 water pumps and 5 weeders, which are going to be tested during this coming harvesting and ploughing season. One more samll workshop has shown interest to start building weeders, and has fabricated one proto-type already.

In west Sumatera the progress of weeder and thresher manufacturing continues to increase. At present there are eight thresher manufacturers, the cumulative production as reported comes to about 120 units. We

have sent two new transmission boxes, manufactured with jigs and manufacturers to this province, for replacing them with the old ones as they failed in the field several times. There is considerable potential for both hand tractors and water pumps in this province which can be converted into actual market by intesifying demonstration during the coming season. We are therefore proposing to increase number of demonstration sets from two to five during the coming season.

Here at Tanjung Barat workshop, we have built 4 sets of rolling injection planters and have just taken up the manufacture of two sets of 3/5 h.p. tractor with harvesting attatchment. One sample piece we have recently received from Los Banos.

We are busy preparing for a training course to be conducted in the month of May for participants to be invited from 4 provinces. Also a field day and seminar is being planned to be organised in June' 82.

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IRRI - DITPROD INDUSTRIAL EXTENSION PROJECT

P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782567

January 4, 1982

To : Dr. J.R. Cowan
IRRI Liaison Scientist

From : V.R. Reddy
Agricultural Engineering Consultant

Subject : Quarterly report October through December 1981.

Trips :

October 21	: Karawang with Ir. Koes Sulistiaji, PD KAWI AGUNG, Jatiluhur authority representatives to demonstrate axial flow pump.
October 22 - 23	: Bandung to visit MIDC and cooperative manufacturers with Ir. Koes Sulistiaji.
October 27 - 30	: Padang with Ir. Zaidir to follow up field extension work.
November 10 - 15	: Ujung Pandang (Luwu Project) with Ir. Koes S. & Ir. Rudy T. to conduct training programme to 10 operators and mechanic of hand tractors.
November 26 - 28	: Banjarmasin (Banjarbaru) with Ir. Zaidir to follow up field extension.
December 8 - 10	: Padang with Mr. Gerit Argento & Dr. Barry Primm for annual field evaluation of the progress of our project there.
December 15 - 19	: Luwu Project (South Sulawesi) with Ir. Koes S. to follow up field extension work there.
December 26 - 29	: Padang to follow up field extension work there.

IRRI - DITPROD

During this quarter we have sent 10 hand tractors with implements to Luwu project, conducted two week training programme at Bonebone where 10 operators and mechanic have been trained to operate and maintain them in the field conditions. As per Luwu project authorities' decision, 6 machines were distributed to farmers who have been given the option to buy these machines at the end of first year and the remaining 4 machines will be operated by the staff of REC for demonstration and extension work within the district. Supervisor, two record keepers have been selected for monitoring work and finalized their office and accomodation premises, transport facilities etc.
With the help of Dr. John Wicks, the questionaires for collecting data from respondents has been finalized in such a manner that these can be used for making analysis work from the computer programme that is already available at Los Banos.

Being the first season and a cruicial one, most of our efforts have gone in launching this sub-project work and in spite of several initial difficulties, it has started off fairly well. We are glad to state that we have received excellent cooperation from the concerned U.S.A.I.D. and Luwu project counterpart and Maros research station staff. Particularly Dr. Jim Hoopper's assistance and his guidance, has been very valuable in this regard.

Two sets of equipment sent to South Kalimantan have been demonstrated by DIPERTA staff there under the guidance of our office here. We have conducted one week training programme for the local manufacturers, and concerned provincial Government staff engaged in extension work there. One of the engineers of DIPERTA staff there was invited to Jakarta and given intensive training in operation and maintenance of transplanter and hand tractor. Already one manufacturer has built 3 paddy threshers two water pumps and 5 weeders as per the order received from DIPERTA there.

We are working in close cooperation with U.S.A.I.D.'s PDP programme there.

Dr. Gerit Argento from Washington has visited us for the first year's evaluation work. After spending a day at our Pasarminggu workshop, we visited West Sumatera to see the progress of our field extension work there. We were able to visit seven manufacturers of IRRI type threshers and weeders and some farmer users of these machines.

We were struck how small workshops with just a welding machine and hand tools in remote areas were taking up the manufacture and were able to turn out fairly good quality products. In fact one of these very small manufacturers has ingeniously introduced two wheels for making it more mobile and better cleaning system in paddy thresher. We are now incorporating these features in our IRRI drawings.
West Sumatera seems to have truly taken off with regard to paddy threshers and weeders. We are now concentrating to introduce water pumps, hand tractors and transplanters for which there seem great potential in this province.

We have conducted demonstration of Axial flow water pump in Karawang district at the request of Jatiluhur authorities as we believe they have 5000 Ha which are above canals and are at present unirrigated. World Bank has shown interest in financing Jatiluhur authority for pump irrigation to the above 5000 Ha. To start with they have indicated to place 10 such pumps and monitor them during the coming dry season and we will be involved in this work.

We have prepared a small proposal to test and demonstrate two driers in Karawang district during the coming wet season harvesting (February to April 1982). This will give us an opportunity to compare present drying costs to farmers and rice traders and show them the advantages of driers.

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IRRI - DITPROD INDUSTRIAL EXTENSION PROJECT

P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

September 30, 1981

To : Dr. J.R. Cowan
IRRI Liaison Scientist

From : V.R. Reddy
Agricultural Engineering Consultant

Subject : Quarterly report July through September 1981

Trips :

June 21 - 24 : ORLANDO to attend ASAE professional meeting

August 12 : Sukamandi to attend field day at research station and also testing of hand tractors

September 14 - 19 : Philippines to attend seminar on 'Consequences of Mechanization'

During ASAE professional meeting held in Orlando from June 21 to 24, I met among several other fellow Agricultural Engineers, Dr. C.W. Bockhop, John McMennamy, Prof. Esmay from Michigan 'Varsity (who has made several studies on Agricultural mechanization in Indonesia and guided several Indonesian P.H, D. students in Agricultural Engineering) and held very useful discussions with them.

After the meeting, visited Washington D.C. and presented a short seminar on our small farm equipment extension work in Indonesia on June 29th at U.S.A.I.D. offices.

About twenty five economist and engineers from U.S.A.I.D. and World Bank attended and we had very useful discussions then.

Later I was able to meet and appraise Dr. Brady along with Gerrit Argento about further progress of our project work here.

On my way back from U.S.A., I was able to visit CAIRO for two days from July 9th to 11th and exchanged useful information with Charles Moss about IRRI industrial extension project in Egypt.

Meanwhile we have been mainly busy getting ready with the manufacturing of 10 Hand tractors for Luwu Project. Each one of them had to be tested in field conditions before despatching. Two transmission boxes developed leakage problem which are now being repaired in local workshop. Remaining eight with cagewheels have been despatched on September 27 to Luwu. The remaining two tractors and attachments will be despatched in 2nd consignment around mid October. In order to finalize at site various details with regard to monitoring, supervision, training of operators/ mechanics I am planning to leave for Luwu on October 6th to get ready for the ploughing season starting in November.

