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MAF-IRRI PROGRAM FOR SMALL FARM EQUIPMENT

FINAL REPORT

(Period: 1 September 1980 through 30 September 1986)

Extension of Small Scale Agricultural Equipment
Cooperative Agreement No. AID 492-CA-1707
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FOREWORD

In 1980, the International Rice Research Institute (IRRI) received a grant from AID/Washington to establish agricultural equipment extension projects in four countries: Indonesia, India, Thailand, and the Philippines. The present report covers the project carried out in the Philippines under the name: "MAF-IRRI Program for Small Farm Equipment".

The first section of this report is an Executive Summary which provides a brief description of the organization and accomplishments of the MAF-IRRI Program. This is followed by a more detailed report plus annexes.

The MAF-IRRI Program was evaluated by USAID/Manila in 1984 and 1986 (see Annex D). In response to the request of the Philippine Ministry of Agriculture and Food (MAF), USAID/Manila has provided IRRI with a grant for continuing the MAF-IRRI Program for an additional 10 months (1 October 1986 - 31 July 1987). Annex C provides a copy of the proposal for this continuation.

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EXECUTIVE SUMMARY

MAF-IRRI PROGRAM ON SMALL FARM EQUIPMENT

I. INTRODUCTION

In developing countries, one of the main factors limiting the productivity of small farms is the lack of appropriate agricultural equipment. For example, pumps and minimum tillage planters are needed to increase cropping intensity in rainfed areas; weeder/cultivators to improve weed control; threshers, shellers, and dryers to reduce crop losses. However, a common problem is: (i) Imported equipment is often inappropriate because it is too expensive, large, heavy, or difficult to repair. (ii) Locally-produced equipment is generally scarce and/or primitive because local manufacturers lack capital, personnel and technology for equipment development. Moreover, progressive manufacturers generally focus on the needs of larger farms, ignoring small farms.

In response to this problem, the MAF-IRRI Program was created in 1981 to help small-scale industries in the Philippines to design and manufacture appropriate small-farm equipment, thereby achieving: (i) low costs of production and marketing; (ii) modification of designs to meet local conditions and farmers' preferences; (iii) utilization of indigenous materials and fabrication methods; (iv) availability of spare parts and repair; (v) employment generation through labor-intensive manufacturing methods.

The Program is a collaborative effort of the Philippine Ministry of Agriculture and Food (MAF) and the International Rice Research Institute (IRRI) with funds provided by the US Agency for International Development (USAID).

II. METHODOLOGY

As indicated in Figure 1, successful development of small-farm equipment requires close collaboration between the consumer (FARMER), private industry (MANUFACTURER), government (MAF), and modern science and technology (IRRI). Attainment of this partnership has been the major achievement of the MAF-IRRI Program, as illustrated in the case studies in Section III.

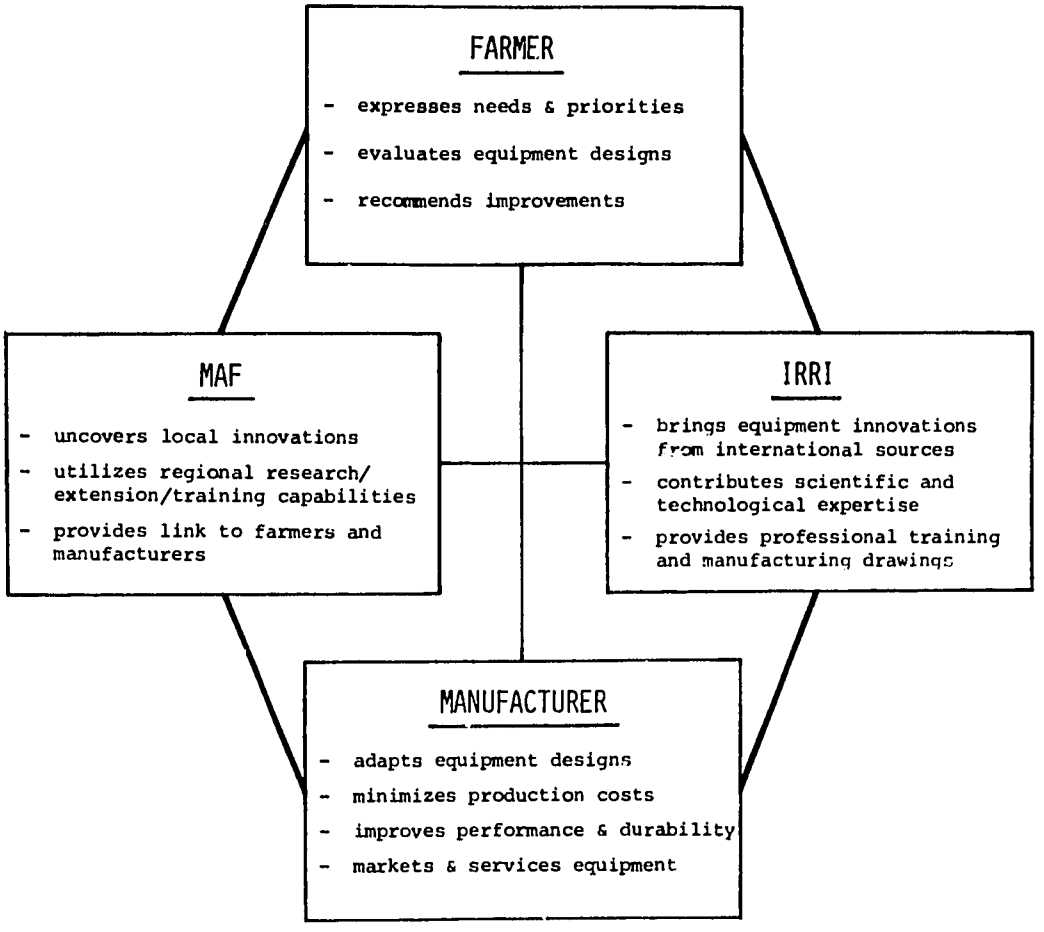


Figure 1. Collaborative relationships of the MAF-IRRI Program for Small Farm Equipment.

The Program has been designed to utilize existing government personnel and infrastructure, thereby reducing cost and increasing efficiency. The principal participants are: (i) Engineering Division, MAF Bureau of Plant Industry, Manila, for overall coordination of R&D and extension; (ii) Regional engineers (one in each of the 12 MAF

Regions), who provide direct contact with manufacturers and farmers; (iii) Other institutions, such as the Small Business Advisory Centers (SBAC) of Ministry of Trade and Industry; the National Irrigation Administration (NIA); the National Food Authority (NFA); the Agricultural Mechanization Development Program (AMDP).

The Program has established the on-going process of research, development, and extension shown in Figure 2. The process begins and ends with the FARMER.

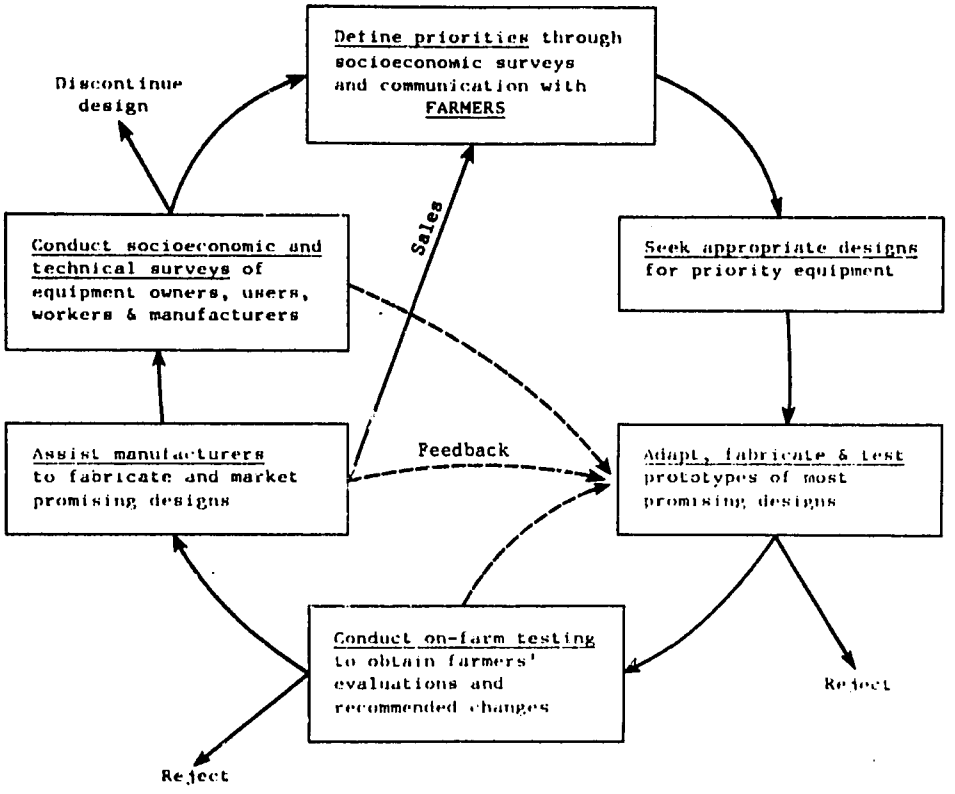


Figure 2. Research/development/extension process of the MAF-IRRI Program

One of the most effective extension activities is the loaning of prototype units of MAF-IRRI equipment to interested manufacturers. Since the majority of the Program's manufacturers are not able to fabricate new designs solely from the engineering drawings, prototypes are essential aids.

III. CASE STUDIES

The Program's most important achievement is the development of synergistic efforts which combine: (i) the high-level science and technology of IRRI; (ii) the regional R&D and extension capabilities of MAF; and (iii) the practical "know-how" and innovations of exceptional manufacturers and farmers. This participatory approach has resulted in substantial advances, as illustrated by the following examples:

1. Tapak-tapak Pump

In 1981 the Program organized a workshop for the purpose of bringing together farmers, manufacturers, and technicians to determine priorities for equipment R&D. An IRRI economist was invited to present a paper proposing equipment priorities on the basis of results of an on-going IRRI study of the principal constraints to increasing rice production in the Philippines. One of his proposed priorities was low-cost irrigation pumps, and the Program began to search for appropriate designs. The most promising design was the twin treadle pump developed by the Rangpur Dinajpur Rehabilitation Service (RDRS) in Bangladesh. The IRRI Liaison Engineer visited the pump project in Bangladesh and arranged for an experienced RDRS engineer to stop over in the Philippines to give a 7-day training course to MAF-IRRI engineers. The resulting "Tapak-tapak pump" has been tested and modified by these engineers, and it is now being promoted with good acceptance by farmers in parts of Northwestern Luzon. It is particularly appropriate in rainfed areas where farmers grow vegetables during the dry season after harvesting the wet-season rice crop.

2. Thresher/Sheller

Government officials informed the Program that the national program for increasing production of yellow corn was being hindered by insufficient availability of corn shellers. Consequently, the Program tried to modify the IRRI-designed axial-flow paddy thresher so that it could also be used to shell corn. The axial-flow thresher is popular in many areas of the Philippines where it is fabricated by local manufacturers, many of whom are cooperating members in the Program. The modification was developed by MAF-IRRI engineers with the collaboration of a cooperating manufacturer who is an experienced fabricator of axial-flow threshers. The resulting modification is outstanding due to its low cost (about US$75 additional cost), high capacity (up to 5 tons/hour), and grain purity (99%). The design has been disseminated to the Program's cooperating manufacturers, and over ten have established commercial production of the thresher/sheller.

3. Sipa Pump

For low-lift irrigation, the IRRI-designed axial-flow propeller pump is far more economical than centrifugal pumps which are commonly

used in the Philippines. MAF-IRRI engineers found that farmers did not accept the axial-flow pump, primarily because of its high initial price. The Program staff searched for ways to reduce the price, and the major breakthrough was in discovering how innovative farmers and manufacturers in Camarines Sur have substituted low-cost local materials for several metal parts of the axial-flow pump. By combining these indigenous innovations with IRRI's high-efficiency propeller based on modern technology, the Program developed the Sipa pump which is about 1/3 the price of the original axial-flow pump. Initial sales are very strong, both for rice farmers and prawn producers.

4. Hydro-Tiller

Filipino inventors have successfully developed and marketed a floating rototiller for tillage of waterlogged rice fields where the mud is too deep for the conventional power tiller or carabao. At the request of the Liaison Engineer, IRRI carried out a technical and economic study which found that this tiller can substantially reduce land preparation costs and turnaround times, even in fields having normal soil and water conditions. However, existing designs generally have two problems: (i) the tiller's belly leaves a furrow which is difficult to level and also reduces the rate of decomposition of stubble, straw and weeds; and (ii) tiller operators complain that strenuous effort is required to control the forward speed and to maneuver turns. Arrangements were made for IRRI and MAF engineers to collaborate with cooperating manufacturers to develop the hydro-tiller which reduces both problems by utilizing two pontoons having V-shaped bows and flat bottoms. A current project is the development of a multi-purpose ("transformer") tiller which serves both as a conventional tiller as well as a hydro-tiller.

These four cases illustrate different ways in which MAF and IRRI have worked together to achieve practical results which most likely would not have been attained by either institution without the collaboration of the other. As indicated in cases 2, 3 and 4, the collaboration of innovative manufacturers and farmers was an essential element.

IV. BRIEF SUMMARY OF RESULTS

1. MAF Staff:

a) 25 attended IRRI training
b) 19 currently participating in Program
c) collaboration with four farming systems projects

2. Manufacturers:

a) 200+ have joined Program
b) Located throughout country -- from Aparri to Zamboanga (Figure 3)
c) Requested and received:

(i) 580 blueprints of MAF-IRRI equipment; (ii) 150 short-term loans of MAF-IRRI prototype equipment for testing and copying.

d) Received 1,800 technical assistance visits
e) Participated in 3 training courses and 4 workshops
f) 1985 sales of MAF-IRRI equipment (survey of 70 manufacturers):

(i) 350 pumps; (ii) 150 seeders & planters; (iii) 1,600 threshers & shellers.

This is only the beginning. Sales are increasing rapidly in spite of depressed economic conditions in the country. Moreover, innovations by cooperating manufacturers have increased due to motivation and experience gained through Program.

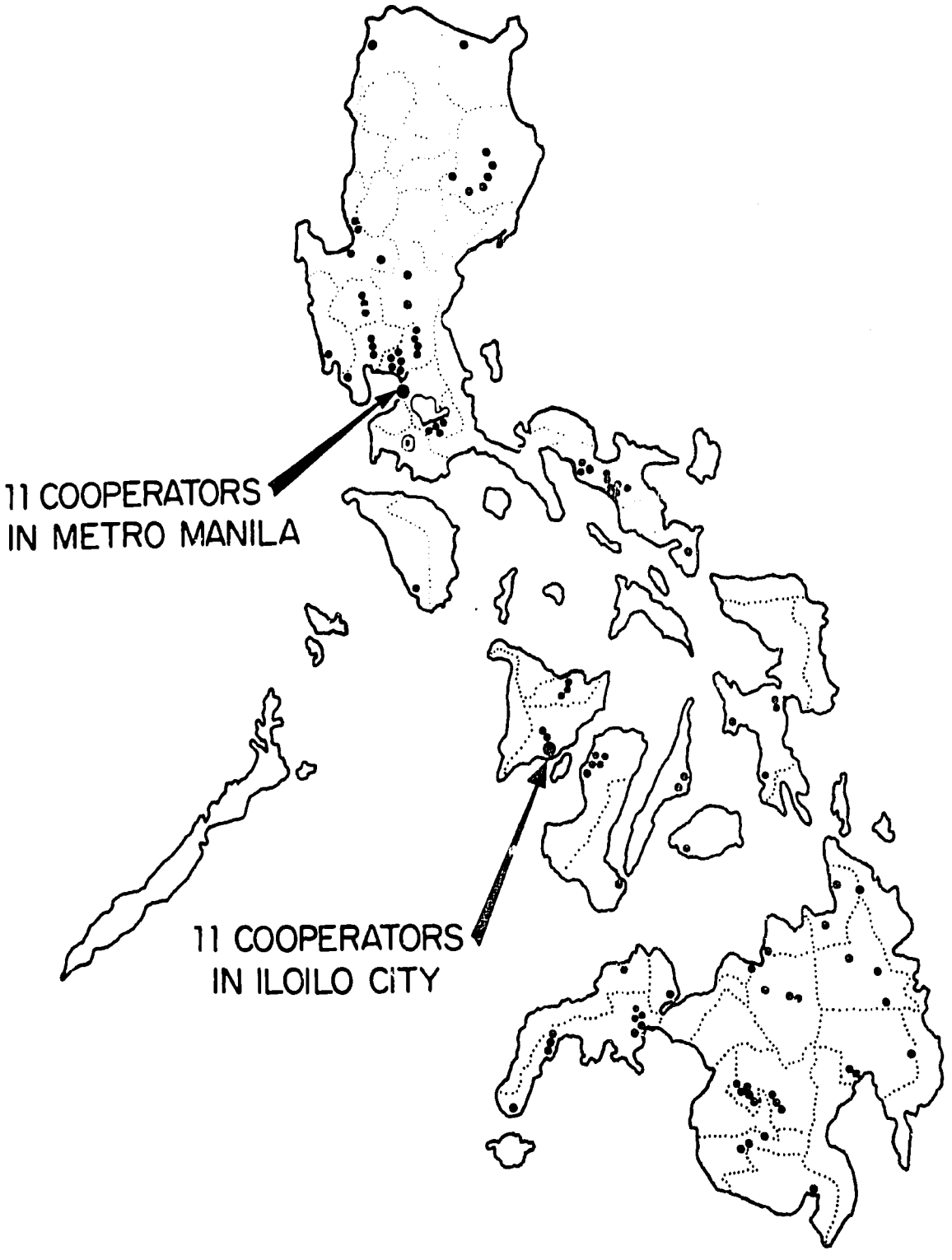
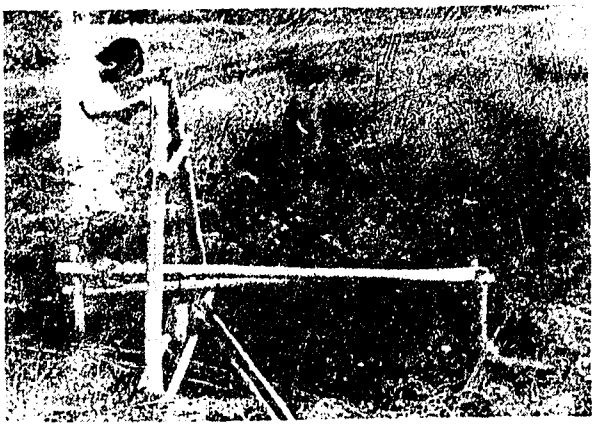


FIG.3. MAF-IRRI COOPERATING MANUFACTURERS: PHILIPPINES (1986)

EXAMPLES OF MAF-IRRI EQUIPMENT DESIGNS



TAPAK-TAPAK PUMP

- Innovation from Bangladesh where sales surpass 40,000.
- Adapted to Philippines for small farms in rainfed areas.
- Low cost (US$30 to $65).
- Increases farm employment and income during dry season.
- Easily fabricated by small shops with common tools and materials.

SIPA PUMP

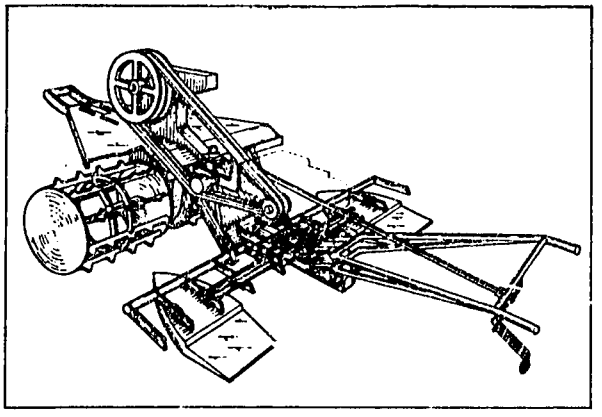
- Original design from Indochina.
- Filipino innovations reduce price to US$45 - $75 (excluding engine).
- Scientifically designed propeller for high pumping efficiency.
- Ideal for small rice farms and fishponds.
- Far more economical than centrifugal pumps for low-lift applications.