At Tanjung Barat workshop in addition to repairing and testing the above 10 Hand tractors for Luwu, built two punch planters, one 8" two stage axial flow pump, which are under test.

Two I.P.B. Agricultural engineer students are presently working with us to test above axial flow pump as part of their thesis work.

Participated in the seminar 'Consequences of Mechanization' at Los Banos, where more than 70 participants were invited to present papers and discuss the analysis of data collected during the last three years survey work at 4 sites. Further analysis work that needs to be made for making policy recommendations to the concerned Governments was discussed and formulated in the session.

BUFFALO DRAWN IMPLEMENTS

by

Chanchai Rojanasaroj,
Raymond C. Fischer,
and
Chak Chakkaphak[a]

Paper presented at the FFTC/ASPAC
Meeting on Buffalo Production
at Kasetsart University
Bangkok, during 11-17 August 1981

(a)
Working on Thai-IRRI Cooperative Project on
Small Farm Machinery.

Buffalo Drawn Implements

1. Introduction

Better farm practices and timing of operations are major factors contributing to good crop yield. In Thailand, however, farming operations such as soil preparation, planting and weeding, are not always properly done. This results in poor establishment of crops which results in a low level of yields in harvesting time.

The subject of agricultural mechanization is much wider in scope than is often realized. In the Division of Agricultural Engineering, mechanization embraces the design, test, development, manufacture, distribution and maintenance of all the tools, implements, equipment and machines used in agriculture. It is concerned with agricultural land development, tillage, crop establishment, weeding, harvesting, threshing, transporting, drying and storage. It embraces all aspects of production, handling, and processing at the rural level.

Farm mechanization includes three main power sources: human, animal and mechanical. Thus, agricultural mechanization will have an impact on, and a key role to play in, the development of the entire rural sector. This applies whether the technology is hand tool, animal draught, or mechanical power.

2. Animal-draught Technology

Buffalo are the primary draught animal in Thailand and in 1979 there were 6,400,000 buffalo in Thailand. With a total of 10,027,000 ha of rice planted in the 1978/79 crop year, there was one buffalo per 1.6 ha. Assuming 75% of the buffalo are useable for field work, there was

one draught animal per 2.1 ha. Additionally many cattle are used for draught; however, their capacity is less than that of a buffalo. If the buffalo distribution corresponded with rice production, the entire crop could conceivably be grown without using any mechanical power. However that is not the case.

Buffalo and Rice Production (000)

Region	Draught Buffalo	Planted Area, ha, 1978-79 1st	2nd	Total	Ha Per D. Buffalo
Northeast	3,000	4,451	25	4,476	1.5
North	525	2,022	92	2,114	4.0
Central	1,125	2,239	554	2,793	2.5
South	150	633	10	643	4.3
Total	4,800	9,346	681	10,027	2.1

There is not much information available on the percentage of land prepared by buffalo in Thailand. It varies by region, and by locality within a region from 20% to over 90%. A recent estimate indicated the following:

	Area, % Rice	Total	Hire Rate, $US/ha(a)	Hours/ha
4 Wheel Tractor	6	24	45	6
Power Tiller	31	25	36	14
Buffalo	63	50	20	40
Manual	T	1	30	100

(a) Two passes, except one pass for manual. Very few power tillers and buffalo are custom hired.

Based on the above estimates, the use of mechanical power is expanding because it completes the task of soil preparation in 15% to 40% of the time required by buffalo. With large 4 wheel tractors, still more time is saved. The advantage of timeliness is selected, even though the cost of mechanical power is approximately double that for animal power for soil preparation. It can be assumed that the increased cost is recovered from higher yields resulting from earlier crop establishment.

Thai rice farmers are more mechanized than other Southeast Asian farmers. However many of them cannot afford mechanical power, and they do not have the resources to invest adequately in other inputs to increase their net income. How can these farmers be helped to improve their position? In the past very little has been done to improve the animal powered tools. The single beam plow with one small moldboard and a combination wood and steel harrow-leveling board are the only animal implements commonly seen throughout Thailand. The agricultural engineers that are concerned with equipment development believe that a feasable solution to the problem of the poorer farmers is to provide improved implements for animal power.

3. Utilization of Buffalo in Thailand

Buffalo are widely used in many areas of the country for farm power.

a. Primary tillage.

A farmer can plow at the rate of approximately .2 ha per day of wet paddy with his buffalo plow, using two plowings at right angles to each other. One buffalo can work effectively for a few hours at a time so rotating two buffalo on the plow through the day

provides a continuous operation. Plowing depth is to 5" which requires 80-120 kg of draught depending on the soil type. For upland plowing or paddy plowing in dry land condition with heavy clay, the pull required is more than double. Under these conditions the use of two buffalo should be considered for the single moldboard plow, unless the plowing depth is shallow.

b. Secondary tillage or harrowing.

After the plowing operation, the farmer will use his comb harrow to break up clods, produce a finely textured seedbed, and remove some trash from the soil. This tool is usually made of wood by the farmer.

c. Weeding or cultivating.

For upland row crops, the buffalo plow is a popular tool for use in inter-row weeding. In a corn field the row spacing may be 80 cm which requires several passes between adjacent rows; however it is much faster than hand weeding.

d. Threshing.

One of the traditional methods of threshing is by animal treading. It is estimated overall that 3% of Thailand's rice crop is threshed by buffalo. In local areas the usage is higher. The paddy is

placed on the threshing floor and the buffalo walk in a circle over it. Subsequently the threshed straw is raked off. The threshed grain is taken up and the chaff is removed by winnowing.

e. Transportation.

A sled or the more popular two wheel cart pulled by a buffalo is used as family transportation and for carrying farm products from the field to the shelter or market. This method of transportation is very popular outside of the mechanized central region.

4. New Developments in Animal Power Equipment.

a. Bed forming equipment.

There is a need for implements to shape beds for areas that plant usually two rows per bed such as peanut. A furrowing implement for the buffalo may be a feasable solution to this problem.

b. Seeding with traditional tools.

A few farmers have applied their experience for expanding the use of conventional tools. A seed tube has been attached to the plow for dropping seed in the furrow during the plowing operation. The comb harrow can be used with new attachments for a multiple seed furrow opener. After sowing seeds along the rows, the seed is covered by foot, or by brushing soil into the furrow.

Row seeding makes weeding easier than if the seed is broadcast. This concept is under test and has high potential for expanding the use of the buffalo.

c. Fertilizer application with a buffalo plow.

An attachment is under test for applying fertilizer in conjunction with plowing. The fertilizer is metered, dropped in the bottom of the furrow and covered by the next furrow slice. The plow capacity is decreased by about 10% for filling the hopper, which is a savings over two separate operations. Results of comparative tests with four other methods of application conclude that the plow-down deep fertilizer placement makes more efficient use of the chemical than other methods.

d. Buffalo weeder.

An attachment for replacing the plow moldboard can be mounted on the plow frame with a series of weeding shovels or blades. This will reduce the number of passes between the rows of upland crops compared to weeding with the narrower buffalo plow.

e. Alternative methods of primary tillage.

Chisel plows or other tined implements for primary tillage should be pursued as alternative to the animal plow, especially for rainfed and upland crops. Objectives in exploring other methods should be to reduce the draught required and increase the productivity of the buffalo for primary tillage.

f. Buffalo tread threshing.

Increasing the efficiency of this traditional method has not yet been tried. It is very slow because the buffalo hoof is relatively small and he must walk a long time to complete the threshing operation. Why could not an attachment for his feet be designed to provide a larger foot print and increase his efficiency as a threshing machine? If this is possible the use of the buffalo would be expanded. It could replace some of the manual beating which is hard manual labor and is used for an estimated 63% of the rice crop in Thailand.

g. Stationary power.

With present practice, most of the buffalo are not utilized full time after the tillage work is completed. In some countries, equipment has been used for stepping up the velocity of a buffalo for powering a water pump, corn sheller, winnower, etc. The buffalo walks in a circle and the stationary device is driven through a series of gears to increase the speed to an appropriate number of revolutions per minute. It is realized that the buffalo may need a rest after soil preparation, but they can be utilized for many stationary power requirements to reduce the drudgery of performing the operations manually.

h. Improved buffalo plow.

The buffalo plow continues to be used for paddy tillage by many Thai farmers, particularly in the Northeast, because they cannot afford mechanical power. The Thai-IRRI Cooperative Farm

Machinery Project undertook the objective of reducing the draught of the buffalo plow, two years ago.

A popular plow manufactured in Khon Kaen was selected as a basis for comparison. Initial tests indicated that a moldboard with a larger radius of curvature required less specific draught. Further reduction was obtained when the plow point and moldboard assembly was rotated 20° to 25° clockwise about a horizontal axis, providing a more gradual approach to the soil. The suction angle of the test plow points were reduced to 18%, from the manufacturer's 22°.

A test plow frame with provision for indexing the attitude of the plow in 5° increments from 0° to 35° was constructed. A strain gage dynamometer and continuous recording equipment were obtained for data collection. Depth was controlled at 127 mm (5") with gage wheels in upland, and with skids in paddy. Mechanical power was used for data collection because velocity was more uniform than with a buffalo. Ground speed and other parameters were controlled. The largest radius of curvature moldboard, 380 mm produced the best results of the radii tested.

Subsequently a larger power tiller moldboard with 457 mm radius of curvature was mounted on the test plow, which improved the performance further. The reduction in specific draught that was achieved was quite similar for upland and paddy conditions. Usually it was about 33% less than that for the manufacturer's plow. This generated two recommendations:

1. A new wider point and moldboard with 50% more projected area and top width than the control plow at 127 mm plow depth. The radius of curvature is 457 mm, attitude angle is 20° and the suction angle is 18° This requires approximately the same total draught in limited testing as the control plow but it will reduce the plowing time by about one third, producing a timeliness benefit.

2. A plow with projected area and top width at 127 mm plow depth comparable to the manufacturer's plow. This reduces the total draught to two thirds. It may be used with small animals, for deeper plowing, or for upland conditions.

The department of Extension at Pitsanuloke became interested in this development. A production plow frame with the two interchangeable recommended plow bottoms, was provided for use in comparative tests with a local plow. A vertical hitch adjustment was provided so they could control the depth comparable to that of their local plow, without depth gaging means. On three successive days they ran one of the plows for five hours, using the same buffalo. The plow depth was 120-130 mm in each test. The area plowed was measured each day.

	m^2	% increase
Local plow	1,980	
Recommended narrow	2,480	25
Recommended wide	3,290	66

The Pitsanuloke tests indicate an increase in productivity for the recommended narrow plow over the comparable width local plow. The lower draft requirement apparently resulted in a higher buffalo ground speed; the recommended narrow plow also had a timeliness advantage. There is a similarity between the area plowed for each moldboard in the Pitsanuloke tests and the specific draught data obtained in our tests.

The reduction in specific draught that has been obtained for the buffalo plow will benefit Thai farmers who cannot afford mechanical power. It may also have application in other countries who rely heavily on animal power.

i. Upland seeder.

There is a need for an animal powered mechanical upland seeder in Thailand, to replace the traditional method of hand seeding by dropping seeds in a row or in hills made with a hoe. When a rainfed farmer wants to grow another crop, either before or after the main rice crop, a faster method is needed to reduce the seeding time, so both crops will have more moisture to produce a higher yield. If

paddy can be seeded before the soil is flooded, a seeder can be used. However, it would have competition from hand broadcasting, which is becoming more popular.

An upland seeder has been tested and improved in Thailand over the past few years. It can be used for five rows spaced 20 cm, three rows spaced 40 cm or for two rows spaced 70-90 cm. Interchangeable seed plates are available for rice, corn, sorghum, soybeans, mung beans, peanuts or wheat. The seed drop in the row can be spaced 20,25 or 33 cm. The hopper is split so fertilizer can be applied when seeding. This machine weighs about 105 kg with empty hoppers. It can be pulled by a buffalo with the operator sitting on the hopper. However the draught requirement is about 130 kg which requires a fairly strong buffalo. The capacity is 1.2 hectares per day with one person required.

A three row 20 cm spacing version of the upland seeder was built primarily as a low cost machine for use with a buffalo for rainfed upland farmers. It will also seed two rows spaced 40 cm. It has been under test for the past two seasons by the Land Development group in the Roi Et area. Blueprints for the 5 and 3 row seeders will be available to manufacturers in the near future.

5. Local Manufacturing.

Farm equipment is produced in Thailand by over 100 firms. Some of them are family operations of 3 to 6 people with a drill press and welder as the principle shop equipment. There are a few factories with 200 employees and a

full range of machine tools. Most of them were purchased used. The larger firms are more sophisticated, as a result of assistance from ISI, with an assembly line and particular emphasis on plant layout, material flow and reduction of time for moving parts from one department to another. The result is increased efficiency and cost reduction. These larger firms may results in difficulty of smaller shops to compete, unless they sell locally with reduced transportation costs or lower labor rates. There are a few instance where a larger firm is purchasing more components rather than fabricating all of the parts. They have discovered that some items can be acquired from a specialty shop that has high volume at a lower unit cost than fabricating in their own shop.

Production of farm equipment has been generally expanding, except in case of the adverse effect of a drought on farmer income. Power tiller production is estimated at over 60,000 units per year. Small 4 wheel tractors to 20 Hp have a volume over 10,000 per year. The axial flow thresher has expanded rapidly from 135 machines in 1976 to nearly 10,000 per year at present. Buffalo plows, disk plows, water pumps, harrows, puddlers, hand sprayers and hand hoes are produced in large volume.

A cutterbar reaper is arousing an unusually high interest among farmers and manufacturers because of a labor shortage in many areas of Thailand during the harvest season. Several hundred machines have been imported and three firms built 221 units during the first six months of 1981. Some transplanters have been built, 12 row engine powered, and a few 5 row manually operated machines. Seeders and other small machines are also expected to go into production.

With country production continuing to increase, there is a significant quantity of farm machines imported. As an example, a Sukothai retailer indicated that he sells 300 power tillers built in Thailand and an equal number of imported units per year. The imported machines have a lower price, due to lower labor costs. However, some manufacturers are beginning to export to other Southeast Asian countries.