HYDRO-TILLER

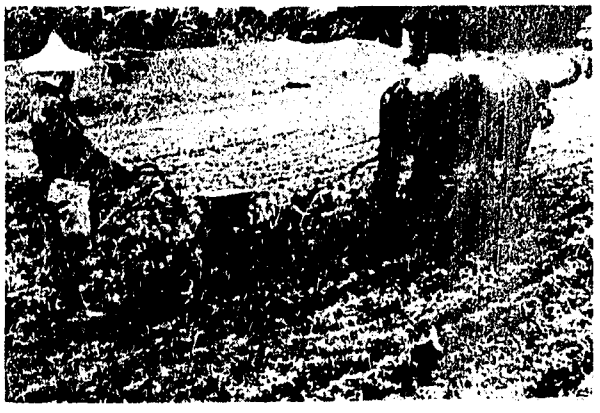
- Improvement of popular Filipino innovation.
- Reduces cost and time required for tillage of rice fields, thereby increasing income, cropping intensity and timeliness.
- Thorough puddling and incorporation of weeds, straw and green manure.
- Suitable for waterlogged areas where conventional tillage equipment cannot be used.

TRANSFORMER TILLER

- Combines best features of conventional and hydro-tillers.
- Multipurpose machine at small increase in price (10 to 15%).
- Higher capacity than conventional tiller; more versatile and transportable than hydro-tiller.



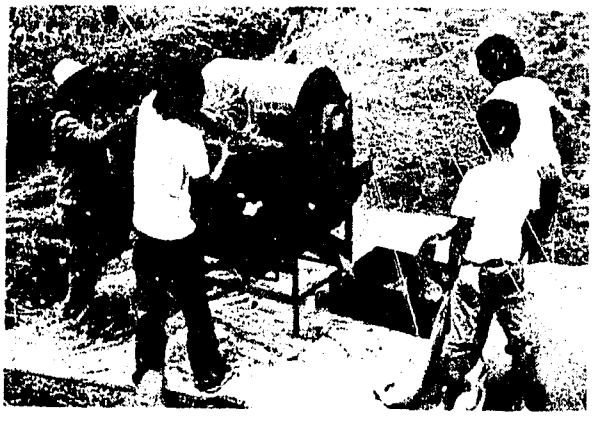
ZERO-TILL PLANTER



- Adaptation of proven high-tech design from New Zealand.
- Effective for planting dry-season crops (beans, corn, peanuts, etc.) in rainfed rice fields.
- Places seeds at proper depth with good soil & moisture environment.
- Avoids costs and delays of tillage, thereby increasing profits and maximizing utilization of residual moisture.

THRESHER/SHELLER

- Modification of popular IRRI-designed thresher to serve also as corn sheller.
- Result of innovative collaboration with manufacturers to meet needs of government corn program.
- Increases machine prices by only 5 to 10%.
- Quickly and easily changes from thresher to sheller.

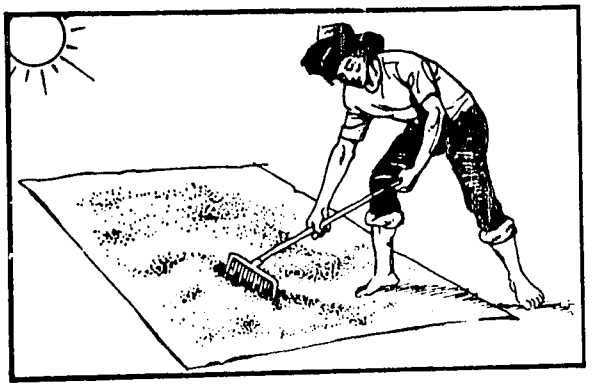


HAND-OPERATED SHELLER

- Based on design developed in Zamboanga del Sur.
- Easily fabricated in small shops with local materials and tools.
- Low cost (US$15 to $20).
- Ideal for small-scale corn farmers who cannot afford machine-powered shellers.

IMPROVED SUN-DRYING

- Substantially reduces amount of broken grains appearing in milled rice.
- Easily used with only small increase in labor.
- Utilizes locally-available materials and tools.
- Enables farmers to obtain higher prices for paddy.



Other MAF-IRRI Equipment Designs:

Lightweight hand tractor; rice seedling transplanter; direct seeders; seed and fertilizer applicator; paddy weeder; cultivating/weeding implements; rootcrop chipping machine; reaper attachment for hand tractor; paddy dryer.

DETAILED REPORT

1. INTRODUCTION

The MAF-IRRI Program was initiated in September 1981 when the IRRI Co-leader reported for work at the Bureau of Plant Industry (BPI), Manila, after completing orientation at IRRI. The present report summarizes the Program's progress from September 1981 through September 1986.

The general objectives and conceptual framework of the MAF-IRRI Program are described in Section 2. A major objective is to establish an institutional structure (described in Sections 3 and 4) capable of sustaining the Program after termination of the present project. Section 5 presents a description of the specific objectives and activities of the MAF-IRRI Program, indicating the degree of progress achieved to date. The current status of the Program is evaluated in Section 6 for the purpose of identifying the principal obstacles and/or problems which are limiting progress and must be overcome, to the degree possible, during a ten-month (1 October 1986 - 31 July 1987) extension of the Program funded by a grant from USAID/Manila. The report's annexes provide reference information, including a detailed progress report on equipment development and extension.

2. GENERAL OBJECTIVES AND PRIORITIES

In broad terms, the ultimate objective 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 towards small manufacturing shops** located in or near agricultural areas. The principal advantage of small, rural 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

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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 having irrigation throughout the year, a 2-ha. farm may be above the subsistence level, while in rainfed areas the equivalent size may be 3 to 5 ha.

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

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 to improve equipment performance and reduce production costs. Small rural shops now found in the country generally utilize labor-intensive methods to minimize capital investments, and this facilitates the proliferation of competing shops and contributes to rural employment. Furthermore, such shops can survive the present economic depression better than large urban firms because they can respond more easily to market changes, - e.g., farmers deciding to request shops to repair their existing equipment rather than to fabricate new (replacement) units.

Although the Program concentrates primarily on small rural shops, assistance is also 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.

The Program's activities are directed towards assisting shops to be largely self-sufficient with respect to financial backing, marketing, and technical innovations relating to new and/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/or excessive technical assistance. R&D institutions are 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 advanced scientific and/or technological concepts or on high-risk ideas; developing special materials or processes, when necessary (e.g., hardened steel cutter blades).

From the outset, the Program has been 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 or project planning methodologies. A principal responsibility of the Program staff is to identify and facilitate the cooperation of institutions which assist the shops in ways that are consistent with these objectives. For example, these may be private or public institutions associated with developing small-scale industry, promoting innovations and inventions, providing credit to small farmers, developing agricultural equipment, etc. The form of institutional cooperation varies markedly from one type of implement 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 are avoided in

order to encourage the adoption of flexible arrangements tailored to fit the particular characteristics of a given type of equipment.

Although agricultural equipment often relates to the problem of reducing the peak (or seasonal) demands for labor, the Program has not limited its focus solely to labor-saving implements. High priority has been given to equipment which increase cropping intensity (e.g., small pumps for irrigation), reduce losses (e.g., dryers), and improve the effectiveness of agricultural inputs (e.g., implements for proper placement of seeds and fertilizer). At present, however, equipment of this type is extremely limited or still in the R&D stage. Consequently, the Program has identified and stimulated the development of implements which may be suitable for extension in subsequent years. This includes efforts to increase local production of equipment now being imported, thereby hopefully reducing prices to farmers, creating employment opportunities, simplifying maintenance and repair, and improving the balance of trade.

3. ORGANIZATIONAL STRUCTURE

A primary purpose of the Program was the establishment of institutional relationships and technical competency which will lead to a national capability for developing, manufacturing, and marketing agricultural equipment appropriate for small farms. When the MAF-IRRI -USAID agreement terminated in September 1986, the institutional structure shown in Figure 1 had been established.

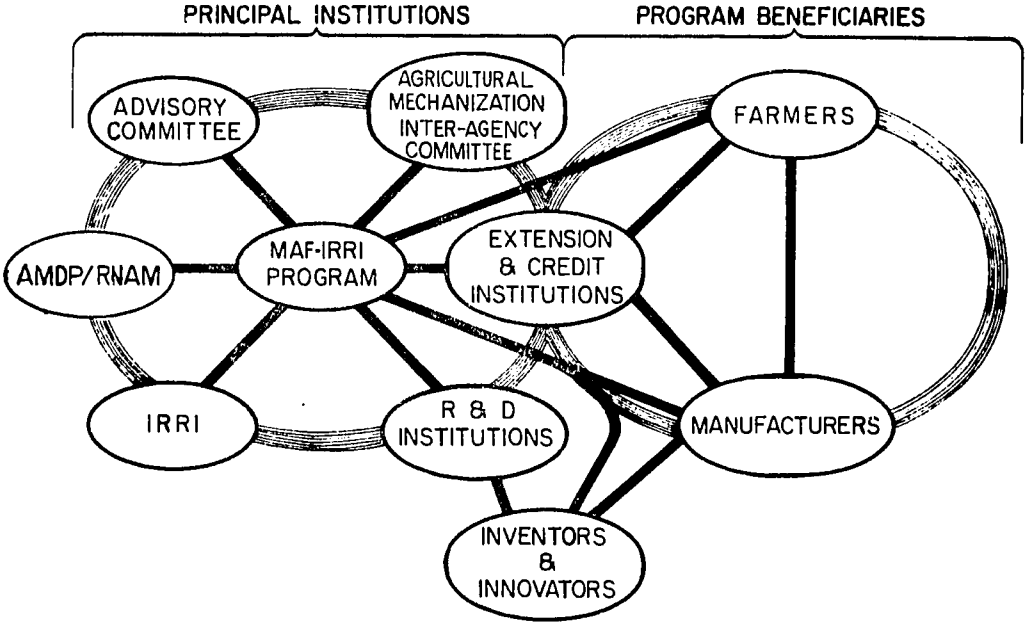

Figure 1. Organizational Structure of MAF-IRRI Program

Although Figure 1 presents a highly simplified picture of the institutional relationships 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 and corn farmers with small land holdings (see Section 2). The objective is to enable FARMERS to purchase appropriate agricultural equipment from local MANUFACTURERS. Both the FARMERS and the MANUFACTURERS are influenced by EXTENSION & CREDIT INSTITUTIONS which promote certain types of equipment by various means, such as field days, on-farm trials, training courses, accreditation, and loans. There is a wide variety of EXTENSION & CREDIT INSTITUTIONS in the Philippines, including the MAF Regional Organizations, Regional Development Projects, National Food Authority, National Irrigation Administration, Ministry of Agrarian Reform, Farm Systems Development Corporation, Area Marketing Cooperatives, Samahang Nayon cooperatives, Small Business Advisory Centers, National Cottage Industry Development Authority, KKK Livelihood Projects, and banking institutions.

The principal role of the MAF-IRRI PROGRAM is to provide the EXTENSION & CREDIT INSTITUTIONS and the MANUFACTURERS with the 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 MAF-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 MAF-IRRI PROGRAM to have direct communication with FARMERS regarding their views on deficiencies 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 MAF-IRRI PROGRAM has depended largely upon its ability to find appropriate designs of equipment which will be acceptable to both FARMERS and MANUFACTURERS. Initially, the MAF-IRRI PROGRAM has relied primarily on selecting (and adapting) appropriate equipment designs from the pool and designs developed by IRRI. However, IRRI and the MAF-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 MAF-IRRI PROGRAM has been to help promote the growth of a national capability for the development of appropriate equipment for small farms. The main groups involved are the

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

Agricultural Machinery Development Program (AMDP) at the University of the Philippines at Los Banos, R&D INSTITUTIONS (agricultural engineering departments at universities such as UPLB, CLSU, VISCA, ISU, and Xavier; government agencies such as NAPHIRE, PCARRD, 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 MAF-IRRI PROGRAM is promoting the efforts of R&D INSTITUTIONS and INVENTORS & INNOVATORS through workshops, field days and fairs, and contests, - and it is also encouraging national and international organizations to provide funds to these institutions for R&D on appropriate equipment.

The MAF-IRRI PROGRAM is guided by an ADVISORY COMMITTEE whose members are the Assistant Secretary of the Ministry of Agriculture, the head of the IRRI Agricultural Engineering Department, the director of the Bureau of Plant Industry, the director of the Agricultural Machinery Development Program (University of the Philippines at Los Banos), the director of the Agricultural Machinery Testing Center (AMTEC), and representatives of the Central Bank, the Ministry of Trade and Industry, and the Agricultural Machinery Manufacturers' and Distributors' Association (AMMDA). This Committee meets quarterly to review progress and plans, recommend corrective actions, and ensure that their institutions provide necessary collaboration.

The Government of the Philippines has created the AGRICULTURAL MECHANIZATION INTERAGENCY COMMITTEE (AMIC) which would coordinate studies of policies and plans relating to agricultural machinery. The ADVISORY COMMITTEE will assist in defining collaborative relationships between the MAF-IRRI PROGRAM and AMIC. The National Economic & Development Authority (NEDA) joined together with the Ministry of Agriculture and IRRI to sponsor a workshop on agricultural mechanization in 1983. However, it appears that neither NEDA nor AMIC has yet been able to initiate substantive activities relating to small-farm equipment.

4. PERSONNEL AND FACILITIES OF MAF-IRRI PROGRAM

The central office of the Program is located in the Agricultural Engineering Division of the Bureau of Plant Industry (BPI) of the Ministry of Agriculture and Food (MAF) in Malate, Manila. The two co-leaders of the Program are Benito C. Gonzalo, Chief of the BPI Agricultural Engineering Division, and Robert E. Stickney, IRRI extension engineer.

The BPI Agricultural Engineering Division has a staff of 15 engineers, of which 10 have regular appointments and 5 are contracted as casual (temporary) employees. Seven of the 15 engineers are devoting at least 50% of their time to the Program, for which they received an

honorarium of P600/month (based on Government-approved PCARRD regulations) if their level of activity was adequate during the month.

The Program also utilizes the part-time services of "Regional Project Engineers" who are regular employees of the Ministry's experiment stations or regional offices located in each of the twelve agricultural regions of the country. These Regional Project Engineers have been devoting an average of 25% of their time to the Program, thereby contributing approximately two man-years of effort per year. Their participation is essential to the Program because they live in the regions and therefore are familiar with the local conditions, practices, and dialects -- and can provide frequent assistance to local manufacturers. They submit monthly reports to the central office and were given an honorarium of P600/month if their level of activity was adequate.

All of the abovementioned engineers who are participating in the MAF-IRRI Program have received training at IRRI. This included the basic two- or three week course on IRRI agricultural machinery, plus individualized on-the-job training at BPI, IRRI and/or field sites on specific equipment (e.g., transplanter, hand tractor, reaper, pump and thresher/sheller) and on specific skills (e.g., drafting).

A primary goal was to have more of the equipment development work be carried out at the regional level rather than at the central office in Manila. This is consistent with the general decentralization movement in the Ministry of Agriculture, and it strengthens the Regional Project Engineers' roles in the Program and benefits from their proximity to farmers and cooperating manufacturers. Moreover, an increasing portion of the work at the regional level is being done through direct collaboration with some of the outstanding cooperating manufacturers, thereby benefitting from their practical experience with farm equipment and farmer preferences, their ability to innovate, and the availability of their shop facilities. This approach is described in more detail in the Annexes.

The MAF-IRRI Program provides the central office with a Program Co-Leader and a secretary/bookkeeper. The program hired three engineers on a temporary basis to carry out specific tasks relating to the seed and fertilizer applicator, paddy dryer, and tapak-tapak pump. All three had skills that were essential to the Program but unavailable among BPI engineers, and it is unfortunate that BPI could not hire them due to a freeze on staff employment.

In general, the Regional Project Engineers are able to use vehicles available at their experiment stations or regional offices, with BPI providing funds to some regions for fuel. However, travel was often limited because these funds from BPI were reduced and delayed. Grant funds were used to purchase two pickup trucks for the Program's activities at BPI and IRRI.

Progress has been hampered by the inadequate facilities and personnel of the BPI machine shop with regard to fabricating prototype equipment. The MAF-IRRI Program has provided the shop with some essential equipment (e.g., sheet metal bender and roller, oxy-acetylene torch, power hacksaw and hand tools), and BPI has taken actions to improve supervision of shop personnel. A basic problem is that the BPI wages for shop technicians are too low (e.g., P25 to P30 per day) to attract qualified workers. The Advisory Committee has been asked to help resolve these problems.

The Industrial Extension Section located at IRRI has provided the Program with approximately two man-years of engineering effort during the past year, plus one secretary. The MAF-IRRI staff agrees that the participation of these IRRI engineers is essential but their role should be that of assisting BPI engineers rather than leading them, especially with respect to visits to cooperating manufacturers when the visible program should be MAF-IRRI, not IRRI.

5. PROGRAM ACTIVITIES

The principal activities of the Program may be described in terms of six steps:

1. Define Priorities
2. Develop Equipment
3. Test and Evaluate Equipment
4. Promote Equipment to Manufacturers
5. Technical Assistance to Manufacturers
6. Monitor and Evaluate

These steps, which are described below, are the basic elements of the on-going process of the Program, - with feedback occurring between steps as a result of learning gained through implementation. For example, experience gained in steps 3 and 6 provide useful information for sharpening the definition of the Program's priorities in step 1.

Step 1: Define Priorities

One of the first tasks of the MAF-IRRI Program was to determine:

- Who are the principal target groups of the Program?
- What types of agricultural equipment would be most appropriate for these target groups?

It was decided that the target groups should be small farmers (say 1-5 ha) who grow either rice or corn as primary crops. Rice is the main food crop of the Philippines and it was the highest priority of the Ministry of Agriculture during the 1970s. Corn is now a high priority because the Government wishes to reduce importation of yellow corn

needed for animal feed. We also chose to consider mungbean, cowpea, and vegetables which are frequently grown by rice and corn farmers as secondary crops.

The Program staff visited all of the major rice and corn areas of the Philippines. Figure 2 presents a map showing the major rice-producing areas. It is recognized that different areas have different needs with respect to small farm equipment. The more recently settled areas, such as the Cagayan Valley and Mindanao, generally have larger farm sizes and lower availability of labor and, therefore, may benefit from labor-saving equipment (e.g., hand tractors, threshers, and reapers) which would not be appropriate in the densely-populated areas, such as Bicol, where farm sizes are small and labor is in greater supply. The latter areas would benefit from equipment which increase the opportunities for labor through, for example, increased cropping intensity (e.g., manually powered pumps and planters to enable dry-season crops). Areas with intense rainfall during harvest periods would benefit from post-harvest equipment (e.g., threshers and dryers) to reduce crop losses. We have kept these considerations in mind when planning area-specific extension activities, as will be subsequently illustrated.

Our first task was to study available information provided by past surveys of agricultural equipment in the Philippines, and then to visit the main agricultural areas to carry out informal surveys to provide missing details. We then organized two workshops for the purpose of determining the types of small farm equipment which should be considered as priorities for the Program. One workshop was held in Central Luzon and the other in Mindanao, and the participants included farmer leaders, agricultural extension technicians, R&D workers, and outstanding manufacturers. The principal output of these workshops is the list of priority equipment shown in Table 1. Although we consider this list to be imperfect and incomplete, it has served as a useful guide in our efforts to identify and develop appropriate equipment for the Program, as described below.

Table 1. Priority Equipment for MAF-IRRI Program.