6. Popularization of Improved Implements.

In order for improved implements to benefit the country and its farmers, the machines must be in demand, and in use on farms. Farmers need to comprehend that they will benefit economically through ownership of the new model. It must reduce the time required for the operation or it should do the task better than the existing tool. A reduction in time required may result in a timeliness benefit of higher harvested yield. When an apparent demand develops, manufacturers become interested in supplying the market potential. Here again, production must benefit the company by way of a reasonable profit to the owner.

Several methods are employed to popularize improved implements among farmers and manufacturers.

a. Exhibits at machinery shows and other events for farmers and manufacturers. Personnel are provided at the exhibits to explain the merits of the new machine and to answer questions. Typically 10 or more such exhibits are held annually.

b. Field demonstrations of new machines. This is most effective in conveying the merits of new machines to interested parties. Often such activities are in conjunction with another division

of the Ministry of Agriculture and Cooperatives, or with the Department of Extension. These groups advertise the event in the particular area to attract a large number of farmers.

c. Training courses. The Agricultural Engineering Division conducts training courses for about 400 young farmers annually. Classroom, laboratory and field operation of machines are included. The farm machinery section of the department of Extension is also planning to conduct courses for farmers at various locations.

d. Department of Extension. The farm machinery development groups in the Agricultural Engineering Division are working very closely with the farm machinery section of the Department of Agricultural Extension. The collaboration is mutually beneficial. It will assist them in carrying on their extension activities throughout Thailand and will help in popularizing and promoting new developments in farm tools. Meetings are held periodically, two extension people have attended IRRI sponsored training course, their farm machinery section has assisted in test activities, and an engineer has been furnished to help the section in conducting a series of four training courses at Chainat for extension personnel.

e. Manufacturer visits. Agricultural Engineering Division personnel visit over 65 farm machinery manufacturers at least twice a year. The principle purpose of these contacts is to

inform them of new developments, and to provide technical assistance if they or their customers have problems with the firms' products.

Summary

Research and development of animal drawn implements has been more advanced in some countries in the region. More work is needed in Thailand. The Agricultural Engineering Division, with help from cooperating agencies such as IRRI and the UNDP and FAO of the United Nations are tackling the problem. Progress has been made and the work will continue to have a high priority. In spite of increasing acceptance of engine powered equipment in Thailand, the intent is to continue the development and improvement of existing and new implements for animal power.

THAI-IRRI AGRICULTURAL MACHINERY PROGRAM

Semi-Annual Report January 1 - June 30, 1982

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THAI-IRRI AGRICULTURAL MACHINERY PROGRAM

Semi-Annual Report January 1 - June 30, 1982

1. Staff

a. IRRI

The Cooperative Agricultural Machinery Program included five full time personnel from January 1 - June 30, 1982 as follows: Ray Fischer, Associate Agricultural Engineer; Kriengsak Sirichaimanus and Suwit Bunyawanichkul, Senior Research Assistants; Juthaporn Charoenpravat, Secretary; Vacharachai Pumarin, Junior Engineer; and Chalit Chuensombat, Technician.

b. Agricultural Engineering Division

Jaruwat Mongkoltanata.., Head of the Workshop and Service Section; and Chak Chakkaphak, Head of Research and Testing Section provided guidance that reflected Ministry policies and priorities, as well as valuable consultation. Prasarn Kradang-nga participated part time with project responsibility during the period. Assistance was provided by other engineers. Mr. Jaruwat and his people fabricate the components and machine required for field test. Mr. Chak provides technicians as required for testing and research activities.

2. Training

Los Banos requested candidates for the Agricultural Engineering training course for manufacturers which was held June 7-18. There are no manufacturers of IRRI designs with enough proficiency in English

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language to recommend at present. Seven firms have a manager who would likely qualify on language, and it is anticipated some of them will become manufacturers of IRRI designs in the future. Meanwhile, three candidates who are in a position to promote and expand farm mechanization were accepted for the June training course.

a. Mr. Boonsom Suwanaruk, Agricultural Engineer, Agricultural Engineering Division,
b. Mr. Charoon Komcomphunt, Agricultural Engineer, Agricultural Engineering Division,
c. Mr. Cherawat Mumkit, Agricultural Engineer, Department of Agricultural Extension, Farm Machinery Section.

Preliminary plans for a six day training course, to be given 13-18 September at the AED in Thai language, for manufacturers of IRRI designs are being made. Twenty firms who did not attend either the Thai-IRRI course in 1980 or the FAO course in 1981 will be invited. The managers who participated in 1980 suggested a longer course. The extra day will provide more time for new machines such as the reapers, additional attention to demonstrations, and non-technical subjects for improving shop operation and management.

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3. Project Activity

A. TH-8 Thresher

Sorghum was threshed very successfully with modifications to the rice machine in January, 1981. Good results were obtained in soybeans with other modifications 12-13 December, 1981. An attempt was made to thresh both crops with revised common modifications during the week of May 10 but results were not as good as in the prior mentioned tests. Therefore, different modifications for each crop, as specified in these trials, are recommended. A further revision to reduce the separation loss, comprising a perforated sheet metal bottom in the straw discharge with a deflector sheet to transfer separated grain to the cleaning sieve, is anticipated.

B. Cutterbar Reaper

1. The 1.6 m machine has been on several field tests accumulating approximately 9.6 ha in both rainfed and irrigated rice. Some structural problems have been revealed. Recently many of the retainers for the front of the ledger plates failed, allowing the plates to get disoriented. Additional testing is needed to further verify reliability.

Single 5½" x 12" rubber tires are preferred for firm, level soil conditions. For rough and moderately moist ground the tires are dualed. Cage wheels perform the best in extremely moist conditions because they provide better floatation than dual rubber tires.

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The belt drive from engine to reaper should be an important advantage because the machine can be adapted to many power tillers produced in Thailand. The Chinese reapers are driven by a PTO which requires a power tiller with this feature and substantially increases the cost of obtaining a reaper. An operator's seat and caster wheel will be provided for the IRRI reaper when time permits.

2. The 1.0 m machine was tested briefly with cage wheels in irrigated rice in May. The field was generally dry but certain areas were very wet and floatation was inadequate. The wheels were modified to improve floatation.

C. Manual Transplanter

The 5 row transplanter that has been revised for use with traditional seedlings has undergone some trials. Some vertical fins on the front of the trays and a spring loaded pressure plate behind the seedlings were intended to maintain vertical orientation of the plants. However, the pressure plate prevented seedlings from properly dropping down the steps at the front of the tray bottom that allow for pushers. The pushers have been removed and development is continuing.

D. Upland Seeder and Leveler

The three row upland seeder is with a Korat manufacturer for use and evaluation in farmer's fields.

Yield results from controlled wheat seedings in late October by the Thai-Australia-World Bank Land Development Project in the north

were received in March. The average of seedings with an Australian drill yielded 46% more than by hand broadcasting. Performance of the IRRI seeder was reported as good, but not equal to the Australian machine. Their intent was to use the IRRI seeder in rice in June. Use of the Thai-IRRI land leveler increased the yield by 47% compared to unleveled but otherwise similarly treated plots.

E. Cyclone Seeder

Yield results and plant population at harvest for the cyclone seeder were comparable to hand broadcasting, using pregerminated seed in the Bangkhen Rice Station trial. A pregerminated application was made at Huntra in May for comparison with hand broadcasting in a seed multiplication paddy. Blueprints were recently given to ten firms.

A belt drive unit is being developed. Although this appears to be a cost penalty, it may appeal to small upcountry shops with no source for the gears used in the original design.

F. Paddy Seeder

The light weight paddy seeder with six rows spaced at 20 cm weighs 14 kg with empty hoppers and requires approximately 10 kg of pull with full hoppers. Four different cell sizes, based on the IRRI metering roller design, provide a range of about 50 to 95 kg of seed per hectare. They have been tested by pulling the seeder over greased paper. The paddy seeder produced a yield 79% higher than that for hand broadcasting in the Bangkhen Rice Station trial. Plant population at harvest were similar. The intent is to conduct a similar comparison

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this year. Blueprints were issued to three manufacturers.

G. Buffalo Plow

The first impression of many farmers and manufacturers is that the recommended wide paddy moldboard is too large. Plows were loaned to four firms in the northeastern region prior to the plowing season. They were requested to let farmers use them and to get their reaction.

A preseason demonstration was held in Si Saket province in May. Approximately forty farmers attended and some of them had an opportnity to use the plow. Their reaction was generally favorable. The plow was left with a Thai volunteer who will arrange for use by farmers. Demonstrations are important in transferring technology. Assistance is anticipated because the Agricultural Engineering Division is fabricating 20 plows for farmer use and evaluation. The Department of Agricultural Extension already has 5 each of the recommended wide and narrow moldboards in the provinces.

An IRRI engineer traveled the northeast during the week of June 14 to contact manufacturers. Of the four firms who had a prototype plow, two of the managers did not want to keep it and were not interested in arranging a field demonstration. These plows were taken back. Another manager took the prototype to the field and he requested and received another improved plow for use by the farmers in his area. A Khon Kaen manufacturer of plows with cast moldboards has produced 3 wide and 5 narrow moldboards which should soon be used in field trials.

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Six plow firms have had a prototype unit to date. One in the north has discontinued production of buffalo plows and is no longer interested. Two companies in the northeast and one in the north may develop favorably by the 1983 plowing season.

H. Plow Sole Fertilizer Attachment

One interested manufacturer has blueprints for the fertilizer attachment. It should become popular when farmers apply nutrients at planting time as well as during the growing season.

I. Four Wheel Drive Tractor

Initial brief trials indicate the tractor should be pursued further. It has been dormant for about four months; hopefully the project can be resumed in the near future.

J. Power Tiller

In anticipation of an operator's seat for use with the reaper, a reverse drive for the PT-3 has been released for fabricating a prototype. It consists of an additional belt with 180° twist. The driven pulley rotates freely on the power tiller shaft. To back up, the forward drive belt clutch pulley will be disengaged and a jaw clutch will engage the reverse driven pulley with the keyed forward driven pulley.

K. Two Ton Batch Dryer

This unit was used for drying 4 tons of paddy by the Department of Agricultureal Extension in the Suphanburi area. Performance was reported as satisfactory. It is currently being used by a Minburi

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farmer for his irrigated crop harvest. Interest is increasing among farmers whose crop is threshed during the rainy season.

4. Survey of Manufacturers

A total of 71 farm machinery producers were contacted during the period. Their responses indicate that employment has decreased by 12% in six months. One of the firms reported that non-farm equipment work has been taken on to help utilize excess capacity. A significantly lower price received by farmers for paddy has reduced the market demand for machinery. Axial flow thresher, Thai tractor and power tiller production are down from 9 to 19% compared to a year ago, based on unofficial volume estimates.

Some additional data on the labor required to fabricate and assemble one power tiller was obtained. A total of seven firms have quoted a range from 2.4 to 4 man days per machine. The variance reflects production volume, number of purchased components, selling sprockets and gears to other firms, and whether steering clutches are provided. A manager who has been active in the Tractor Manufacturer's Association indicated that 60,000 power tillers were produced in Thailand in 1981. Use of the man-power guidelines totaled 59,700 machines which suggests that the power tiller guidelines are reliable. Additional guideline data for Thai tractors and threshers was not revealed during the June visits.

5. Manufacturers of IRRI Designs

A total of 11 firm managers signed the memorandum of agreement during this six month period. Blueprints were issued to interested shops as follows :

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Design	# Shops
Thresher, TH-8	5
Thresher, TH-7	4
Cyclone Seeder	10 (a)
Paddy Seeder	3 (a)
Upland Hand Weeder	3 (a)
Upland Seeder	2
Batch Dryer, 2 Ton	2
Transplanter, TR-1	1
Grain Cleaner	1 (a)
Improved Buffalo Plow	1

(a) First release of machine.

Designs available from the Thai-IRRI cooperative project were built by 24 firms. Two of them produced their first thresher prototypes. A Khon Kaen manufacturer has built eight improved buffalo plow moldboard assemblies for use by farmers and for market evaluation.

Region and Company	Built		
	AFT	Ext. Wheel	Plow
Metro Bangkok			
Pramual Kolakij	x		
Thai Seng Yont	x		
Yontrakumpanich	x		
Other Central Region			
Banpong Utsahakum		x	
Jakkawan Tractor	x		
Jongpradit	x		
Sahakarnyont	x		
Sompis Karnchang	x		
Ubol Posit	x		
Yontpradit	x		
North			
Kaset Pattana	x		
Kunasin	x		
Lim Chieng Seng	(a)		
Uppakorn Kaset	(a)		

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Region and Company	Built AFT	Ext. Wheel	Plow
Northeast			
Chan Thai Lek			(a)
Chor Karnchang	x		
Settakit Karnchang	x		
East			
Chinnadit	x		
Chit Panich	x		
J. Chaidee Panich	x		
Kaset Pattana	x		
Roongroj	x		
Talay Thong	x		
South			
Paisal Karnchang	x		
Total firms	22	1	1

(a) First production.

6. Machinery Exhibits

The cooperative project exhibited several machines at each of the following locations :

a. National Exhibition, Tha Pra, February 11 - 15

b. Suphanburi, March 1

c. Kasetsart University, April 3 - 9

d. National Exhibition, Chieng Mai, April 10 - 14.

7. Translation of Machinery Information

ASAE Engineering Practice EP-389, Auger Flight Design Considerations, was translated to Thai and distributed to thresher manufacturers in December, 1981. Information for manufacturers covering the operation and adjust-

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ment of four machines has been translated to Thai, and distributed to appropriate firms as follows :

a. Improved Buffalo Plow - 3 pages

b. Cyclone Seeder - 2 pages

c. Upland Seeder - 3 pages

d. Transplanter Operation and Seedling Cultur (1981) - 14 pages.