RICE FARMS	CORN FARMS
Reaper	Planter-fertilizer
Dryer	Weeder-cultivator
Rotary weeder	Sprayer
Broadcaster	Sheller
Transplanter	Dryer

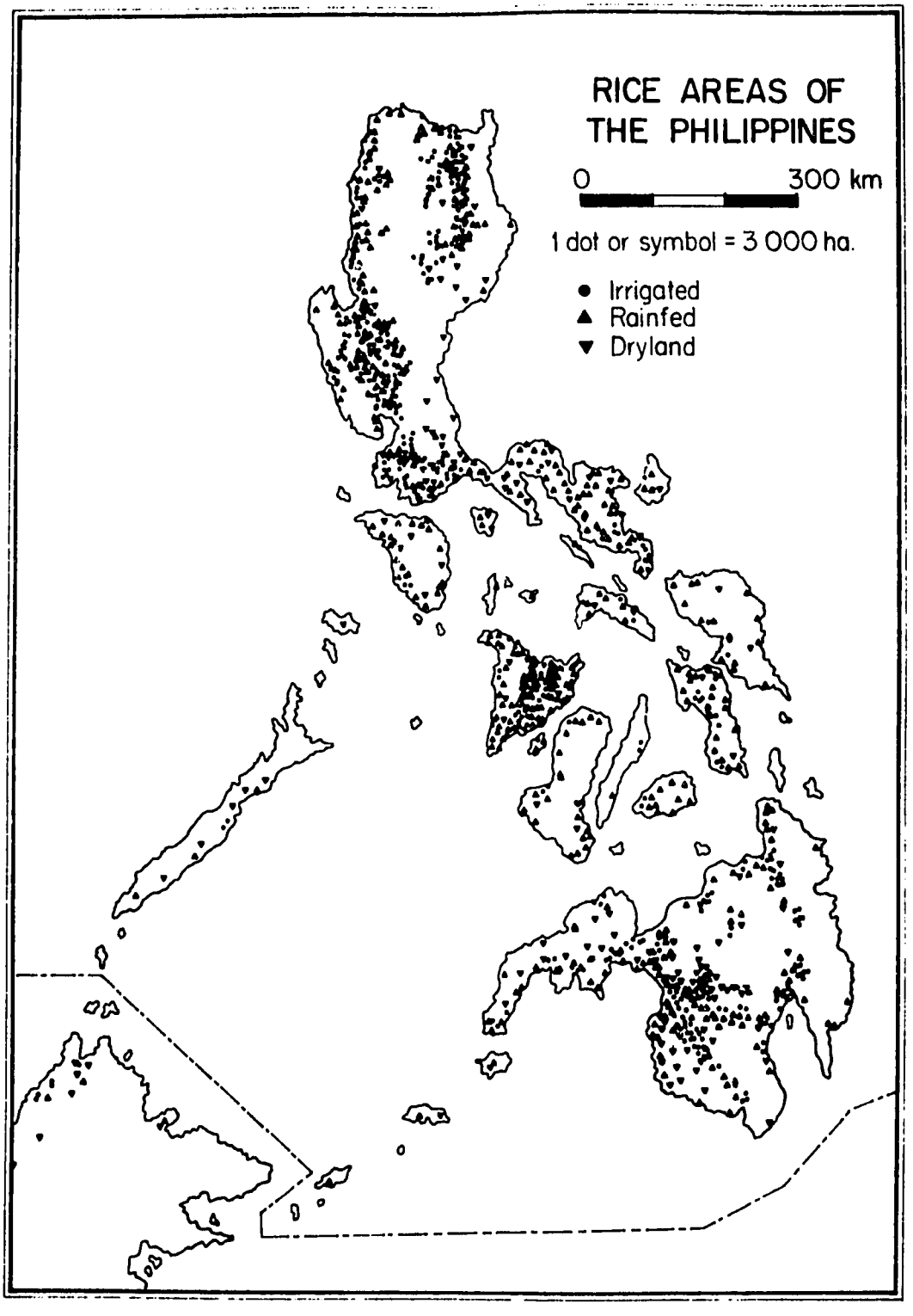

Figure 2. Rice Areas of the Philippines.

Step 2. Develop Equipment

The Program's effort to develop equipment may be divided into a short-term and a long-term effort. The objective of the short-term effort was to identify promising designs of priority equipment for immediate use in the Program. The search for designs began at IRRI and UPLB, and then extended to other universities and R&D institutions within the country, as well as to talk with farmers and manufacturers about existing innovations. It also included a review of international publications on agricultural equipment suitable for small farms.

The objective of the long-term effort was to establish contacts with Philippine institutions which may help provide the Program with new equipment designs in the future. This is an institution-building activity which focuses on strengthening the national capability for R&D on small farm equipment. It included contacts with organizations such as PCARRD and ARD which provide funds to government and private institutions for R&D on agricultural equipment. A related activity was to promote the development of inventors and innovators of small farm equipment through national contests, such as the Philippine Inventors Fair and the National Science Fair.

Table 2 provides a list of the equipment which has been considered by the Program during the past three years. (See Annex E for detailed report). Notice that equipment designs have come from a variety of sources. As indicated, we have discontinued work on some designs which did not appear to have sufficient promise.

Step 3. Test and Evaluate Equipment

We have carried out two types of tests or evaluations:

1. Intensive on-farm tests of prototype equipment to determine its durability and technical and economic performance under a wide variety of conditions (e.g., soil composition, rainfall, crops, etc.). An example is the intensive test of the reaper and transplanter carried out at the PPC Rice Farm in Mindanao.

2. On-farm demonstrations and tests to obtain farmers' evaluations of prototype equipment, including their suggestions regarding possible improvements.

Equipment tests and evaluations were carried out in various regions during the past three years, as indicated in Table 2. These were time consuming and relatively costly undertakings, but we consider them as essential steps to be taken before making a decision to promote (or not to promote) a particular type of equipment.

Table 2. Equipment Considered by MAF-IRRI Program*

	Equipment	Source of Design	Region where evaluated	Current Status
1.	Axial-flow thresher	IRRI design	2, 5, 8-12	MAF-IRRI continuation of IRRI extension initiated in 1975
2.	Reaper	Chinese design adapted by IRRI	2, 4, 5, 8-12	Extension initiated in 1982.
3.	Hand tractor	IRRI modification of existing designs	2, 4, 5, 8-12	Extension initiated in 1982.
4.	Axial-flow ("Sipa") pump	Thailand and Vietnam designs modified by IRRI and MAF-IRRI	1-12	Extension initiated in 1982 and modified in 1985.
5.	Seed and fertilizer applicator	MAF-IRRI modification of existing designs	2-4, 6-12	Extension initiated in 1983.
6.	Transplanter	IRRI design with improvements through MAF-IRRI feedback	2-6, 10, 12	Preliminary extension initiated in 1984.
7.	Rolling injection planter	IITA design modified by IRRI	2, 4, 6, 11, 12	Discontinued on basis of on-farm evaluations.
8.	One-wheel hand tractor	USA-manufactured unit purchased by MA-IRRI for evaluation	4	Discounted work on basis of evaluation.
9.	Heated floor dryer	MAF-IRRI and IRRI design	10	Discounted work on basis of evaluation.
10.	Root-crop chipping machine	BPI adaptation of existing designs	4, 8	Extension initiated in 1984.
11.	Corn harvesting hook	USA design via San Miguel R&D Center	2, 4	Discounted work on basis of evaluation.
12.	Low-volume sprayer	Sri Lankan design	4	Evaluation shelved due to inadequate personnel.
13.	Corn sheller	USA design modified by MAF-IRRI	4	Discounted work on basis of evaluation.
14.	Thresher/sheller	MAF-IRRI adaptation of IRRI thresher design	2-4, 10-12	Extension initiated in 1984.
15.	Tapak-Tapak Pump	Bangladesh design adapted by MAF-IRRI	1, 3, 4, 6	Extension initiated in 1984.
16.	Disk plow for hand tractor	Filipino manufacturer adaptation	4, 6, 11, 12	Evaluation in progress.
17.	Vertical-bin dryer	Modification of IRRI design	4	Discontinued work on basis of evaluation.
18.	Hydro-tiller	Modification of Filipino manufacturer design	2-6, 9-12	Extension initiated in 1986.
19.	Rice hull furnace	Japanese design; unit purchased by MAF-IRRI for evaluation	4	Discontinued on basis of tests.
20.	Corn dryer	UPLB design	4	Discontinued on basis of tests.
21.	Harness for draft animals	Designs from international publications	-	Discontinued on basis of evaluation.
22.	Manual corn sheller	Developed by Philippine-Australian Project in Zamboanga del Sur	2-12	Promoted by distribution of comic-book fabrication manual.
23.	Transformer tiller	MAF-IRRI adaptation	2-6, 9, 12	Extension initiated in 1986.
24.	Rotary paddy dryer	MAF-IRRI design utilizing inputs from CLSU and UC Davis	5	Evaluation will be completed in January 1987.
25.	Paddy seeder	IRRI design	2-6, 8-12	Extension initiated in 1986.
26.	Paddy weeder	IRRI improvement of existing Filipino designs	2-6, 8-12	Extension initiated in 1986.
27.	Cono puddler	IRRI design	6, 11	Extension initiated in 1986.
28.	Improved sundrying	MAF-IRRI development	10	Extension initiated in 1986.

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2.	Reaper	Chinese design adapted by IRRI	2, 4, 5, 8-12	Extension initiated in 1982.
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4.	Axial-flow ("Sipa") pump	Thailand and Vietnam designs modified by IRRI and MAF-IRRI	1-12	Extension initiated in 1982 and modified in 1985.
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7.	Rolling injection planter	IITA design modified by IRRI	2, 4, 6, 11, 12	Discontinued on basis of on-farm evaluations.
8.	One-wheel hand tractor	USA-manufactured unit purchased by MA-IRRI for evaluation	4	Discounted work on basis of evaluation.
9.	Heated floor dryer	MAF-IRRI and IRRI design	10	Discounted work on basis of evaluation.
10.	Root-crop chipping machine	BPI adaptation of existing designs	4, 8	Extension initiated in 1984.
11.	Corn harvesting hook	USA design via San Miguel R&D Center	2, 4	Discounted work on basis of evaluation.
12.	Low-volume sprayer	Sri Lankan design	4	Evaluation shelved due to inadequate personnel.
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14.	Thresher/sheller	MAF-IRRI adaptation of IRRI thresher design	2-4, 10-12	Extension initiated in 1984.
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25.	Paddy seeder	IRRI design	2-6, 8-12	Extension initiated in 1986.
26.	Paddy weeder	IRRI improvement of existing Filipino designs	2-6, 8-12	Extension initiated in 1986.
27.	Cono puddler	IRRI design	6, 11	Extension initiated in 1986.
28.	Improved sundrying	MAF-IRRI development	10	Extension initiated in 1986.

Step 4. Promote Equipment to Manufacturers

A major effort of the Program was to establish close working relationships with a number of manufacturers throughout the country, especially in farming areas (Section 2). This was done by visiting the main agricultural areas and asking leading farmers and agricultural extension technicians to identify the best equipment manufacturers and repair shops in the vicinity. We then visited these manufacturers to inform them of the Program and to invite them to become "cooperators". A manufacturer becomes a cooperator in the MAF-IRRI Program by signing a Memorandum of Agreement covering two major points. First, the Program agrees to provide cooperators with designs of agricultural equipment, together with training and technical assistance. Second, the cooperators agree to: (a) refrain from starting commercial production of equipment based on MAF-IRRI designs until they have manufactured a prototype unit which successfully passes an acceptance test by Program engineers; and (b) provide data annually to the Program on the types and numbers of agricultural equipment manufactured by the cooperator during the year.

At present, the Program has over 200 cooperators located in the main rice-producing areas of the country. The geographical location of these cooperators is illustrated in Figure 3.

The cooperators range in size from small blacksmith and metalcraft shops to large-scale industries. The data presented in Table 3 indicate that the majority of the cooperators are small with respect to capital assets and number of employees. However, a few of the cooperators are large-scale manufacturers located in or near Metro Manila.

Table 3. Profile of MAF-IRRI Cooperating Manufacturers according to Capital Assets and Labor.

Ranges			Cooperators (%)
CAPITAL ASSETS			
Cottage Industry	:	Below US$10,000	43
Small Industry	:	$10,000 to $100,000	43
Medium Industry	:	$100,001 to $400,000	10
Large Industry	:	Above $400,000	4
LABOR (Number of employees)			
Below 6			29
6 to 15			44
16 to 50			21
above 50			6

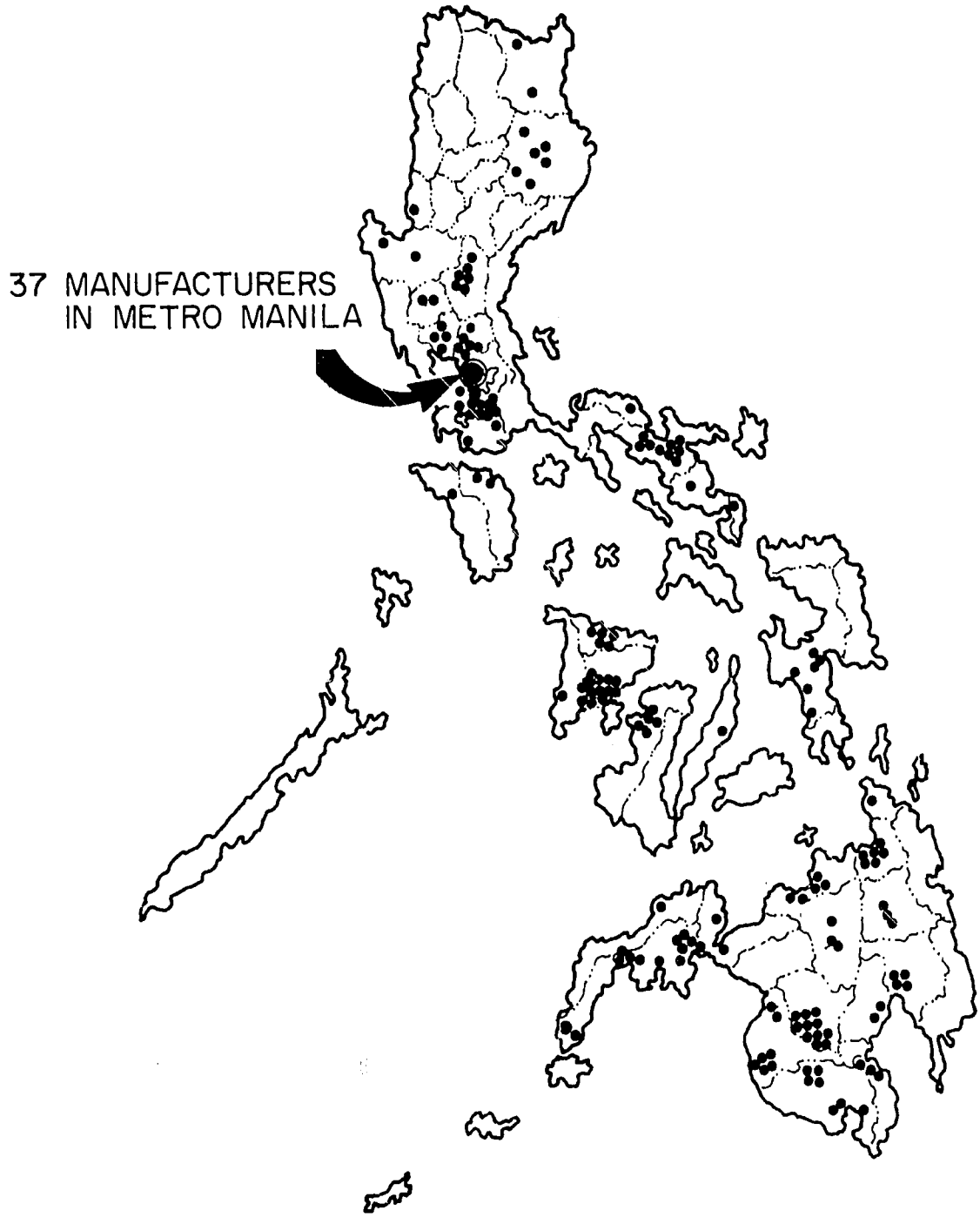


Fig. 3. Geographical location of cooperating manufacturers of the MA-IRRI Industrial Extension Program for Small Farm Equipment.

Figure 4 of the Executive Summary illustrates the types of equipment promoted by the Program. New cooperators are allowed to request a set of engineering drawings ("blueprints") for only two types of equipment until they have proven their capability. Table 4 summarizes the number of blueprints requested by cooperators during the past three years. It also indicates the number of cooperators who have borrowed a unit of prototype equipment from the Program to facilitate fabrication of their first unit. Most small shops are not capable of fabricating equipment solely from the blueprints, and they are helped by loaning them a unit to serve as a model.

Table 4. Numbers of cooperating manufacturers who requested blueprints and/or borrowed demo units of MAF-IRRI equipment (1982-86).

Equipment	Number who requested blueprints	Number who borrowed unit
Thresher (TH6, 7 and 8)	95	9
Reaper (RE2)	130	28
Hand Tractor (PT5)	136	30
Axial Flow Pump (PU & Sipa)	50	25
Transplanter (TR3 and 4)	65	11
Seed and Fertilizer Applicator (SFA)	45	20
Rolling Injection Planter (RIP)	14	9
Manual Corn Sheller	15	10
Hydro-tiller	NA	3
Transformer Tiller	NA	1
Paddy Seeder	15	5
Paddy Weeder	10	3
Puddler	5	3
Totals	580	157

Step 5. Technical Assistance to Manufacturers

The Program provided the following types of technical assistance to manufacturers:

a. Assist manufacturers to understand the blueprints for the type of MAF-IRRI equipment selected by them.

b. Loan prototype units of equipment to small manufacturers who are not capable of fabricating equipment solely from blueprints. In some cases, the most important jigs and fixtures were also loaned.

c. Advise manufacturers on where they may purchase materials and parts that either are not available in their vicinity or may be purchased elsewhere at much lower prices.

d. Assist manufacturers with the most difficult and/or critical steps of fabrication, assembly, and adjustments. In the case of the reaper and PT5 hand tractor, the Program carried out two training courses for interested manufacturers. (A total of 56 manufacturers attended at their own expense.)

e. Collaborate with manufacturers in pre-tests of the first ("prototype") units produced by them, indicating how to operate the equipment properly in the field, as well as correcting fabrication defects and demonstrating critical adjustments and maintenance procedures.

f. Conduct detailed tests of the prototype units produced by manufacturers, both in their shops and in the field, indicating any necessary modifications. If the prototype passes this test, the MAF-IRRI Program provides a written approval informing the manufacturer that he may commence commercial production.

g. Assist manufacturers with initial sales efforts, including field demonstrations to farmer groups, using equipment for custom (contract) work, and arranging loans from local banks.

Our technical assistance efforts were most intensive in Regions 2, 5, 6, 9, 10, 11, and 12, followed by Regions 1, 3, 4, 7, and 8.

The most tangible indicator of the effectiveness of the Program's technical assistance efforts is the number of manufacturers who have successfully fabricated at least one unit of equipment promoted by the Program. As may be seen in Table 5, the reaper and PT5 hand tractor were fabricated successfully by 39 manufacturers. Thirteen other types of equipment were fabricated by a small number of manufacturers. At

present, the axial flow pump is the most popular equipment, while the recently-introduced hydro-tiller, paddy seeder, weeder, and puddler are very promising.

Table 5. Number of manufacturers who have fabricated at least one unit of MAF-IRRI equipment.