Copies of translations were furnished to the Ag ultural Engineering Departments at Mae Jo Institute of Agricul .l Technology; Kasetsart, Khon Kaen, Chieng Mai, and Prince of Songkl iversities. This information may be helpful in the instructional/e sion programs at these locations. The mailings included :

a. ASAE standard S-211.3, V-belt Drives for Agr ltural Machines

b. ASAE standard S-320, Category "O" Three-Poin ree-Link Attachment for Hitching Implements to Lawn Garden Riding Tractors upto 20 Hp.

c. ASAE Engineering Practice EP-389, covering rs

d. Introduction to Farm Machinery

e. Dryer

f. Transplanter Operation and Seedling Culture

g. Upland Seeder

h. Improved Buffalo Plow

i. IRRI literature on Transplanter, Seeder, Fertilizer Applicator, Thresher, Diaphragm Pump, 2 Ton Dryer, 5-7 Hp Power Tiller, and Extendable Lug Wheel. (English).

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8. Presentation at Meetings

a. Thai-IRRI Cooperative Project in Farm Machinery -- R.C. Fischer. Presented at Department of Agriculture Seminar, at Bangkhen on April 26, 1982

b. Farm Machinery Development in Thailand -- R.C. Fischer. Presented at the 75th annual meeting of the American Society of Agricultural Engineers, at the University of Wisconsin - Madison on June 29, 1982.

Estimated Farm Machinery Production in Thailand

January 1 - June 30, 1982

REGION	MFGR CALLS	IRRI DESIGN			OTHER			
		AFT	PLOW	L.WHEEL	POWER TILLER	THAI TRACTOR	C'BAR REAPER	12 ROW TRANSP.
Metro Bangkok	7	1,130			9,275			
Other Central	20	468		7	6,010	4,290	150(1.0 m)	
Total Central	27	1,598		7	15,285	4,290	150	
North	19	388			1,150	240		3
Northeast	11	52	8					
East	8	2,225			11,940		30(1.6 m)	
South	6	2			20			
Total	71	4,265	8	7	28,395	4,530	180	3
Change, 12 mos.		-9			-19	-17		

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Dr. Beachop

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Meeting of Engineering Personnel

Aug. 11, '82 - Bangkok

Attendees: AED - Khun Chak, Jaruwat, Supasit

FAO - Messrs. Howson, Toet

IRRI - KS, SB, VP, RCF

FAO-UNDP Project

1. The three universities that are involved in testing were visited recently. The plow from Pakistan looks quite good and a few models of a scaled-down version will be fabricated. It is a western style moldboard with a 6" wide share. A replaceable share and moldboard are incorporated along with a special quick mounting to the Thai buffalo plow frame which requires only one bolt.

2. Thirteen manufacturer trainees recently attended a 5 day training course in blueprint reading. The course was given at I.S.I.

3. A small rice head thresher from the Republic of Korea has been tested at Chieng Mai University. The unthreshed loss was initially 10% because all the pannicles did not get into the machine. A revision reduced the loss to 4% but at the expense of increasing blockages in the unthreshed heads return auger.

4. Six weeding devices have been tested and evaluated by a performance index number. An Indian hand pushed weeder had a rating of 600, whereas the next best weeder was 167.

5. Upland tillage tests will resume at AIT during the week of August 23. Six primary tillage, 6 secondary tillage, 3 seeder, and 3 weeder tests will be run.

6. A super granule applicator from Holland is being readied for tests, to be conducted by the Rice Division. It has an oscillatory granule metering device and an air pump which forces the pellet into the mud and which prevents plugging of the tube.

A.E.D. Activities

1. Rainfed Project. Work has been conducted at the stations in the four provinces involved, principally for familiarization of personnel and for their own information. Most of the testing will be done in farmer's fields. Successful demonstrations have been conducted on the jab planter and the 3-4 row seeder development to date. Additional planters are to be fabricated.

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2. Policy and strategy statements concerning mechanization strategy are being revised for a National Agricultural Machinery Committee Meeting on August 18.

3. The importation of power tillers with steering clutches, and small used 4 wheel tractor has been presented by the Agricultural Machinery Branch of the Thai Industrial Association. It is anticipated that this will result in a revision of import duties on these items. Two other types of power tillers are not a problem. Thai tillers without clutches are not imported and higher priced imports with several speeds are not produced locally.

4. A two day machinery program is being planned for the Northern Agricultural Center, Cheing Mai. The program will include a farm machinery exhibit, seminar, and demonstrations. All cooperating projects should participate in this event.

5. The AED proposes to budget for a manufacturer's training course in 1984. Assuming Thai-IRRI also has a course that year, coordination to avoid a time conflict is required. However, the course content will be directed to manufacturing engineering which will not conflict with the 1980 and 1982 IRRI or 1981 FAO courses which are principally concerned with product design and function.

Thai-IRRI Cooperative Project

1. Manual transplanter for root washed seedlings. Performance has been improved with a brush underneath the slot for removing seedlings but additional work is required to obtain acceptability.

2. Paddy Seeder. A Nonthaburi farmer used the seeder for 5.6 ha (35 rai). He has a good stand and is pleased with the machine performanc He reported a capacity of 1 3/4 ha (10-12 rai) per day for the 6-20 cm row spacing machine. Blueprints have been furnished to 3 firms. Material is ordered for fabricating 3 additional machines.

3. AFT. Drawings are being prepared for release of recommended modifications to interested manufacturers for threshing soybeans and sorghum.

4. Reaper, 1.6 m. Drawing modifications are underway, prior to releasing to several interested manufacturers.

5. Reaper, 1.0 m and PT-5. Questions of adequate floation and engine power in wet, irrigated fields require resolution. It was anticipated that these machines would be released after the 1.6 m unit. However, two manufacturers called on successive days and indicated they wanted to start on the 1.0 m reaper during their upcoming off season. It was then decided to release now. Blueprints of Los Banos sepias are with five firms who specified interest in the small reaper.

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Twenty two additional factory managers are being contacted to determine which size of reaper they wish to pursue. Improved cage wheels will be released as soon as they are verified in field tests.

6. Cyclone seeder. The Huntra seeding comparison of May 27 was observed two months later. There was no visual difference between hand broadcast and cyclone seeded plots at that time. The belt-drive option for the cyclone seeder is released to manufacturers.

7. Four wheel drive tractor. The 7 Hp B&S engines have been sent out for servicing and governer repair, to aid in maintaining comparable speeds. Evaluation will resume after installation of the automotive steering gear.

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11/8/1982

THAI-IRRI ACTIVE PROJECT STATUS

	Project	Priority	Engineer	Development Start	Development Finish	Remarks
1.	Reaper, 1.6 m	1	Suwit	Jul. 81	Sept. 82	Test program on 14 ha. is completed. To be released to manufacturers in September.
2.	Reaper, 1 m	1	Suwit	Mar. 82	Mar. 83	Blueprints released to 5 firms. Improvement of floation in wet fields will continue.
3.	Manual Transplanter (Root washed seedlings)	1	Kriengsak	Aug. 81	Nov. 82	Performance in lab tests has improved.
4.	Cyclone Seeder (manual)	2	Vacharachai	May 81	Jun. 82	Belt drive option is released to manufacturers.
5.	TH-8 Thresher	2	Kriengsak	-	Aug. 82	Decision to release modifications for soybeans and sorghum.
6.	Power Tiller, PT-3	2	Suwit	Apr. 82	Jan. 83	Design of caster wheel and operator's seat has begun.
7.	4 Wheel Tractor	1	Vacharachai		1984	Work has resumed. Steering modification being made.
8.	Buffalo Plow Weeding Attachment	2	Vacharachai	-	Mar. 83	An attachment to replace the plow moldboard comprising 2 sweeps for 25 cm row spacing or 3 sweeps for wider spacings has had limited test.

RCF:jc

CWB

TEST REPORT

July 19, 1982

Written by: S.B.

Test title: Field test of 1 m rice reaper

Test date: July 15-16, 1982

Test place: Suphanburi Rice Experiment Station, Suphanburi

Introduction

The test was conducted in the station field with RD23 variety. The crop was broadcast and was about a week under maturity. The crop was very dense, not lodge, and was 1.3 m high. The field surface was very rough and the soil was very dry. The 1 m reaper was mounted on the IRRI PT-5 with a 3 Hp B&S gasoline engine. Cutting height of the reaper could by adjusted by changing the hitching points between the reaper and the PT-5 and the skid relatively needed to be adjusted.

Procedure

A rectangular shape of 60 x 100 m^2 field was measured from a full size of 80 x 100 m^2 field. Performance data of the machine was taken from this field. A headland at the ends, 2 m and 3 m width, was used for this test. The skid was removed because of the rough field to provide a standing stubble to support the cut paddy. Some hand tools were put into the tool box which was added at the rear to assist in balancing the reaper weight. The machine was equipped with a set of 5 1/2" x 12" single rubber tire with a wheel tread of 21 5/8" (55 cm). Some data was collected as shown below.

Testing Data

Cutting height	: 30 cm
Effective width of cut	: 1.00 m
Traveling time over 96 m	: 87.7 sec.
Machine ground speed	: 3.94 km/hr (1.09 m/sec)

Testing Problems and Observation

1. The engine killed frequently when operating at about 2.5 km/hr ground speed. It occasionally killed with the engine throttle wide open, or about 3.9 km/hr. This may be because of the engine not performing satisfactorily, or too small an engine for the heavy crop condition. The engine performance should be evaluated and corrected or a larger engine should be taken along for the next test.

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2. A 2-m width of the head land seemed to be not enough for turning. A 3-m width was tried and it provided better cutting at corners and easier to turn.

3. Cutting the crop was satisfactory but the butt end of the windrow was uneven compared to the 1.6 m machine performance. This was probably due to the rough field and to the high machine speed which tended to back feed.

4. The roller chain connecting link required replacement. Since no interchangeable link was available a new chain was installed.

5. The total area harvested by the 1 m reaper for this test was 8 rais (1.28 ha)

cc: MRV
CWB
BRJ
MLN
RCP
JM
SK

Thailand Industrial Extension Project

Progress Report for USAID

Mar. 1, 1982 to Aug. 31, 1982

General

The demand for machinery for the rice farmer has declined in this period relative to a year earlier, principally because of a substantially lower price paid to farmers for rice. This has resulted in reduced machine production schedules, which can be expected to continue until the problem of farm income improves. The demand may be adversely affected further by a drouth throughout the northeastern region. Firms with under-utilized manufacturing capacity are encouraged to select one or more new products for manufacture. A greater interest exists than formerly; however, they have some reluctance to proceed with a new product, not knowing the market potential under the depressed economic condition of the farmer.

Two shops initiated production of the improved buffalo plow in the second fiscal year of the present contract. Six other firms started their first production of axial flow thresher; three of them each produced a prototype of the TH-7 or TH-8 from blueprints. Another firm produced a new model about the size of the TH-7 with wheels; however he has built axial flow threshers for some time. The recent first releases of blueprints for the paddy seeder, cyclone seeder, and 1.0 m reaper to 3, 9 and 5 interested firms, respectively, should see manufacturing activity in the third fiscal year.

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The farm machinery development activities in the IRRI semi-annual report through June 30, 1982 is quite comprehensive and remains current. Training, extension, translations and manufacturer information in the IRRI report also are current.

AED Engineering Participation

One AED engineer was active on a part time basis during this period, until July 1 when he entered the monkhood for four months. A June graduate in Agricultural Engineering from Kasetsart University was assigned full time to the Thai-IRRI project on July 23. He will be assisting a senior research engineer on project development and test activities.

Equipment Demonstrations

	Central	North	N.E.
Buffalo Plow			2
Reaper, 1.6 m	1	1	
Reaper, 1.0 m	1		
Cyclone Seeder	1		
Paddy Seeder	1		

First Production (2nd fiscal year)

Improved Buffalo Plow

	Units
Chan Thai Lek, Khon Kaen	8
Khun Mee, Si Saket	15
	23

Axial Flow Thresher

	Units
Samakki, Bangkok	25
Sompis Karnchang Lopburi	21
Uppakorn Kaset Nakhon Sawan	2
(Cylinder, 1 m long) Thunyawisawakum Suphanburi	30
TH-8 Nanaphan, Ayudhaya	1
TH-7 Lim Chieng Seng Nakhon Sawan	1
Khun Suwet, Pattani	1
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Work Plan Targets and developments completed in the second fiscal year of the present contract.

1. Paddy Seeder. After completion of the test and development phase, blueprints of the manually operated machine for pre-germinated seed were released to three interested firms.
2. IRRI Inclined Plate Planter - 2 row. A limited test program has been finalized. No interested manufacturers have been found to date for this upland planter for rice and other crops.
3. Cyclone Seeder. Drawings were made after limited testing of this manually operated broadcast seeder with gear drive. It may be used with dry seed in upland or with pregerminated seed in paddy. Blue-

prints have been given to nine interested company managers. An Alternate belt drive design for manufacturers who may not have a source for gears has also been designed and released.

4. IRRI Reaper, 1.6 m. After mounting on the PT-3 power tiller, a test program encompassing 14 ha. was completed. It has been decided to release to manufacturers and blueprints will be furnished to over twenty firms in September, 1982.
5. IRRI Reaper, 1.0 m and PT-5 Power tiller. Blueprints for these machines were released to five manufacturers in August, 1982.

Work Plan Target Update, for completi n during the third fiscal year (ending August 31, 1983).

1. Reverse drive caster wheel and operator seat for PT-3 power tiller. These features are considered to be important in Thailand for use with the 1.6 m reaper and other applications. This package is targeted for release by August, 1983.
2. Four wheel drive tractor. This development is periodically dormant for long periods because of

other urgent work. The objective is to complete the feasability phase in year 3. If positive, it should be finalized during year 4.

3. Transplanter, manual 5 row for root washed seedlings. Development and test to be completed and released to manufacturers.

4. Axial flow thresher. Design of a perforated sheet in the straw discharge, to reduce the separation loss in soybeans, is targeted for completion of tests in soybeans, rice and other crops. Threshing mung beans is also anticipated.