Equipment	Number of Manufacturers
Reaper (RE2)	39
Hand Tractor (PT5)	39
Axial Flow Pump (PU and Sipa)	25
Transplanter (TR3 and 4)	12
Seed and Fertilizer Applicator (SFA)	12
Tapak-Tapak Pump	9
Rolling Injection Planter (RIP)	7
Thresher/sheller	7
Manual Corn Sheller	7
Chipping Machine	3
Hydro-tiller	3
Paddy Seeder	3
Paddy Weeder	2
Puddler	2
Transformer Tiller	1

Step 6. Monitor and Evaluate

An on-going effort was made to monitor and evaluate the Program's performance with respect to the time-phased implementation plan, thereby identifying problems and deciding upon corrective measures. The most

tangible measure or indicator of the overall performance of the MAF-IRRI Program is the number of units of MAF-IRRI equipment manufactured and sold by cooperating manufacturers. These data are presented in Table 6, where the reader may observe that the reaper and PT5 hand tractor initially achieved reasonable levels of production, but sales dropped off markedly in 1984 due to both technical and economic problems (see reference 8 and 17 listed in Annex A). The data in Table 6 show that other types of MAF-IRRI equipment have achieved only low levels of production, perhaps because of the newness of the equipment and the depressed economy. Consequently, it is too early to judge these equipment with respect to degree of acceptance by farmers.

The most important output of the Program is the impact (positive or negative) of MAF-IRRI equipment on the productivity and income of small farmers and landless farm laborers. Because of the low level of sales of MAF-IRRI equipment, it is too early to carry out a detailed impact study of this nature. However, with IRRI economists, we have undertaken preliminary studies of the reaper, transplanter, hydro-tiller, Tapak-Tapak and Sipa pumps (see references 12, 13, 14, 16, 17 and 20 listed in Annex A).

6. SUMMARY OF PROBLEMS AND FUTURE PLANS

Although specialized training at IRRI and elsewhere has strengthened many of the skills of BPI engineers, the Program continues to suffer from the lack of: (a) a person who can conceptualize and innovate new designs of small-farm equipment; (b) a machine design engineer/draftsman; (c) a person capable of performing economic evaluations; and (d) a project coordinator to assist the BPI co-leader with planning and implementation of Program activities. Unfortunately, a freeze on hiring prevents BPI from adding persons with these skills. We are attempting to train existing BPI engineers to handle these responsibilities.

The BPI budget was adequate for the MAF-IRRI Program until 1984 when the total BPI budget was markedly reduced. Funds are now insufficient for travel and transportation expenses associated with technical assistance visits, field trials, and demonstrations. Furthermore, vehicles are often unavailable to MAF-IRRI regional engineers. These problems are being considered by the Program's Advisory Committee.

The MAF-IRRI Program was evaluated in 1984 by USAID/Manila, and the principal recommendation was that AID should continue funding the Program for two more years. AID/Washington agreed to continue the grant for one additional year (1 October 1985 - 30 September 1986). At the request of MAF, USAID/Manila has provided funds for an additional 10 months (1 October 1986 - 31 July 1987). The proposal for this

PRODUCTION STATISTICS FOR MAF-IRRI COOPERATING MANUFACTURERS

PHILIPPINES 1975-1985

EQUIPMENT	YEAR											TOTALS
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	
1. Hand Tractor (various designs)	2178	2586	856	795	1337	978	1107	2310	2268	1985	3844	20244
2. Axial-Flow Thresher (TH7 & 8)	275	552	494	689	1850	1059	1417	1689	1162	1571	1314	12072
3. Portable Thresher (TH6)	-	-	827[1/]	1746	2290	1218	1275	1113	1129	515	310	10423
4. Batch Dryer (BD1, BD2, and variations)	33	93	64	34	47	82	118	47	26	95	58	697
5. Axial-Flow Pump (PU4)	-	-	-	-	13[2/]	55	66	38	86	63	45	366
6. Transplanter (TR1, 4, and 5)	-	-	-	-	-	17[3/]	82	73	31	80	84	367
7. 1.0 m Reaper (RE?)	-	-	-	-	-	-	-	37[4/]	363	40	19	459
8. Seed and Fertilizer Applicator (SFA)	-	-	-	-	-	-	-	50[5/]	67	74	71	262
9. Tapak-Tapak Pump	-	-	-	-	-	-	-	-	-	213[6/]	189	402
TOTALS	2486	3231	2241	3264	5537	3409	4065	5357	5132	4636	5934	45292
No. of manufacturers reporting	14	19	17	20	21	31	33	55	75	79	79	

[1/] Portable thresher was released during later part of 1976.

[2/] Axial-flow pump was released during 1979.

[3/] Transplanter was first released during later part of 1979; modified version released in 1983.

[4/] 1.0 m reaper was introduced in early 1982.

[5/] Seed and fertilizer applicator was introduced in 1983; data include existing designs.

[6/] Tapak-tapak pump was introduced in late 1983.

NOTE: These statistics should not be interpreted as being representative of the total production of agricultural equipment in the Philippines because: (a) data have been obtained only from MAF-IRRI cooperating manufacturers; and (b) the number of cooperators has increased markedly over the past four years.

continuation is included in Annex C. USAID/Manila reviewed the Program in September 1986, and the report is presented in Annex D. MAF Deputy Minister Carlos Dominguez was a strong supporter of the Program and had agreed to serve as Chairman of the Program's Advisory Committee. Annex E provides a copy of his letter to USAID Director Frederick Schieck. This letter summarizes the recommendations of the review team and indicates the actions to be taken by MAF. Mr. Dominguez recently resigned as MAF Deputy Minister in order to assume the position of Minister of Natural Resources. This is a great loss to the Program, but it is hoped that the new Deputy Minister will also be an enthusiastic supporter.

ANNEXES

A. List of reports prepared by the MAF-IRRI Program

B. Leaflets on Equipment Promoted

C. Proposal to USAID/Manila for one-year continuation of the MAF-IRRI Program

D. Report on the Review of the MAF-IRRI Program (September 1986)

E. Letter from Deputy Minister Carlos Dominguez to USAID Director F. Schieck (Note: a similar letter was sent to IRRI Director General M. S. Swaminathan).

ANNEX A

LIST OF REPORTS PREPARED BY THE MAF-IRRI PROGRAM

1. Report on the Workshop on Small Farm Equipment R&D, Maligaya Rice Research and Training Center, Munoz, Nueva Ecija. December 3-4, 1981.

2. Report on the Workshop on Small Farm Equipment for Corn Production and Processing, Regional Health Training Center, Cagayan de Oro City. June 2-3, 1982.

3. Report on the Rolling Injection Planter ("RIP"), The International Rice Research Institute, Los Banos, Laguna. July 16, 1982.

4. Comparative Advantages of Axial-Flow Pumps over Centrifugal Pumps for Low-Lift Irrigation, February 1983. (See #12 for final publication).

5. "Exploratory Study of Partial Drying of Paddy to Reduce Deterioration of Grain Quality", A. T. Belonio and R. E. Stickney, 1985.

6. "IRRI Training for Industrial Extension", C. W. Bockhop, R. E. Stickney, V. R. Reddy, and R. C. Fischer. Paper presented at the American Society of Agricultural Engineers Summer Meeting, Montana State University, Montana, June 26-29, 1983.

7. "Paddy Drying in Bukidnon, Philippines", R. E. Stickney, B. D. Shukla, and I. Manalili. Published in: Maintaining Good Grain Quality, Southeast Asia Cooperative Post-Harvest R&D Programme, pp.103-119, 1983.

8. "Introduction of the CAAMS-IRRI Mechanical Reaper in the Philippines", C. P. Fernandez, H. T. Manaligod, and R. E. Stickney. Paper published by the Philippine Agricultural Engineering Journal, Vol. XV, No. 1, pp. 3-9, 1984. Also presented at the Chinese Academy of Agricultural Mechanization Sciences, Beijing, People's Republic of China, October 1984.

9. "Extension of Small-Farm Equipment in the Philippines", R. E. Stickney, B. C. Gonzalo, and C. W. Bockhop. Paper presented at the Chinese Academy of Agricultural Mechanization Sciences, Beijing, People's Republic of China, October 1984. Also presented at the Summer Meeting of American Society of Agricultural Engineers, University of Tenesse, Knoxville, June 24-27, 1984.

10. "MA-IRRI Industrial Extension Program for Small Farm Equipment", B. C. Gonzalo, and C. W. Bockhop. Paper presented at the Chinese Academy of Agricultural Mechanization Sciences, Beijing, People's Republic of China, October 1984. Also presented at the Summer Meeting of American Society of Agricultural Engineers, University of Tenesse, Knoxville, June 24-27, 1984.

11. "MA-IRRI Industrial Extension Program for Small Farm Equipment", B. C. Gonzalo and R. E. Stickney. Journal of Philippine Development Studies. Number Twenty-One, Vol. XII, No. 1, pp. 226-235, 1985. Also presented at the Workshop on the Consequences of Small Rice Farm Mechanization Project, Development Academy of the Philippines, December 1-2, 1983. Available in Tagalog version.

12. "Comparison of Axial-Flow and Centrifugal Pumps for Low-Lift Irrigation", E. J. Calilung, G. C. Salazar, C. L. Maranan, and R. E. Stickney. Paper published by Agricultural Mechanization in Asia, Africa and Latin America. Vol. 16, No. 4, pp. 35-38, 1985.

13. "Comparison of Tillage Equipment for Small Rice Farms", E. J. Calilung and R. E. Stickney. Paper presented at the 1985 Summer Meeting of American Society of Agricultural Engineers, Michigan State University, East Lansing, June 23-26, 1985. Paper No. 85-5046. Also submitted for publication in the Journal of Agricultural Mechanization in Asia, Africa and Latin America (Japan).

14. "Human-Powered Pump for Low-Lift Irrigation", R. E. Stickney, V. N. Piamonte, Q. de Sagun, and I. Ventura. Paper presented at the Summer Meeting of American Society of Agricultural Engineers, Michigan State University, East Lansing, June 23-26, 1985.

15. "MAF-IRRI Thesher/Sheller", Teresita Silva. Philippine Agricultural Engineering Journal Volume XVI, No. 1, pp. 15-18, 1985.

16. "Rice Seedling Transplanters: Philippines", G. C. Salazar, L. Ebron, H. Icatlo, B. Duff, and R. E. Stickney. Proceedings of the International Conference on Small Farm Equipment for Developing Countries: Past Experiences and Future Priorities, IRRI, pp. 213-232, 1986.

17. "CAAMS-IRRI Mechanical Reaper: Experiences in the Philippines", R. E. Stickney, G. C. Salazar, H. T. Manaligod, F. S. Juarez, B. Duff, and C. W. Bockhop. Proceedings of the International Conference on Small Farm Equipment for Developing Countries: Past Experiences and Future Priorities, IRRI, pp. 341-358, 1986.

18. "The IRRI Industrial Liaison Program", C. W. Bockhop, R. E. Stickney, M. M. Hammond, B. J. Cochran, V. R. Reddy, F. E. Nichols, and S. C. Labro. Proceedings of the International Conference on Small Farm Equipment for Developing Countries: Past Experiences and Future Priorities, IRRI, pp. 479-486, 1986.

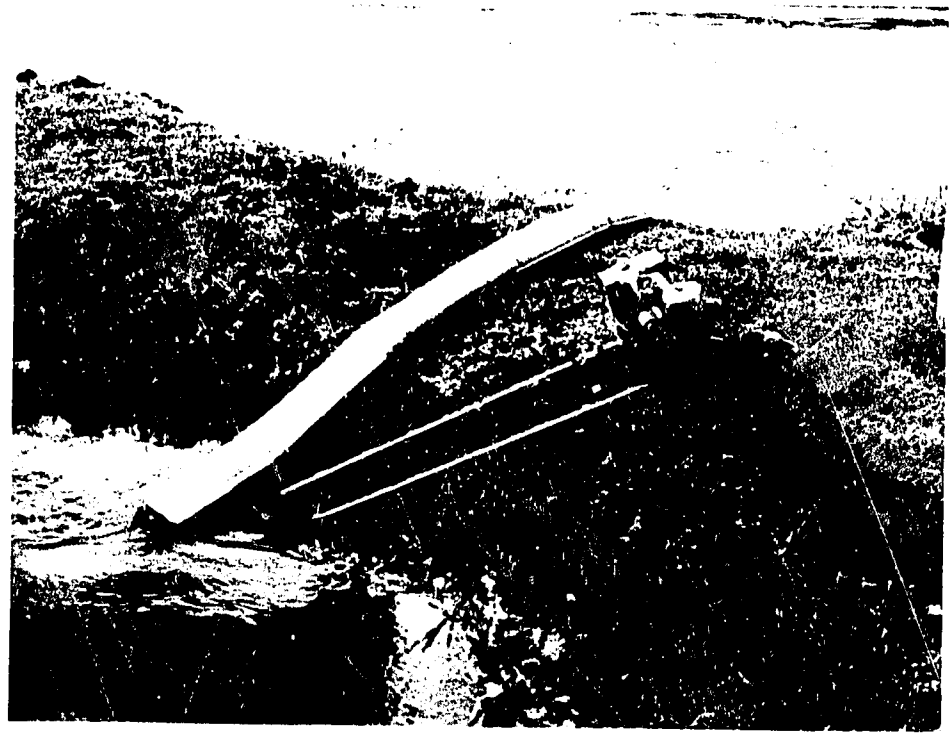
19. "Sundrying of Paddy: Factors Influencing the Occurrence of Broken Grains in Milled Rice", R. E. Stickney and A. T. Belonio. Paper presented at the Summer meeting of the American Society of Agricultural Engineers, San Luis Obispo, California 1986. Now being revised for submission to the Rice Journal.

20. "Low-Lift Propeller Pump for Small Farm and Fishponds in Developing Countries", R. E. Stickney, G. C. Salazar, F. E. Daguro, and H. Icatlo. For submission to the journal: Agricultural Mechanization in Asia, Africa and Latin America (Japan). An abbreviated version has been published in Modern Fish Farming (Philippines), pp. 35-36, 1986.

21. "Experiences of the MAF-IRRI Collaborative Program on Small Farm Equipment in the Philippines", R. E. Stickney and B. C. Gonzalo. Journal of Japanese Society of Agricultural Machinery. (forthcoming).

22. "Design and Development of Rotary Dryer for Partial Drying of Paddy", V. N. Piamonte, B. C. Gonzalo, A. T. Belonio, and R. E. Stickney. 1986.

MAF-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT



MAF-IRRI "SIPA" PUMP

Ideal for low-lift applications where water needs to be raised only 1 to 2 meters, such as irrigation and drainage of rice fields and fishponds.

ADVANTAGES

LOW COST: About ₱1000 (US$50) excluding the engine, which is generally borrowed from another farm machine such as a handtractor or thresher.

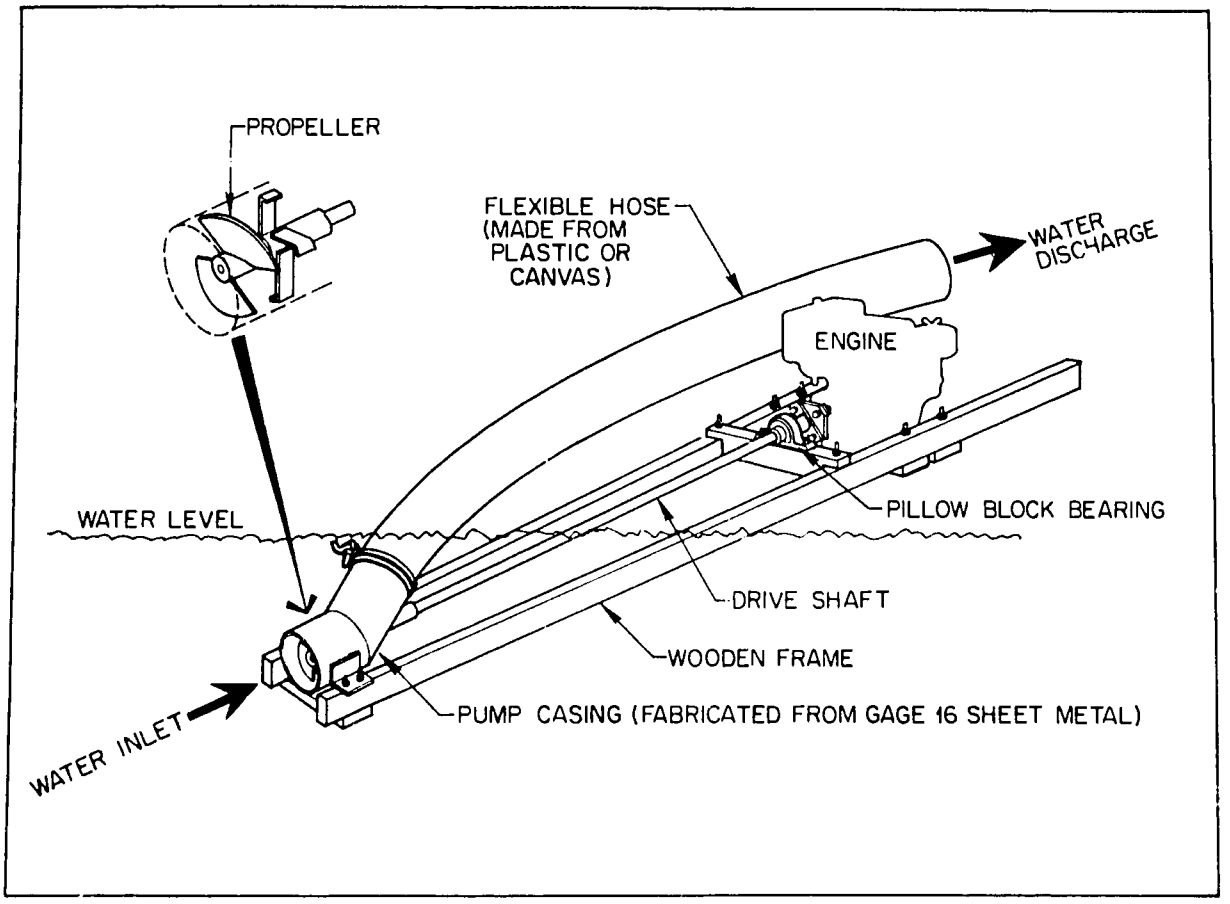
EASY TO OPERATE: Portable; easily installed; self-priming.

SIMPLE CONSTRUCTION: Fabricated from locally-available materials using common shop tools, thereby reducing cost and simplifying maintenance and repair.

ADAPTABLE: Suitable for irrigation, drainage, or aeration; flexible discharge hose allows water to be directed to desired point; can be adapted for brackish water.

HIGH CAPACITY: A 15-cm (6-inch) diameter pump powered by a 7 hp engine has an output of approximately 40 liters per second (145 m^3/hr or 635 gallons/min) for a lift of 1.5 m. This capacity is 2 or 3 times higher than that of either a centrifugal pump or an axial-flow pump using a boat propeller, for the same lift and engine power. The difference is due to the specially designed propeller which provides highest efficiency for low-lift pumping.

MAF-IRRI "SIPA" PUMP

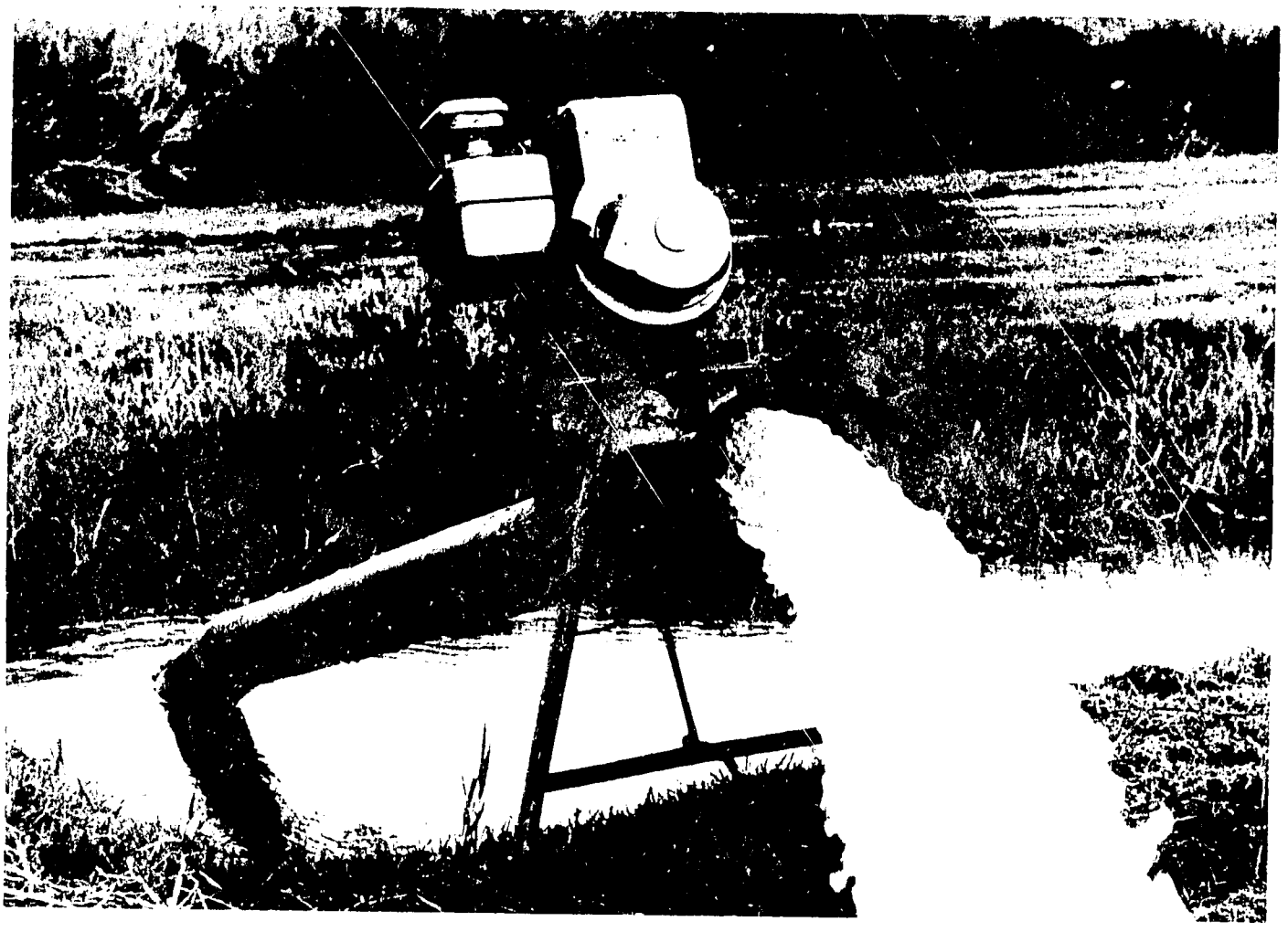


Technical information and blueprints may be obtained from:

MAF-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

Telephone: 50-08-01
59-81-14



AXIAL FLOW PUMP for FISHPOND OPERATIONS

- TILAPIA - - BANGUS (MILKFISH) - - PRAWNS -

- Useful for pumping water for:

  * draining and filling fishponds
  * adding water to control salinity, temperature, transparency, (turbidity), etc.
  * "refreshing" water when stocking density is high
  * aerating pond water to prevent oxygen depletion
  * harvesting by "pasuba" method in low tidal range fishponds
  * enabling efficient and effective fishpond water management

- The Axial Flow Pump is:

  * Suitable for brackish or fresh water
  * Portable
  * Self-Priming
  * More economical than centrifugal pumps for low-lift (low head) applications

(See reverse side for Technical Information)

TECHNICAL SPECIFICATIONS

Axial flow pumps are available in different sizes to meet your particular pumping need. Information on three common sizes are given below:

Pump Specifications	Diameter of Pump Tube		
	15 cm (6 inch)	20 cm (8 inch)	25 cm (10 inch)
Power:			
Gasoline or diesel engine (hp)	5	7	10
Electric motor (kw)	2	3.5	5
Pumping Capacity*			
Cubic meters per hour	145	250	410
Gallons per minute	635	1100	1800
Total Lift (vertical distance from water surface to pump discharge)	From 0 to approx. 3 m (0 to 10 feet)		
Weight, without engine (kg)	45	55	65
Materials			
For fresh water :	- - - Common steel - - -		
For brackish water :	- - Stainless steel - -		
Power transmission	- Direct coupled or belt drive -		

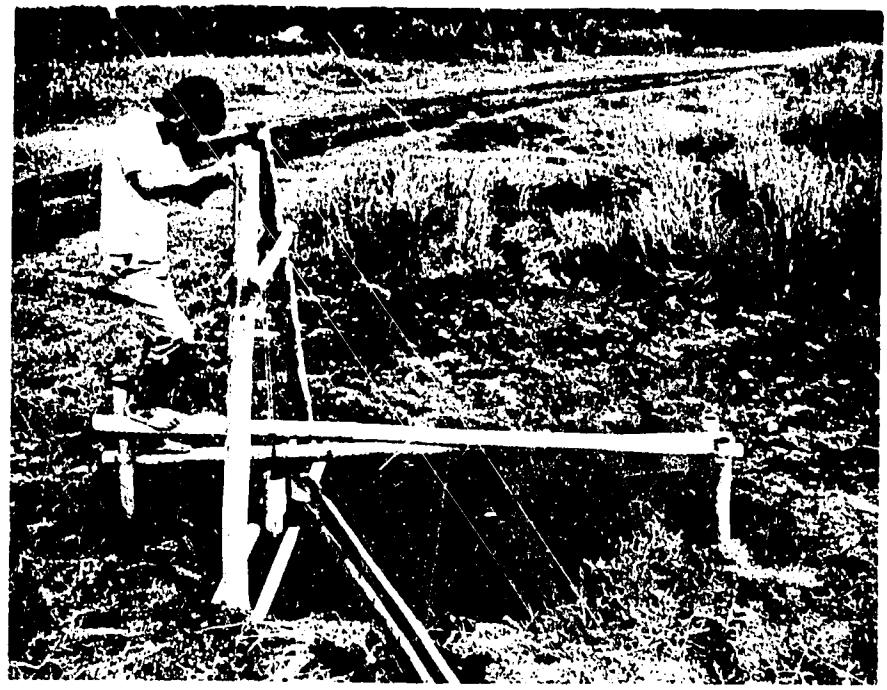
*NOTES:

1. The power requirement and pumping capacities given above are for lifting water 1.5 m (5 ft); the capacity increases as the lift decreases.
2. IRRI performed a test to compare the capacities of axial-flow (15 cm) and centrifugal pumps when powered by the same 5 hp gasoline engine. For a lift of 1.5 m (5 ft), *the capacity of the axial flow pump was approximately 3 times greater than that of the centrifugal pump.* This means that to pump the same amount of water the centrifugal pump requires 3 times more fuel than the axial flow pump.

For further information, contact:

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

MA-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT



MA-IRRI "TAPAK-TAPAK" PUMP

Ideal for small-farm irrigation where engine-driven pumps are generally too expensive and bucket-lifting by hand is limited to very small areas because of its high labor requirement.

ADVANTAGES

EASY TO OPERATE: Uses the body weight and leg muscles; less tiring than conventional pumps which use arm and back muscles.

LOW COST: About ₱500.00 (US $25) for all materials and labor for complete pump, including bamboo framework (but excluding cost of digging or drilling the well).

SIMPLE CONSTRUCTION: Can be fabricated from locally available materials using common shop tools, thereby reducing cost and simplifying maintenance and repair.

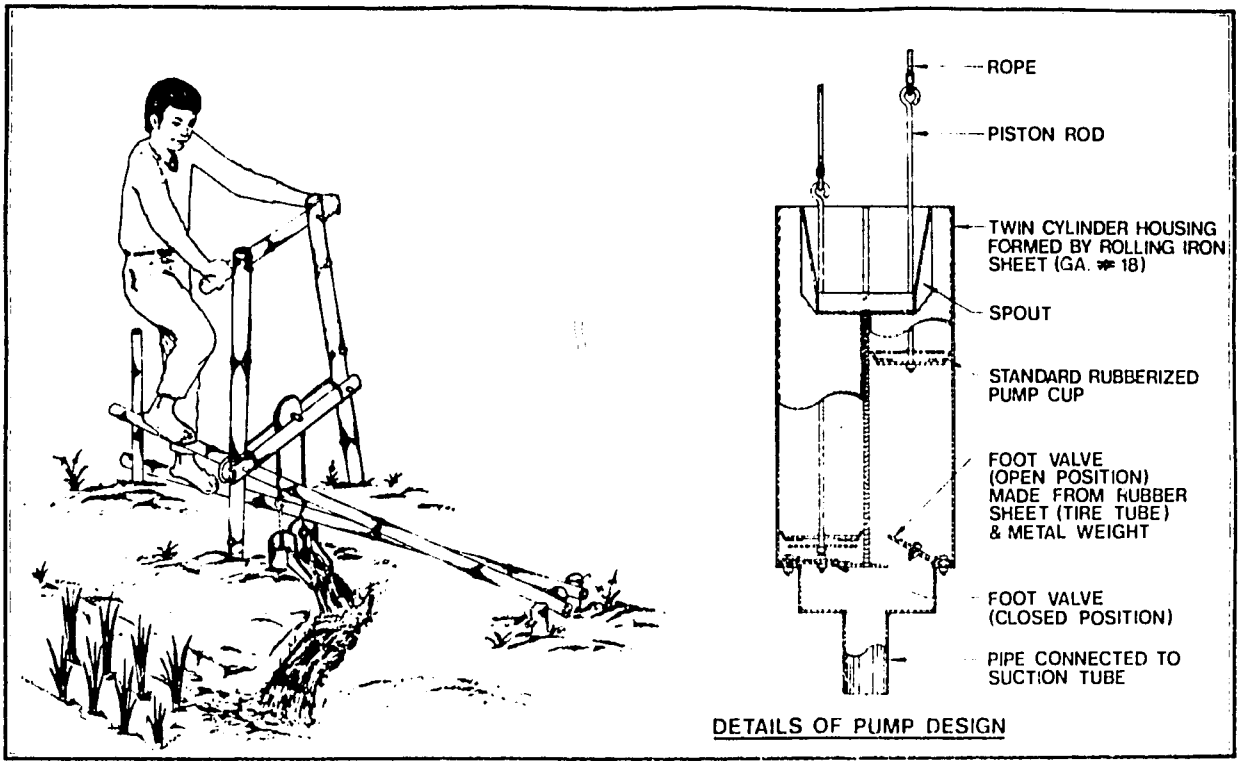
ADAPTABLE: Can be portable or stationary; suitable for open-pit wells, tube wells, canals, lakes, and rivers; no priming required for depths as great as 5 meters (16 feet).

HIGH CAPACITY: Due to the effective use of the body weight and the twin pump cylinders, the capacity is higher than for most low-cost manual pumps. Approximate capacities are:

3 liters/second (48 gallons/minute) for a 2 meter lift.
2 liter/second (32 gallons/minute) for a 4 meter lift.

- /over/ -

MA-IRRI "TAPAK-TAPAK" PUMP*



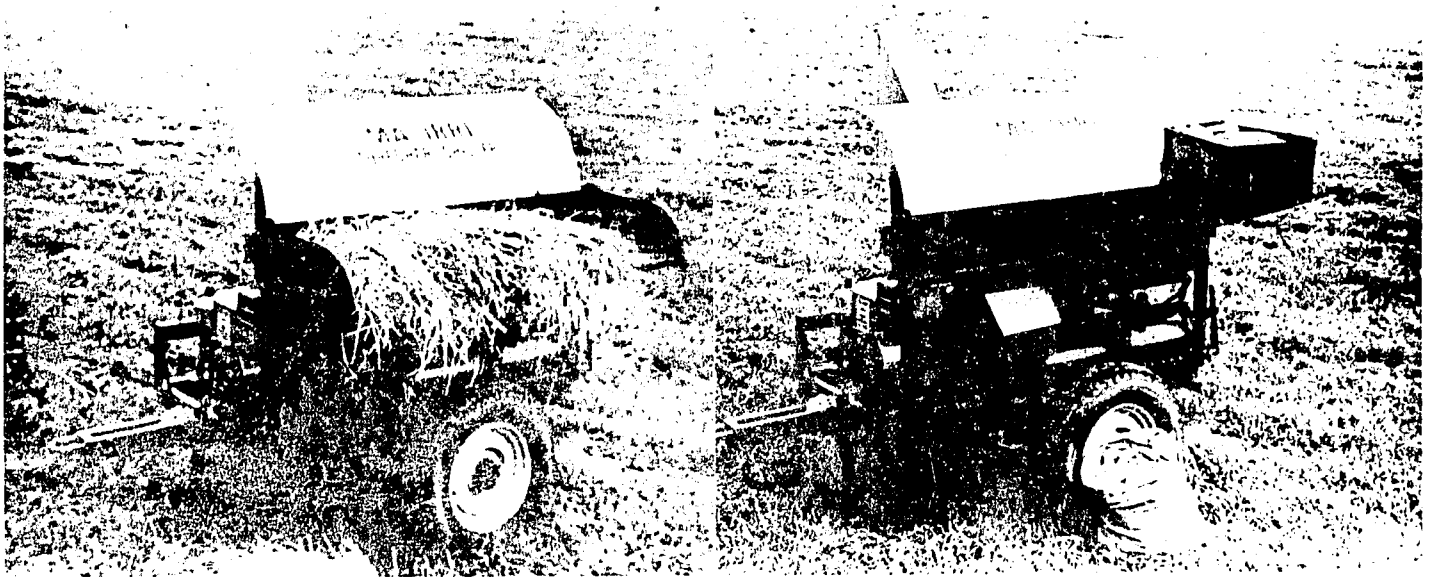
Technical information and blueprints may be obtained from:

MA-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

Telephone: 59-81-14

*Note: The Tapak-Tapak Pump is based on a design developed in Bangladesh by the Rangpur Dinajpur Rehabilitation Service.



RICE THRESHER — converts in 15 minutes to — CORN SHELLER

MA·IRRI THRESHER/SHELLER

The popular axial-flow thresher* has been modified so that the same machine may be used both as a corn sheller and as a rice thresher.

ADVANTAGES

- o Economical: - The cost of the thresher/sheller is only about 5% higher than the cost of a conventional axial-flow thresher.
- o Convenient: - Easy to change from threshing to shelling in less than 15 minutes; only five components are modified (see details on reverse side).
- o Versatile: - Even existing (used) threshers may be modified at low cost. Capable of shelling all sizes and varieties of corn.
- o High Performance: - Comparable to single-purpose corn shellers:

Corn:	Capacity**	Up to 5 tons per hour
	Shelling Efficiency**	over 99%
	Total Shelling Loss**	less than 0.3%
	Kernel Breakage**	less than 2.5%
	Cleaning Efficiency**	over 99% purity
Rice:	Capacity	20-30 cavans (1-1.5 tons) per hour
	Separation Recovery	98% (weight basis)

*Originally designed by IRRI (Phil. Patent No. 12001; U.S. Patent No. 3776242).

**Performance data of AMTEC for modified TH8 thresher with 16 hp gasoline engine or 11 hp diesel engine and built-in grain cleaner (oscillating screen with blower).

- /over/ -

MA·IRRI THRESHER/SHELLER

ONLY 5 COMPONENTS ARE MODIFIED TO CONVERT THRESHER TO SHELLER:

① Concave grill is strengthened by using heavier bars and/or extra lateral reinforcing bars.

② Hopper to facilitate feeding corn into the machine is installed in place of the horizontal tray used for feeding paddy.

③ Baffle is installed in discharge tube to prevent passage of corn cobs and kernels.

④ Door in side-wall of discharge tube is opened to allow cobs and kernels to pass to oscillating screen.

⑤ Oscillating screen for paddy is replaced with one having larger holes for corn kernels.

Detailed information may be obtained from:

MA-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

Telephone: 59-81-14

MAF-IRRI INDUSTRIAL EXTENSION PROGRAM FOR SMALL FARM EQUIPMENT

HAND-OPERATED CORN SHELLER

Ideal for farmers with small landholdings who cannot afford to buy or rent engine-driven corn shellers but find that shelling by hand is too slow and laborious.

FEATURES

EASY TO OPERATE: Operated by one person who rotates the shelling cylinder with one hand while pressing the corn ear against the cylinder with the other hand.

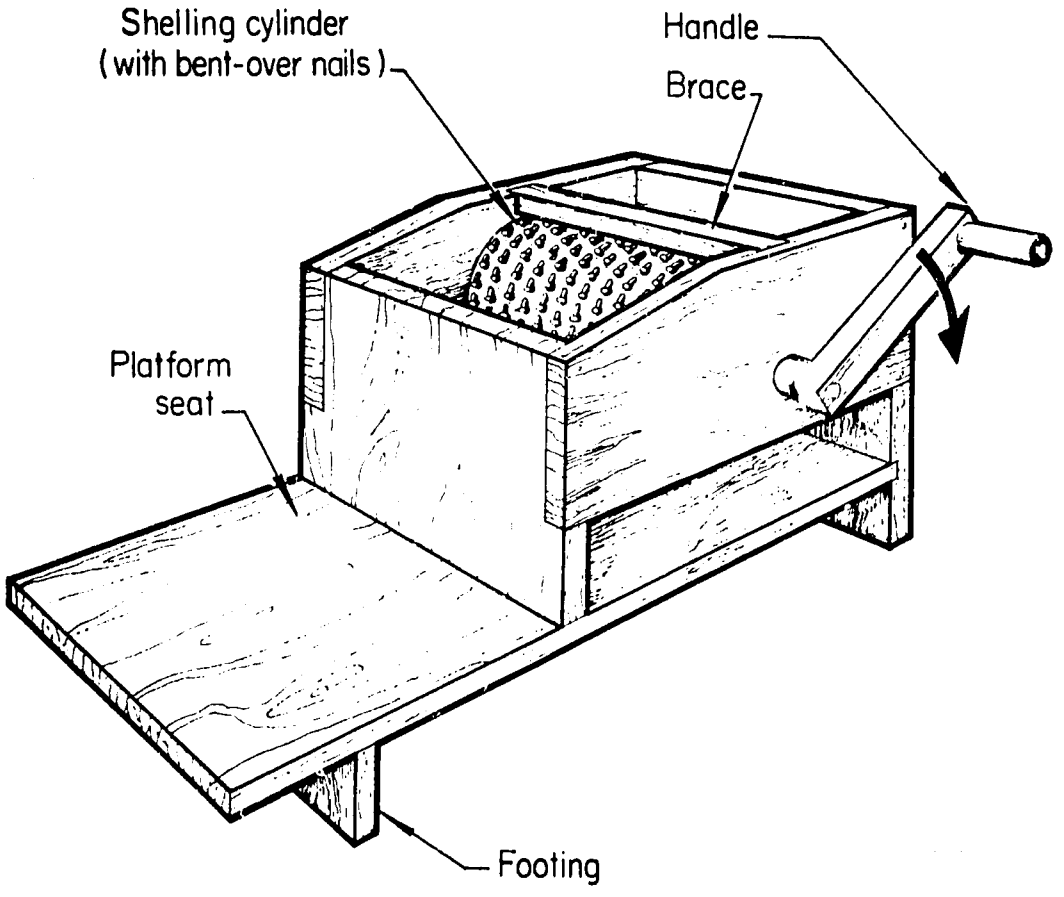
LOW COST: From ₱250.00 to ₱350.00 for all materials and labor.

SIMPLE CONSTRUCTION: Easy to fabricate with tools and materials available in rural areas.

HIGHLY PORTABLE: Can be carried by one person. (Weight = 15-20 Kg.)

CAPACITY: 300-400 Kg. of shelled kernels per day (8 hours), depending upon operator's skill.

HAND-OPERATED CORN SHELLER



Technical information and plans may be obtained from:

MAF-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

Telephones: 50-08-01; 59-81-14

Note: The hand-operated corn sheller was developed by the MAF-PHIL-AUSTRALIAN Program in Zamboanga del Sur.