5. Weeding attachment for buffalo plow frame.

Concerns

1. Long term continuity of machinery project.

   a. An objective of the Thai-IRRI project is to provide training for AED engineers through their participation in the work, in order to provide continuity. The increased activity in another machinery project and a ministry comitment to supply engineers to it has created a problem for the AED to assign more engineers to the Thai-IRRI project. Participation declined to one part-time AED engineer during the first half of 1982 and he took temporary leave on July 1 to enter a temple. On his return, it has been stated that he will rejoin the project on a full-time basis. Three Kasetsart University

recipients of BS degrees in agricultural engineering in July, 1982 joined the AED recently. One of them was assigned full time to the Thai-IRRI project on July 27. This development is a welcome improvement in AED engineer participation in the project.

b. A more positive assurance of long term continuity may be obtained by maximizing the number of machines in the project that get into production. The axial flow paddy thresher is well established and accepted in Thailand. Even though assistance and suggestions continue to be transferred to manufacturers, production is expected to continue to expand, until a better thresher concept surfaces or until small combines are adapted, irrespective of the cooperative project.

A principle objective of the project is to have several additional machines in a similar position of acceptance. Although they will not have been in production by Sept. 1, 1985 as long as the thresher now has been, many of them should be well enough established that they will enjoy an increasing demand. The manufacturers should be able to develop them further on their own if this is necessary. Accomplishment of this objective should assure long term benefits from the project for Thailand.

2. Promotion and extension.

It is realized that, after completion of the local test and development phase of a machine, the activity cannot be

considered to be a success until it has been accepted by manufacturers and farmers. Some machines will be received with less extension activity than others.

A specific problem, cited as an example in this regard, is the recommended wide paddy moldboard for the buffalo plow. In two instances, manufacturers appeared receptive when a prototype was left with them. Farmers who called at their shops could not comprehend that a moldboard 50% wider than a conventional moldboard will not require considerably more pulling force. Based on the farmer comments, these manufacturers lost all interest and were unwilling to take it to the field for a demonstration during the next visit. In two other instances a demonstration was generally successful in turning the negative farmer reaction around. The suggests that demonstrations are necessary and important promotional activities for certain machines.

A full load of developmental work for present personnel remains for another year on projects that are not yet completed, even though a number of them were finalized during year 2. Assistance from others in promotional activities at the farmer level is off to a slower start than was anticipated but it should improve over time. The farm machinery section of the Department of Agricultural Extension is the logical body to carry this load. Others who have expressed an interest in assisting with certain machines are the Agricultural Engineering Division, experiment stations, volunteer groups and a rainfed project.

Meanwhile, increased emphasis on promotional activities is an objective for cooperative project personnel.

IRRI-DESIGNED SMALL-SCALE AGRICULTURAL MACHINES IN BURMA

Prior to 1980 the only IRRI-designed machine in Burma was the axial flow threshing machine. About 60 units had been built at the Base Workshop of the Agricultural Mechanization Department (AMD). In 1980 the model in production was discontinued and replaced by a better current model, the TH7. By late 1982 about 90 TH7 units will have been built.

Although not yet in production in Burma a TH8 model of greater capacity than the TH7 was introduced and used in conjunction with the IRRI-designed small grain cleaner at the Applied Research Division's research farm at Gyogon. The 1981 paddy harvest of about 100 tonnes was threshed and cleaned in 20 working days compared to the 3 to 4 months normally required by animal and hand operations.

In early 1980 the IRRI-designed manually operated rice transplanter (TR1) was introduced to Burma. About 30 units were built at AMD for the 1980 transplanting season. The Extension Division of Agriculture Corporation trained about 170 operators and planted about 160 hectares in 1980. For the 1981 transplanting season 289 units were used to transplant 3243 ha and train 525 personnel. Over 300 000 hills per hectare were achieved and the average yield of paddy was 4.6 t/ha. It was reported that one TR1 unit was equivalent to six hand transplanters. An effective field capacity of 0.20 to 0.25 hectares per machine-day is achieved using 2 units and 3 operators. It is planned to use about 1500 units to transplant over 6000 ha in 1982.

In 1981 the reaperwindrower (RW1) was introduced from IRRI. The 1.6 m wide unit was adapted to a locally produced power tiller. By the end of the 1981 harvesting season 7 units had been built at AMD but only 1 unit had limited testing. More extensive demonstration and testing is planned for 1982. In addition a light weight 3 hp unit cutting only a 1 m wide swath will be tested.

Other IRRI-designed small-scale machines that should be of use in Burma include paddy dryers, fertilizer applicators, hand weeders and the rolling injector planter for postmonsoon crops after rice. IRRI-designed machines have already contributed to greater labor productivity but much remains to be done in Burma.

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EXPERIENCE IN BURMA WITH THE IRRI-DESIGNED MANUALLY OPERATED RICE TRANSPLANTER

by

J. S. Townsend and Mya Than[1/]

The IRRI-designed manually operated rice transplanter (TR1) was introduced to Burma in February, 1980. A prototype unit, built in the Agricultural Engineering Department at the International Rice Research Institute (IRRI) in the Philippines, was shipped to the Cooperative-IRRI-Burma Project (CIBP) in Rangoon, Burma. The introduction of the mechanical transplanter had the strong support of the Ministry of Agriculture through the Deputy Minister of Agriculture, U Kyaw Htain, and through the former Director-General of the Agricultural Mechanization Department (AMD), Lt. Col. Hlaing Myint, and the present Director-General, U Myint Maung.

The prototype unit was successfully demonstrated on 80 02 22 using dapg grown seedlings which were available. Six additional TR1 units were ordered for further demonstration and testing. The transplanters were built at the No. 1 Base Workshop of AMD using locally available materials as much as possible. The initial order was quickly followed by an order for 30 additional units to be delivered in time for the 1980 transplanting season. Technicians at AMD made any required modifications for Burmese conditions. At the same time training was given in the proper procedures for growing seedlings in the double frame method.

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The next successful demonstration was completed 80 05 23 on the Central Farm at Hmawbi. Twenty-five TR1 units, built in Burma at AMD, were demonstrated to 72 township managers. Many of the observers joined the demonstration in a "hands on" test. An order for 100 more TR1 units was subsequently received. The units were to be built and delivered for testing in 1980.

The transplanters were used in 23 townships across all 14 states and divisions for demonstration purposes in June, July and August in 1980. A total of 169 personnel from the Agricultural Corporation's Extension Division were trained in the use of the transplanter. About 160 ha of paddy were transplanted by the TR1 units and grown to maturity. Limited field data indicated that the effective field capacity of the units was about 0.25 ha/machine-day. This capacity was stated as being a gain of about 3 over the productivity of hand transplanting.

At the start of the 1980 transplanting season an additional 200 units had been built and delivered by AMD. Total production had reached 336 units. Altogether 289 units were used to transplant 3243 ha of rice in 1981. Again, all of 14 states and divisions had some area transplanted using the TR1 units. Seven training courses in seedling preparation and machine operation were held with a total of 525 personnel participating. By 1982 the double frame technique for growing seedlings has been modified to a "Burmese narrow bed" method where no frames are used except for a light bamboo side frame. The raised bed width is about 30 cm wide and a double handled knife is used to slice out the seedlings mats.