IRRI TR4 6-Row rice transplanter

FEATURES

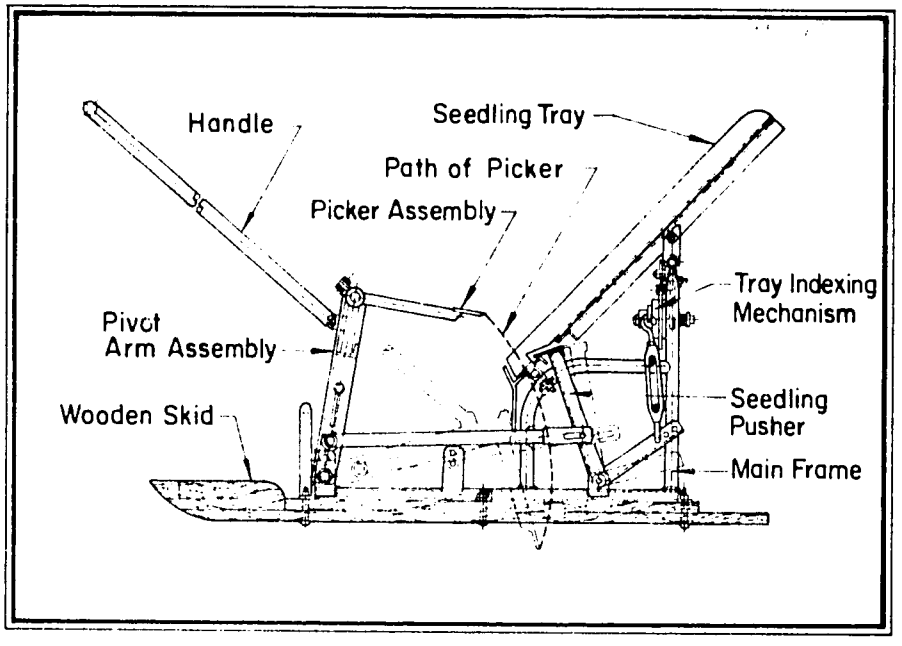
HIGH CAPACITY _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ 0.3 - 0.4 hectare per day, depending upon the skill of the operator.

EASY TO OPERATE & MAINTAIN _ _ _ _ _ _ _ Machine is operated by single push-pull of the handle. Requires few adjusments.

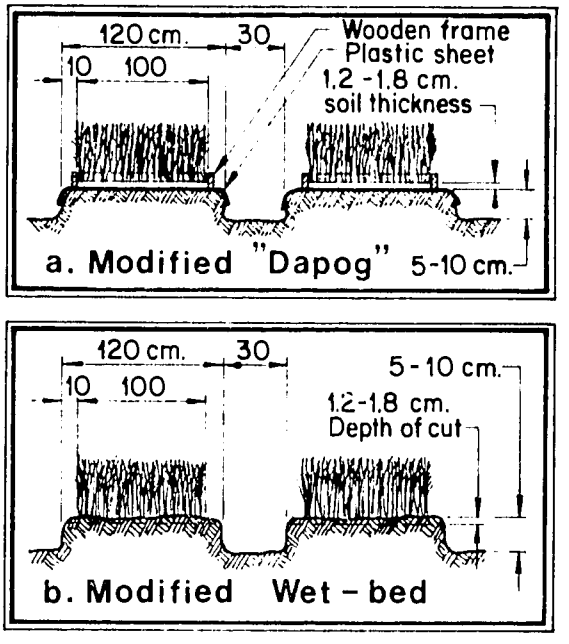
LOW POWER REQUIREMENT _ _ _ _ _ _ _ _ _ Machine is operated by one person.

SIMPLE CONSTRUCTION _ _ _ _ _ _ _ _ _ _ Can be fabricated by small shops using readily available materials.

HIGHLY PORTABLE _ _ _ _ _ _ _ _ _ _ _ _ _ Can be carried by one or two persons.



Schematic of IRRI 6-Row Mechanical Rice Transplanter



SEEDLING PREPARATIONS suitable for IRRI Mechanical Transplanter.

MACHINE SPECIFICATION

POWER _____ 1 person

FIELD CAPACITY _____ 0.3 - 0.4 ha. per day

PLANTING DEPTH _____ 3 to 5 cm.

TRAY DISPLACEMENT PER STROKE ADJUSTMENT _____ 1.0 / 1.3 cm.

FIELD STANDING WATER DEPTH _____ 1 to 5 cm.

WEIGHT _____ 20 kgs.

LENGTH _____ 85 cm.

WIDTH _____ 125 cm.

CONSTRUCTION _____ steel and wood

SEEDLING PREPARATION :

SIZE OF SEEDLING MAT _____ 20 cm. x 50 cm.

NO. OF SEEDLING MAT PER HECTARE _____ 400 - 450

SIZE OF SEEDBED PER HECTARE _____ 1.2 m. x 45 m.

SEED REQUIREMENT PER HECTARE _____ 30 - 40 kgs.

For further information write: Agricultural Engineering Department
The International Rice Research Institute
P.O. Box 933, Manila, Philippines
Cable : RICEFOUND, MANILA

SEED AND FERTILIZER APPLICATOR (SFA)

For planting:

- CORN
- SORGHUM
- MUNGBEAN
- SOYBEAN
- UPLAND RICE

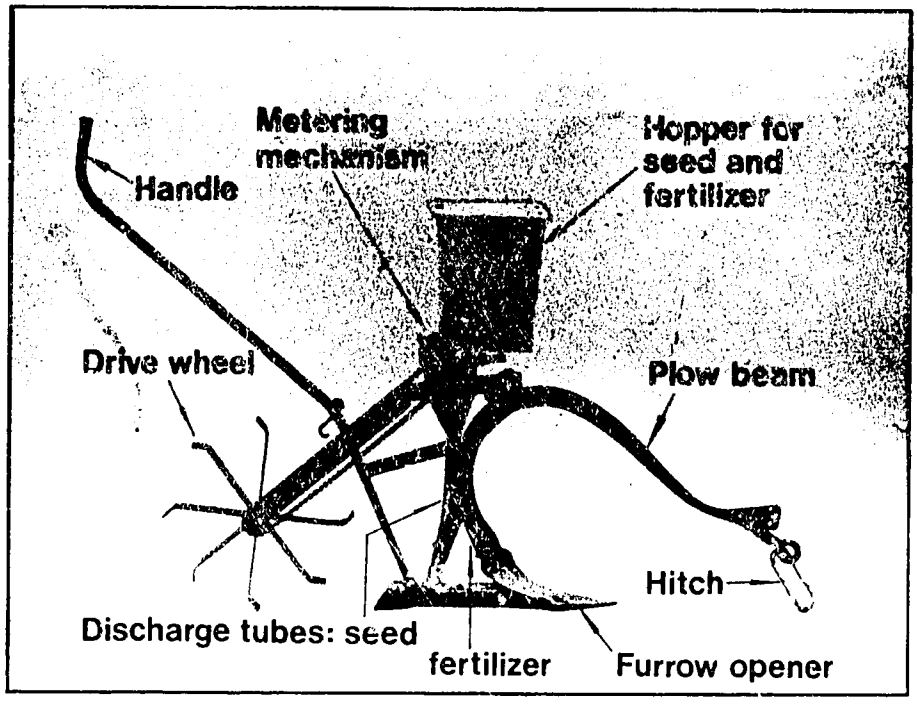
In a single operation, this unit makes a furrow and applies fertilizer, seeds, and a soil covering over the seeds.

Features:

* Rates of application of fertilizer and seed are easily adjusted by changing the metering rollers
* Fertilizer is placed at the desired depth below and to the side of the seeds
* Seed spacing is adjusted by changing the metering roller or press wheel
* Thickness of soil covering on seeds is easily varied
* Saves on fertilizer, seeds, and labor
* Low cost; easy to fabricate with tools and materials available in rural areas

-/OVER

SEED AND FERTILIZER APPLICATOR (SFA)



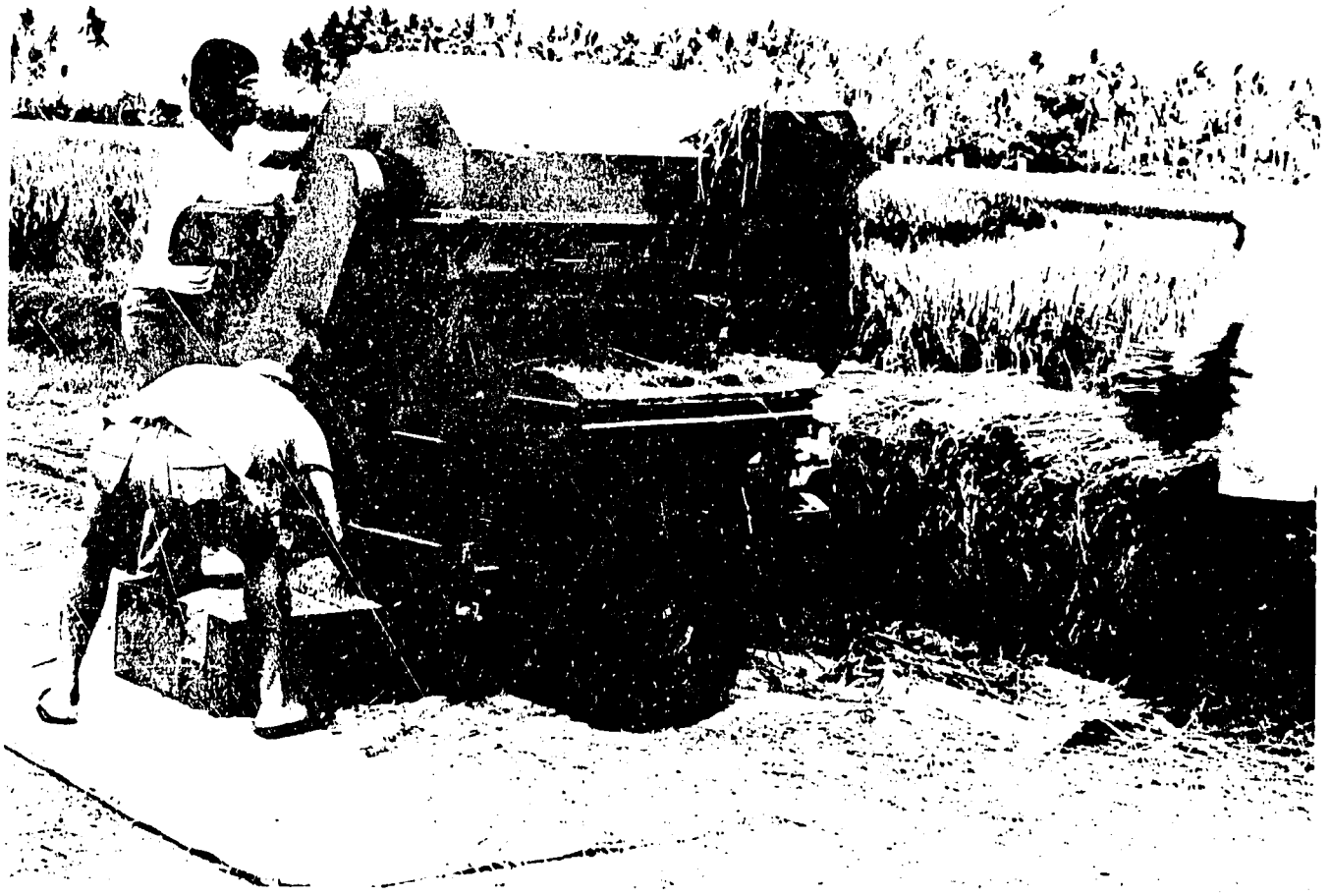
Technical information and blueprints may be obtained from:

MA-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

Telephone: 59-81-14

IRRI TH8 axial flow thresher



FEATURES

HIGH OUTPUT . . . . . Up to one ton per hour when threshing paddy

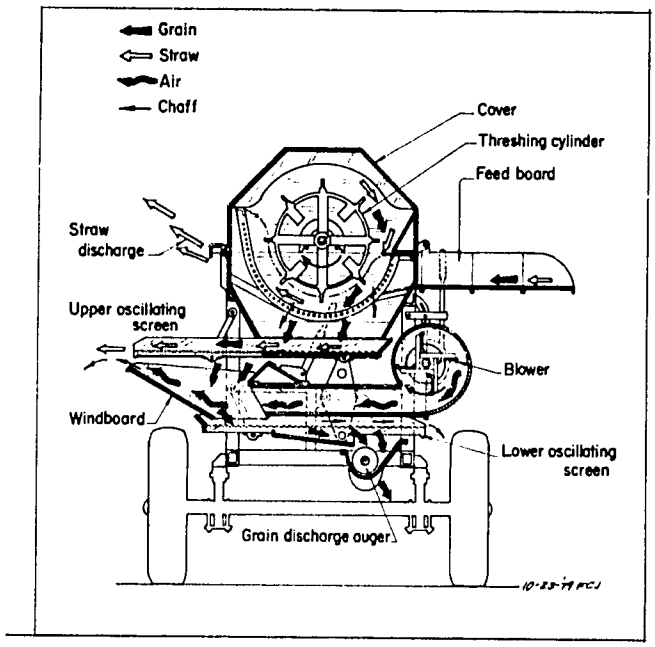
LOW HORSEPOWER REQUIREMENT . . . . . 10 hp engine

LOW LABOR REQUIREMENT . . . . . Three to four men to feed, thresh, and bag grain

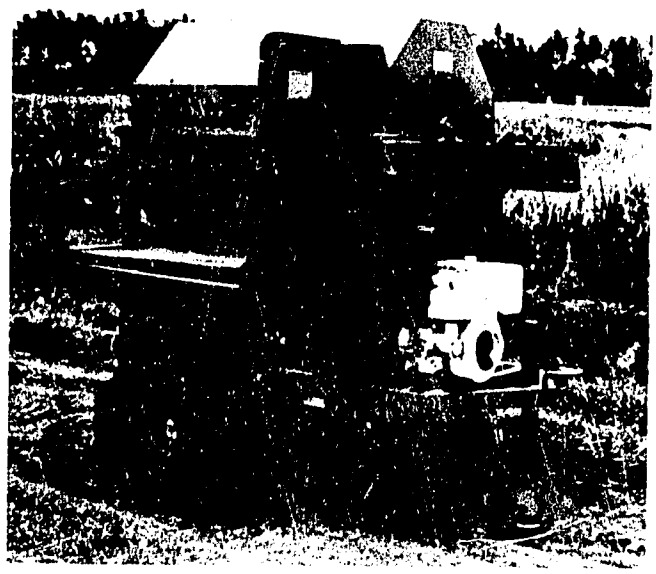
EASE OF OPERATION . . . . . Simplicity of design reduces operation and maintenance problems

THRESHING AND WINNOWING COMBINED . . . . . Throw-in threshing combined with an air and double screen cleaning system

HIGHLY MOBILE . . . . . Can be pulled by a power tiller, light truck, or animal



Schematic of thresher



Compact design

Machine specifications

POWER	10 hp engine
WEIGHT (with engine)	465 kg
LENGTH	190 cm
WIDTH (with tray folded up)	150 cm
HEIGHT	178 cm
FIELD CAPACITY	800-1000 kg/hr (rough rice)
GRAIN BREAKAGE	less than 4%
SEPARATION RECOVERY	98% (weight basis)
CYLINDER (open type)	Spiketooth, 39.4 cm O.D. x 111 cm length
CONSTRUCTION	All steel
COMPONENT SPEEDS	
Cylinder	540-600 rpm
Fan	800 rpm
Oscillating screen (frequency)	340 cycles/min
Oscillating screen (stroke)	3.2 cm
ADJUSTMENTS	Blower shutter, angle of windboard
LABOR REQUIREMENTS	3-4 men

For further particulars write: International Rice Research Institute, P. O. Box 933, Manila, Philippines
Cable: RICEFOUND, MANILA

52

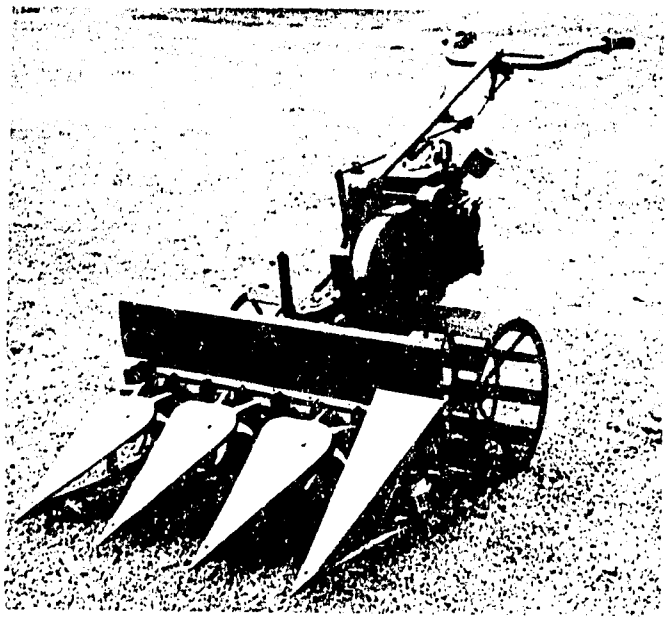
CAAMS*-IRRI 1.0m reaper

Harvests paddy of different varieties

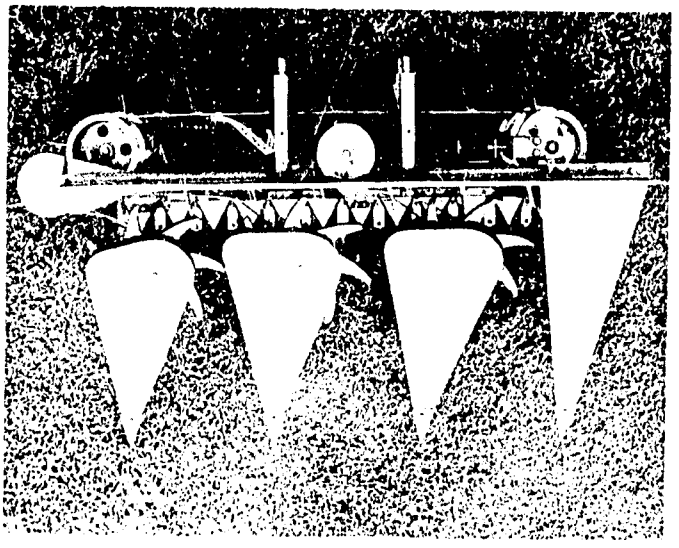
FEATURES:

HIGH CAPACITY	2.4 hectare per day
LOW HORSEPOWER REQUIREMENT	3-hp engine
LOW LABOR REQUIREMENT	One to three men to operate, prepare plots and gather crop.
EASE OF OPERATION	Simplicity of design - reduces operation and maintenance problem.
HIGHLY MOBILE	Can be operated and carried with ease

* CHINESE ACADEMY OF AGRICULTURAL MECHANIZATION AND SCIENCES



Compact design



Reaper is adaptable to other hand tractor unit

Machine specifications:

POWER	3 hp gasoline engine
WEIGHT OF REAPER-TILLER UNIT	135 kg
WEIGHT OF REAPER ALONE	48 kg
TOTAL LENGTH OF REAPER PLUS 3 HP TILLER	218 cm
TOTAL WIDTH	117 cm
TOTAL HEIGHT OF 3 HP TILLER, MINIMUM	90 cm
FIELD CAPACITY	2.4 hectare per day
FIELD LOSSES	Less than 1%
MINIMUM CUT	7 cm
FORWARD SPEED	2.5 to 4.5 kph
KNIFE AVERAGE SPEED	1.3 x forward speed
CONSTRUCTION	All steel except the non-metallic starwheels
ADJUSTMENT	Throttle (synchronized with cutting speed), flat belt tension, windrow deflector.
FUEL CONSUMPTION	Approximately 1 liter per hr

For further information write: Agricultural Machinery Development Program
International Rice Research Institute
P.O Box 933, Manila, Philippines
Cable: RICEFOUND, MANILA

IRRI Inverted-T Seeder
for rice-based crops establishment

Features

a. Seed groove opener which creates soil micro-environment best suited for seed germination, root penetration and seedling emergence.

b. Precise seed depth control.

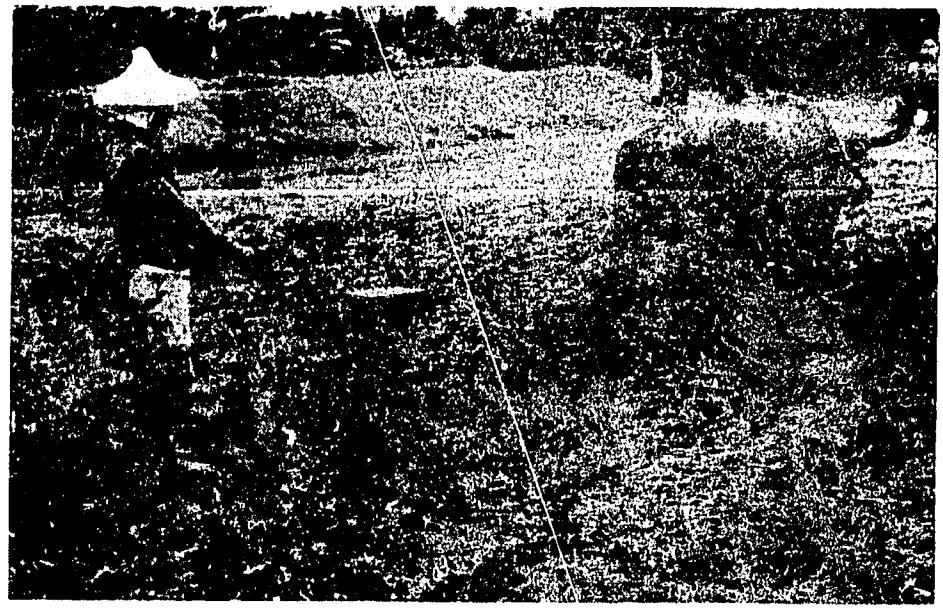
c. Presswheel(s) to provide seed cover and seed-soil contact as required.

d. Ability to sow both in the previously tilled and untilled soils.

e. Crop residue or trash (left lying or standing after previous harvest) handling ability.

f. An accurate and even seed metering mechanism, utilizing a foam-pad, to sow wide range of seed species without any damage.

g. Ability to meter and apply granular fertilizers accurately.



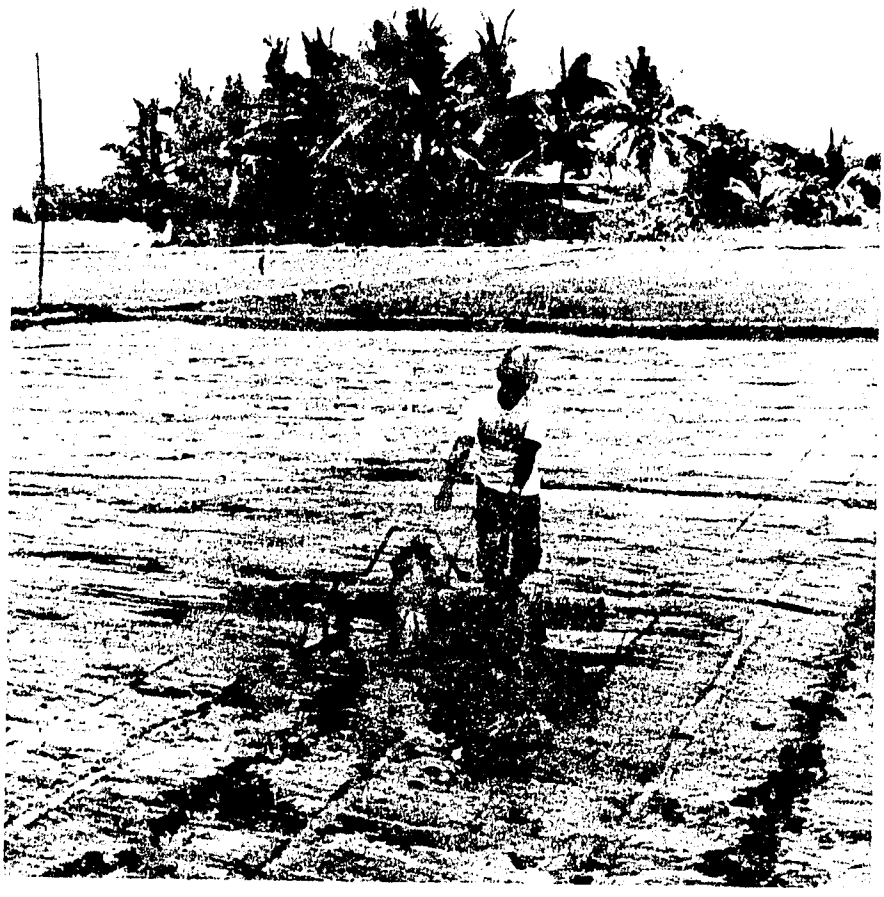
Seed and fertilizer field calibration rate with 1.15-m circumference drive wheel (to be use as a guide only).

CROP	Drive sprocket ratio 36T/18T (2:1)	56T/18T (31:1)	36T/9T (4:1)	56T/9T (6.2:1)	Variety used in test: g /1000 seeds
	No. of seeds per meter of travel *				
Peanut	13	9	7	4	UPL PN-2 : 312.6
Soybean	25	20	15	10	UPL SY-2 : 150.5
Mungbean	83	52	42	30	PAGASA 1: 54.0
Cowpea	40	29	23	12	TVX-1836-19E: 116.2
Pigeon pea	63	42	33	23	ICPL-8 : 71.6
Corn	22	14	9	6	IPB VAR 1: 264.6
	Grams per meter of travel *				
Wheat	5.9	3.6	2.9	1.8	Trigo-1 : 20.2
Sorghum	4.2	3.1	2.1	1.4	SG-5 : 20.0
Rice	4.6	3.0	2.2	1.4	IRAT 13 : 35.4
	4.6	3.0	2.4	1.6	UPL Ri-5 : 23.9
	3.7	3.3	2.6	1.7	N22 : 14.9
Crotolaria	3.9	3.4	2.4	1.6	Jun Zea : 38.7
Sesbania	4.7	2.9	2.3	1.4	S.Rostrata : 18.0
Fertilizer	Application rate, g/m row				Type of fertilizer
Urea	2.8	1.7	1.3	0.9	Prilled
	5.4	3.5	2.7	1.7	Forestry grade
	5.3	4.0	3.2	1.9	Super granule
Complete	5.3	3.4	2.5	1.6	(14-14-14)

* Averaged over 20-meter travel. T = No. of teeth (metering sprocket/wheel sprocket)

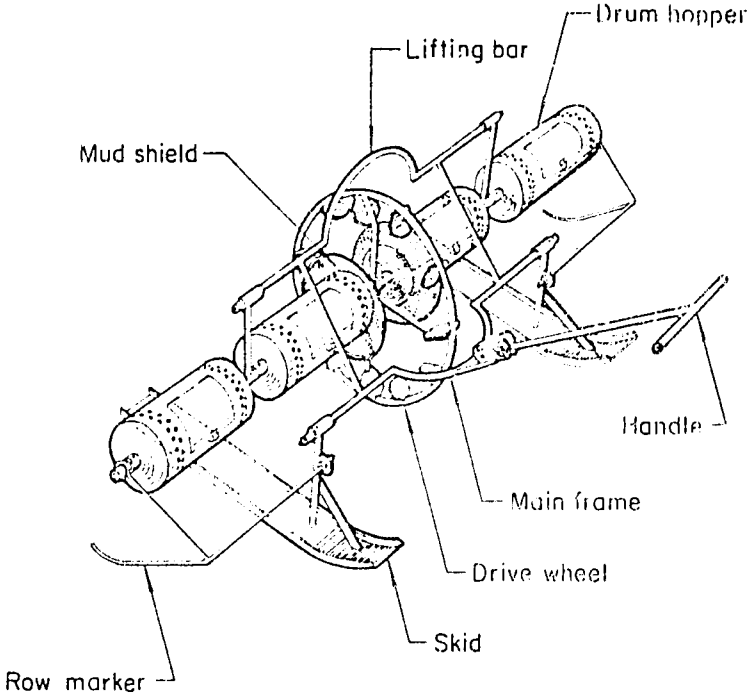
For further particulars write:
Agricultural Engineering Dept., International Rice Research Institute, P.O. Box 933, Manila, Philippines.
Cable: RICEFOUND, Manila.

IRRI Drum Seeder for Wetland Paddies



SAVES SEED & FACILITATES MECHANICAL WEEDING

Transplanting of paddy is a costly labor intensive operation. This low-cost machine was developed for row seeding of pre-germinated paddy on puddled soils. Since mechanical weeding is not possible in broadcast seeded fields, farmers must spend much labor for manual weeding or must apply costly herbicides. This machine seeds paddy in neat rows which can be conveniently weeded with push type mechanical weeders. This machine permits uniform seeding at fairly low seed rates of 50-100 kg/ha thus savings substantial amount of seeds as compared to traditional broadcasting method.



The 8-row drum seeder

Features

SAVES SEED - Can save 50 to 70% seeds over broadcast seeding.

CONVENIENT ADJUSTMENT OF SEED RATES - Can apply 50 , 75 and 100 kg/ha seed rate with simple adjustment.

SIMPLE DESIGN - Simple for easy fabrication, operation and maintenance. Made of light weight tubing & sheet metal.

LOW POWER REQUIREMENT - The machine is easy to pull. The 8 row seeder requires only 9 kg of pulling force to operate.

LOW - COST - Economic to operate and maintain. Pays for itself in only one seasons use.

ROW SPACING - Can be easily manufactured for any row spacing between 15 to 25 cm.

NO OF ROWS - Designs available for 8 & 12 row models.

Specifications

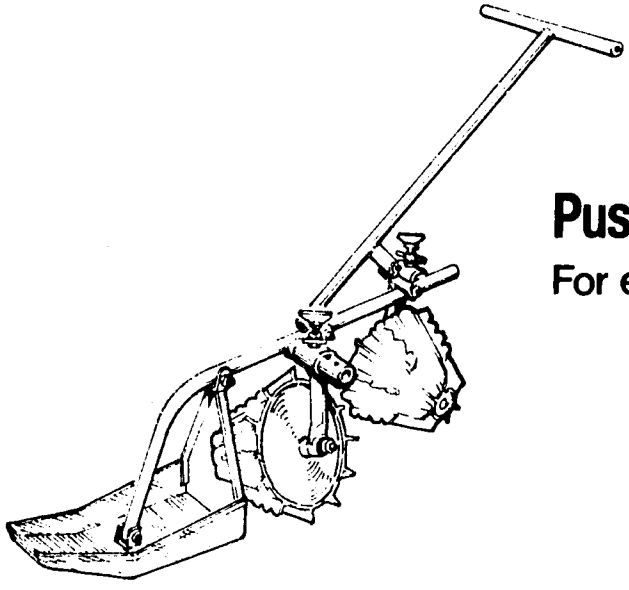
NUMBER OF OPERATOR REQUIRED.....	1 person
SEED CAPACITY.....	8 kg (2 kg per hopper)
SEEDING OUTPUT PER DAY.....	About 1 ha
SEEDING LABOR REQUIREMENT.....	14 man hrs/ha.
MACHINE WEIGHT (without seed).....	11 kg

.AGRICULTURAL ENGINEERING DEPARTMENT.
THE INTERNATIONAL RICE RESEARCH INSTITUTE
P.O. BOX 933 o MANILA o PHILIPPINES

Push type single row cono-weeder

For easy & faster weeding of lowland paddies

Manual weeding requires an average of 120 manhours to weed one hectare. Conventional single-row rotary weeders require 80-90 manhrs to weed a hectare. These weeders are difficult to push and must be moved back and forth for proper operation. The IRRI Cono-Weeder utilizes a novel concept for uprooting and burying weeds with conical shaped rotors. This weeder creates a horizontal back & forth movement in the top 3 cm soil layer, where most of the weeds grow. It can weed satisfactorily in a single pass without requiring a back and forth movement. Power requirements are low as only a small quantity of soil is worked during weeding. This cono-weeder is about twice as fast to operate as conventional rotary weeders. The machine can be easily operated by women and children.



Push type single row cono-weeder

For easy & faster weeding of lowland paddies

MACHINE DESCRIPTION

This weeder has two conical shaped rotors, mounted in tandem with opposite orientation. Smooth and serrated blades are alternately mounted on the conical rotors to uproot and bury weeds. The portion of the blades on the larger end of the cones produce greater horizontal soil movement. Opposite orientation of the two rotors provides uniform weeding across the full width of the machine. A small skid in front of the rotor provides sufficient floatation in soft flooded paddies.

The pushing force of this machine is about half that required by conventional rotary weeders. The machine can be set for crops planted in 15-22.5 cm row spacings by offsetting the two rotors. The handle height can be adjusted to suit different operators. A two-row cono-weeder has also been developed which permits 3 to 4 times faster weeding than conventional single-rotary weeders. Engineering drawings of these weeders are available free of cost to Interested manufacturers.

MACHINE SPECIFICATIONS

No. of operators required	1 man
Labor required	40-50 manhours/ha
Average field capacity	0.18 ha/day
Average pushing force	4.4 kg
Weight	3.7 kg
Length	165 cm
Width	45 cm
Construction	All steel, tubular frame & sheet rollers

• AGRICULTURAL ENGINEERING DEPARTMENT •

THE INTERNATIONAL RICE RESEARCH INSTITUTE

P.O. BOX 933 ° MANILA ° PHILIPPINES

BPI CASSAVA CHIPPING MACHINE

Function:

For cutting cassava tubers or other root crops into chips to improve drying and storage.

Advantages:

- high capacity; powered by pedal or engine
- adjustable blades for desired chip thickness
- except for the blades, little maintenance is required
- low cost; simple in design and easy to fabricate
- saves on time and labor

Specifications:

Power requirements	a) foot pedal; or b) small motor or engine (1-3HP)
Weight	70 kgs
Length	76 cm
Width	76 cm
Height	91 cm
Power transmission	a) bicycle chain and sprocket when powered by pedal; b) V-belt when powered by engine
Capacity	a) 300 kg/hr when powered by pedal; b) 1300 kg/hr when powered by engine

Technical information and blueprints may be obtained from:

MA-IRRI INDUSTRIAL EXTENSION PROGRAM
FOR SMALL FARM EQUIPMENT

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

ANNEX C

REVISED
(15 September 1986)

PROPOSAL

for

MAF-IRRI PROGRAM FOR SMALL FARM EQUIPMENT

Summary

A continuation of the MAF-IRRI Program for Small Farm Equipment is proposed for 10 months, 1 October 1986 through 31 July 1987. The objective is to establish MAF's capability for the development and extension of agricultural equipment suitable for: (a) improving the income of small farmers, especially those in rainfed and upland areas; and (b) increasing production of priority crops, such as rice, yellow corn, sweet potato, and legumes. The practical output will be local manufacture of low-cost equipment that will increase income and employment on small farms (e.g., irrigation pumps and minimum-tillage planters which enable crops to be grown during the dry season).

The unique feature of the present Program is that it effectively combines the particular strengths of MAF and IRRI, together with direct participation by innovative manufacturers and farmers. Therefore, it is recommended that the same relationship be maintained for the proposed continuation.

At the request of MAF and NEDA, the continuation will be partially supported by a grant to IRRI from USAID/Manila under the Rainfed Resources Development Project. Described herein are the objectives, implementation plans, and budget.

1. INTRODUCTION

In 1981 the Ministry of Agricultural and Food (MAF) and the International Rice Reserch Institute (IRRI) initiated a collaborative project entitled "MAF-IRRI Industrial Extension Program for Small Farm Equipment". The project was financed by a grant to IRRI from USAID/Washington for the purpose of assisting national institutions in four developing countries to strengthen their capabilities for the development and extension of locally-made agricultural equipment suitable for small farms.

The attached briefing paper provides a summary of the MAF-IRRI Program's activities and accomplishments. The principal achievements are:

a. A central office for the Program has been established at the Bureau of Plant Industry (BPI), where 8 engineers are participating on a part-time basis. The Program also has part-time participation of MAF engineers located in each of the twelve agricultural regions. (See Annex I.)* These engineers have received training at IRRI, BPI, and in the field, and are now responsible for demonstration and promotion of MAF-IRRI equipment in their regions, together with providing technical assistance to cooperating manufacturers.

b. Over 200 cooperating manufacturers have joined the Program. These manufacturers are located in all of the major agricultural areas of the country, as well as in the principal cities. (See map in Annex II.)*

c. The Program is actively promoting eight types of small-scale agricultural equipment, and it is currently developing four other promising types of equipment. (See annexes.)* Cooperating manufacturers have responded by requesting over 550 sets of technical drawings for these equipment, and over 130 prototype units have been loaned by the Program to manufacturers to facilitate fabrication of their first units.

d. Collaboration has been established with all 12 MAF Regional Offices, which includes research (RIARS), extension, and special projects, such as: the Farming Systems, Rainfed Resources, and Kabsaka projects; and the Philippine-Australian Development Projects (Zamboanga del Sur and Northern Samar).

e. In our opinion, the Program's most important achievement is the development of synergistic efforts which combine: (a) the high-level science and technology of IRRI; (b) the regional R&D and extension capabilities of MAF; and (c) the practical "know-how" and innovations of exceptional manufacturers and farmers. This participatory approach has resulted in substantial advances, as described in Section 3.

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*Annexes I-XVII have been omitted because most of this information has been included in Annex B of this final report.

The MAF-IRRI Program was evaluated in 1984 by representatives of USAID, MAF, the manufacturing sector, and the Bureau of Small and Medium Industries (Ministry of Trade and Industry). The principal recommendation of the evaluation team was that the Program should be continued at least until October 1987 to "enable BPI to gain needed additional institutional capability and to maintain its recently acquired momentum". The purpose of the present proposal is to suggest the objectives, institutional collaboration, and budget for the continuation.

2. OBJECTIVES

The purpose of the proposed project is to establish MAF's capability for the development and extension of locally-manufactured agricultural equipment which will benefit small farmers who are among the principal target groups of government programs, such as:

a. Farmers whose economic status is below average because of small landholdings, the lack of irrigation (i.e., areas which are totally rainfed or have irrigation only during part of the year), poor soils and/or water control (e.g., eroded or flooded areas), and/or inadequate infrastrature (e.g., inadequate postharvest facilities).

b. Farmers who are potential producers of priority crops, such as yellow corn, sweet potato, soybeans, and rice.

At first, the MAF-IRRI Program promoted existing IRRI-designed equipment that generally are most appropriate for irrigated rice farms. However, during the last three years the Program has begun to direct its effort towards rainfed areas and upland crops. The Tapak-tapak pump, Sipa pump, sweet potato chipping machine, thresher/sheller, and seed and fertilizer applicator are concrete examples of this effort.

The specific objectives for the proposed continuation of the Program are:

a. Develop and promote equipment suitable for small farmers lacking irrigation during part or all of the year. Examples: (1) low-cost pumps (Annex III and IV); (2) minimum tillage and planting devices to conserve residual moisture and/or reduce the time and risk of crop establishment (Annex V); (3) manually-operated rice seedling transplanter to speed up the establishment of a second rice crop in a rainfed cropping pattern (Annex VI); (4) manually-operated row seeder (Annex VII) to replace direct seeding by broadcasting, - a practice which pushes farmers to use herbicides, whereas the row seeder enables them to use the manually-operated push weeder (Annex VIII).

b. Develop and promote low-cost postharvest equipment (e.g., dryers, chipping machines, threshers and shellers; (Annexes IX, X and XI) that will reduce losses due to deterioration and will increase the prices received by farmers for their products. Proposed new priorities for 1986-87: improved sundrying practices (Annex XI); the IRRI warehouse-type dryer; and the MAF-IRRI rotary dryer (Annex XII).

c. Develop and promote equipment that will help farmers to increase the production of priority crops such as rice, yellow corn, sweet potato, and soybean. Examples: (1) seed and fertilizer applicator which economizes on fertilizer by proper placement (Annex XIII); (2) animal-drawn weeder suitable for weeding corn earlier than the present farmers' practice of using the traditional plow (weeds are often the major problem of upland crops); (3) postharvest equipment (as described above).

d. Strengthen collaborative work with the ARO and PARS system, as well as with agricultural colleges and universities. The Program has collaborated with: UPLB on corn shellers and rice transplanters; VISCA on chipping machines and seed and fertilizer applicators; CLSU on the Tapak-tapak pump; University of Eastern Samar on training.

e. Strengthen manufacturers of agricultural equipment suitable for small farms. This involves continuation of training, technical assistance, and prototype testing.

3. PROPOSED MAF-IRRI COLLABORATION

The experience of the past five years indicates that the primary strength of the MAF-IRRI Program is that it combines the unique capabilities of the two institutions, MAF and IRRI, in an effective manner to achieve the desired objectives. The capabilities of MAF and IRRI are complementary, and both are essential to the Program's success. For example, through its direct contact with farmers in all regions of the country, MAF is capable of carrying out demonstrations and trials to determine which types of equipment are most suitable, - and then follow up with extension activities to promote these equipment and, when necessary, make adaptations to varying local conditions. On the other hand, IRRI is capable of R&D on equipment requiring advanced scientific and technological knowledge and facilities, including inputs from economists, farming systems specialists, irrigation engineers, soil and plant scientists, and other disciplines available at IRRI.

The principal responsibility of the IRRI Liaison Engineer is to ensure that these comparative advantages of MAF and IRRI are utilized in an effective manner to achieve the main objective of the Program, - which is to increase the availability of agricultural equipment suitable

for small farmers. This collaborative relationship may be illustrated by the following cases:

1. Tapak-tapak pump (Annex IV). The Liaison Engineer and the BPI Engineering Chief organized a workshop in Nueva Ecija for the purpose of bringing together farmers, manufacturers, and technicians to determine priorities for equipment R&D. They invited the current head of IRRI's Agricultural Economics Division to present a paper proposing equipment priorities on the basis of results of an on-going IRRI study of the principal constraints to increasing rice production in the Philippines. One of his proposed priorities was low-cost irrigation pumps, and the Liaison Engineer began to search for appopriate designs. The most promising design was the twin treadle ("Tapak-tapak") pump developed by the Rangpur Dinajpur Rehabilitation Service (RDRS) in North Bangladesh. During his home leave trip the Liaison Engineer visited the pump project in Bangladesh and arranged for an experienced RDRS engineer to stop over in the Philippines to give a 7-day training course to MAF-IRRI engineers. The resulting "Tapak-tapak pump" has been tested and modified by these engineers, and it is now being promoted with good acceptance by farmers in parts of Region I. It is particularly appropriate in rainfed areas where farmers grow vegetables during the dry season after harvesting the wet-season rice crop.

2. Thresher/sheller (Annex IX). Government officials informed us that the national program for increasing production of yellow corn was being hindered by insufficient availability of corn shellers. Consequently, the Liaison Engineer suggested that the MAF-IRRI Program try to modify the IRRI-designed axial-flow paddy thresher so that it could also be used to shell corn. The axial-flow thresher is popular in many areas of the Philippines where it is fabricated by local manufacturers, many of whom are cooperating members in the MAF-IRRI Program. The modification was developed by MAF engineers and the Liaison Engineer, with the collaboration of a cooperating manufacturer who is an experienced fabricator of axial-flow threshers. The resulting modification is outstanding due to its low cost (about P1000 additional cost), high capacity (up to 5 tons/hour), and grain purity (99+%). The design has been disseminated to the Program's cooperating manufacturers, and over five have established commercial production of the thresher/sheller.

3. Sipa pump (Annex III). For low-lift irrigation, the IRRI-designed axial-flow propeller pump is far more economical than centrifugal pumps which are more commonly used in the Philippines. MAF-IRRI engineers found that farmers did not accept the axial-flow pump, primarily because of its high initial price. The Liaison Engineer urged the MAF-IRRI staff to search for ways to reduce the price, and the major break-through was in discovering how innovative farmers and manufacturers in Camarines

Sur have substituted low-cost local materials for several metal parts of the axial-flow pump. By combining these indigenous innovations with IRRI's high-efficiency propeller based on modern technology, we developed the Sipa pump which is about 1/3 the price of the original axial-flow pump. Initial sales are very strong, both for rice farmers and prawn producers.

4. Hydro-Tiller (Annex XV). Filipino inventors have successfully developed and marketed a floating rototiller for tillage of waterlogged rice fields where the mud is too deep for the conventional power tiller or carabao. At the request of the Liaison Engineer, IRRI carried out a technical and economic study which found that this tiller can substantially reduce land preparation costs and turnaround times, even in fields having normal soil and water conditions. However, existing designs generally have two problems: (a) the tiller's belly leaves a furrow which is difficult to level and also reduces the rate of decomposition of stubble, straw and weeds; and (b) tiller operators complain that strenuous effort is required to control the forward speed and to maneuver turns. Arrangements were made for IRRI and MAF engineers to collaborate with cooperating manufacturers to develop the hydro-tiller which reduces both problems by utilizing two pontoons having V-shaped bows and flat bottoms. A current project is the development of a multi-purpose ("transformer") tiller which serves both as a conventional tiller as well as a hydro-tiller.

These four cases illustrate different ways in which MAF and IRRI have worked together to achieve practical results which most likely would not have been attained by either institution without the collaboration of the other. As indicated in cases 2, 3 and 4, the collaboration of innovative manufacturers and farmers is also an essential element.

The Philippines is fortunate to have the unique opportunity for MAF and IRRI to collaborate in the development and extension of small farm equipment, and it is proposed that the current relationship be continued in order to provide small farmers with additional equipment, such as the types indicated in Section 2.

4. PROPOSED IMPLEMENTATION AND FUNDING

Since 1981, the MAF-IRRI Program has been supported in part by the funds of a grant to IRRI from USAID/Washington. These funds have not only supported the IRRI Liaison Engineer and his staff (secretary and driver) at BPI, but have also been used for purchases and operating expenses that cannot be covered by BPI either because of the lack of funds (especially near the year's end) or because MAF regulations do not allow funds to be used for certain purposes (e.g., new equipment, additional personnel, incentives) or cannot be obtained on short notice

(e.g., travel advances and materials purchases). An innovative "learning- by-doing" development project like the MAF-IRRI Program could not function effectively without a flexible budget which can respond immediately to sudden needs, such as materials or parts to repair or modify prototype equipment, or urgent requests from regional offices for equipment demonstrations or technical assistance. In order to sustain the Program after the proposed 10-month extension to 31 July 1987, BPI will need to increase both the amount and the flexibility of the budget provided to the Program.

Since the present arrangement has proven to be effective, it is proposed that USAI/Manila provide approximately the same level of support as a grant to IRRI for the MAF-IRRI Program (see Proposed Budget). These funds would be managed in the same manner as at present, which is consistent with USAID regulations, but with joint approval of expenditures by both the IRRI Liaison Engineer and the BPI Engineering Chief. A detailed accounting of expenditures would be provided to the Advisory Committee (described below) and USAID on a quarterly basis, and any changes from the proposed budget would be submitted in advance for approval.

BPI will continue to provide partial support to the Progam from its regular budget. The current level of this support is estimated to be P300,000 which corresponds to approximately 25% of the total annual budget of BPI's Agricultural Engineering Division. This includes past transfers of BPI funds to MAF Regional Offices for travel and miscellaneous expenses of regional engineers while participating in activities of the Program. Due to inflation plus reductions in the BPI budget, it is no longer possible for BPI to transfer the necessary funds (P2,000 per month for each of the 12 regions). Consequently, the proposed budget includes an appropriate amount for this purpose. By the end of the proposed continuation project, BPI's regular budget should be increased to cover these expenses.

The Program's progress is currently hindered by the lack of a BPI engineer capable of coordinating the diverse activities (e.g., equipment development and promotion, training, technical assistance to manufacturers, activities of regional engineers) under the direction of the BPI Engineering Chief with the assistance of the IRRI Liaison Engineer. The latter two persons have had to assume these duties but the situation needs to be improved because the BPI Engineering Chief cannot devote full-time to the Program and the IRRI Liaison Engineer should not coordinate the daily activities of BPI and MAF employees. The coordinator should be an experienced BPI/MAF engineer who has a demonstrated ability with respect to the practical development and extension of small farm equipment, as well as effective management of technical activities and personnel. Although engineers of this calibre are scarce, a potential candidate has been tentatively identified. The person should be appointed and trained during the continuation period so as to have a capable coordinator available to sustain the Program after the proposed project is completed.

IRRI has partially supported the Program from its regular budget by providing personnel and facilities for training of MAF engineers at IRRI, as well as collaboration on equipment development, testing, and promotion. One of IRRI's outstanding Filipino engineers has been assigned to the Program on a full-time basis with salary provided by IRRI's core budget. His continued participation is essential to sustaining effective MAF-IRRI collaboration.

It is proposed that the program be guided by an Advisory Committee having the following members: MAF Deputy Minister, MTI Deputy Minister, Director of the Bureau of Plant Industry, Head of IRRI Agricultural Engineering, Director of the Agricultural Mechanization Development Program (AMDP), Director of the Agricultural Machinery Testing Center (AMTEC), President of the Agricultural Machinery Manufacturers and Distributors Association (AMMDA), and a representative from the Central Bank (section on agricultural credit).

A workplan/timetable of the proposed activities is included, and it will be the basis for monitoring the Program's progress.

PROPOSED BUDGET

(1 October 1986 - 31 July 1987)

1.	Salaries and Wages Liaison engineer, secretary/bookkeeper, driver/field aide, plus short-term engineers, draftsmen, shop and field laborers as needed for particular activities at BPI, IRRI, and/or in the regions		$ 63,000
2.	Overhead		9,300
3.	Fringe Benefits & Allowances (for liaison engineer and support staff)		56,600
4.	Travel and Transportation		65,200
	a. Local Travel		
	- Travel & operational expenses for regional engineers: $100/mo. x 10 mo. x 12 regions	12,000	
	- Local travel for MAF-IRRI staff (IRRI and BPI)	20,900	
	- Maintenance of motor vehicle	2,700	
	b. International Travel - Trips by Program staff to search for new equipment; terminal travel of liaison engineer and family	29,600	
5.	Equipment, Materials & Supplies		25,900
6.	Training and Workshops		8,000
		TOTAL	$228,000

MAF-IRRI Industrial Extension Program for Small Farm Equipment

WORKPLAN: 1 October 1986 - 31 July 1987

ACTIVITIES	1986			1987						
	10	11	12	1	2	3	4	5	6	7
1. TRAINING:										
(a) Three-week ag. engineering training course at IRRI for four MAF-IRRI engineers.		—	—					—	—	
(b) On-the-job training (appox. 3 months) for four MAF-IRRI engineers.	—	—	—	—	—	—	—	—	—	
(c) Practical training of BPI shop technician at IRRI (approx. 1 month).		—	—							
(d) Short courses for cooperating manufacturers on new equipment and fabrication techniques.		—			—			—		
(e) Short courses for MAF Farming Systems technicians.	—									
2. ANNUAL MEETINGS OF COOPERATING MANUFACTURERS:										
(a) Plan and prepare for meetings in three convenient locations (e.g., Luzon, Visayas, and Mindanao).	—	—	—							
(b) Carry out meetings.										
(c) Summarize feedback expressed by manufacturers during meetings; plan and carry out appropriate responses.							—	—	—	
3. ASSESSMENTS/EVALUATIONS/MONITORING:										
(a) Annual survey of cooperating manufacturers (production and sales data, problems, requests, etc.).				—	—	—				
(b) Economic and technical evaluations of new equipment (with IRRI economists).		—	—	—	—	—	—	—	—	—
(c) Detailed evaluation of program by MAF, MTI, USAID, industry, etc.	—									

(Continued)

ACTIVITIES	1986			1987						
	10	11	12	1	2	3	4	5	6	7
4. PREPARATION OF QUARTERLY PROGRESS REPORTS AND WORKPLANS.										
5. MEETINGS OF ADVISORY COMMITTEE TO REVIEW PROGRESS AND PLANS.										
6. COLLABORATION WITH POLICY AND R&D ORGANIZATIONS.										
(a) Ongoing contact with PICAM and PCARRD on policy studies.										
(b) Collaborative efforts with AMDP/UPLB, AMTEC, UEP, CLSU, VISCA, etc. on specific equipment.										
7. PROMOTION OF PRIORITY EQUIPMENT										
(a) Thresher and thresher/sheller (emphasis on Regions 2, 9, 10, 11, and 12).										
(b) Tapak-tapak pump (emphasis on Regions 1, 3, 4, and 6).										
(c) Sipa Pump (all regions, depending on requests from MAF reqional offices).										
(d) Transplanter (limited extension effort, primarily Regions 2, 5, and 12).										
(e) Manually-operated corn sheller (preliminary promotion in Regions 2, 4, 5, 6, 7, 8, 10, 11, and 12).										
(f) Chipping machine (all regions, depending on requests from MAF regional offices).										
8. DEVELOPMENT AND EVALUATION OF NEW EQUIPMENT										
(a) Rotary dryer; continue test and modification of experimental unit in Bicol during wet season.										
(b) Hydro tiller; continue field trials and pilot production by cooperating manufacturers.										

(Continued)

ACTIVITIES	1986			1987						
	10	11	12	1	2	3	4	5	6	7
(c) Transformer tiller										
- testing and modification										
- formulation and implementation of extension effort, if test results are satisfactory.										
(d) Inverted-T seeder										
- collaborate with IRRI in demonstrations to determine farmer interests (initial emphasis on Regions 5, 6, and 7).										
- collaborate with Farming Systems programs on field trials of planting upland crops in rice fields during dry season.										
- evaluation of field trial results and formulation of extension plans.										
(e) Manually-operated seeders and weeders										
- collaborate with IRRI in demonstrations to determine farmer interests (regions to be determined)										
- formulation of extension efforts based on results of demonstrations and trials.										
(f) Improved tapak-tapak pump										
- testing and R&D of alternative designs										
- demonstrations of best designs to determine farmer acceptance (initially in Regions 1, 2, and 6).										
(g) Paddy dryers										
- formulation and implementation of extension effort to promote improved sundrying practices.										
- collaborate with IRRI in determining which types of warehouse dryers should be promoted in the Philippines.										
- pilot promotion of warehouse dryers in selected areas.										

MAF-IRRI Program for Small Farm Equipment

REPORT OF REVIEW TEAM
(September 24-30, 1986)

EXECUTIVE SUMMARY

I. INTRODUCTION:

The development of improved farm equipment is recognized as an essential element in lifting agricultural producers from practices that tie them to subsistence level farming. By introducing better agricultural methods, machines and techniques to farmers and by developing farmer acceptance of these new methodologies, productivity can be increased and farmer income raised. Such development can help bring production costs down to world-competitive levels thereby strengthening demand for agricultural output and, at the same time, strengthening industry in the rural sector. The MAF-IRRI Program for Small Farm Equipment has shown that it has the capacity to assist in this important effort.

The review of the MAF-IRRI Program was limited in its scope and timing so that an in-depth assessment of all factors was not possible. Consequently, the review team's findings on the Program's effort are based on limited field surveys (25 farmers and 12 manufacturers in Luzon, Iloilo, and the Bicol region). However, the dispersed geographic coverage and the "typicality" of those visited suggest that the conclusions are reasonable, but variations in emphasis in some regions should be considered.

It was apparent from the interviews conducted that the basic weaknesses of the Program are:

(1) A lack of entrepreneurship or marketing and sales ability on the part of many manufacturer cooperants and insufficient operational funding and personnel within the Program itself to provide adequate alternate marketing support.

(2) Insufficient emphasis on applying sound engineering techniques. Materials were not readily available and production facilities were rudimentary. Although an aim of the Program is to replicate provincial manufacturing facilities, the team felt that more modern equipment, access to newer materials and availability of sufficient funds would speed up the development process. Even simple requirements, e.g., nuts and bolts, resulted in long delays.

(3) The program suffers in some cases from a cultural dichotomy -- the desire or need to improve farm productivity weighed against the need to provide employment of the vast labor force in the rural sector.

(4) In general, the very low purchasing ability of farmers has resulted in:

(a) A need to produce machines of the simplest design. MAF-IRRI equipment was frequently modified by cooperants; in many cases the equipment was designed down to accommodate a need for an affordable price rather than to maximize longevity and efficiency.

(b) Problems with capturing returns to investment in labor. Once workers learn how to build a machine, they often set up in competition with their former employers and undercut prices by considering only immediate production costs rather than the needs of long-term sustenance of their business. Also, once farm laborers learn new operating techniques of machines (e.g., transplanters), they often transfer to other farms with their enhanced skills.

(5) Finally, the Program faces the widespread problem of insufficient credit facilities in the rural sector both for the expansion of manufacturing facilities and for the sale of farm inputs, in this case farm equipment.

The MAF-IRRI Program to date has been focused on equipment development, modification and refinement towards the most cost-effective and workable designs. The review team believes that, in addition to its present focus on the development and extension of existing and new products, the Program needs to expand or strengthen its scope to upgrade activities relating to promotional aspects of farm mechanization, including strategies that introduce marketing and financial techniques.

In addition to problems relating to technical aspects of the overall program, there are two institutional areas that are of particular concern. MAF-IRRI financial resources have been supplemented by, and to a large extent dependent upon, outside flows from U.S.A.I.D. which are scheduled to terminate in July, 1987. The Bureau of Plant Industry (BPI) is the central coordinator for the program and draws on the technical expertise of IRRI for machine development and training programs. BPI uses the extension arm of the MAF Regional Divisions to provide the outreach link to the rural sector for both farmers and manufacturers. Financial support and the organizational structure of the program are central concerns that could only be minimally addressed during review team discussions; however, it should be noted that the resolution of the two concerns of budget and organizatonal framework is of critical importance to the sustainability of the program.

II. RECOMMENDATIONS:

The following recommendations represent the most pressing needs identified by the review team. Additional areas of concern are contained in the full report.

A. Continuation of the Program: The review team is of the opinion that the Program is worthwhile because it assists two critical economic units in the Philippine economy - small farmers and rural machine shop operators. There are large numbers of both groups and their potential contribution to the economy is great. Use of appropriate small scale agricultural equipment can improve productivity, yields, efficiency and farm incomes, raising farmers into a higher level of economic viability. Accordingly, the team recommends that the MAF continue this Program beyond the planned U.S.A.I.D. phase-out in July, 1987. This will mean that alternative funding sources will need to be developed within the Ministry's budget or possibly solicited from another donor agency.

B. Budget Support: Given the planned phase out of U.S.A.I.D. financial support in July, 1987, the regular budget of the MAF will be the primary source of Program funds. The precise level of the budget must be the primary concern of a study group which should be organized by the MAF from among its units and collaborating agencies. Such study should be undertaken soonest in order that the budget and plans be included in the CY 1988 budget of the MAF. Financial resources must be secured for the following components:

1. Adequate professional staff, including engineers and other required specialists, for both the project management staff in Manila and for field operations in the Regional Divisions.

2. Sufficient operating expenses to ensure an efficient level of program services that include travel of program personnel and production, transportation and availability of prototype equipment.

C. Increased Emphasis on Extension/Promotion. To date, the program has successfully developed a range of small farm implements and machinery. The team believes that the Program will be improved if increased effort is placed on developing more rapid and effective acceptance of the equipment already available while continuing to test and improve on a more limited scale those as yet unrefined units that offer promise to critical underrepresented areas of the economy, e.g., upland/rainfed areas.

D. Organization: With the pending MAF reorganization, the team is not in a position to identify which group/agency will be responsible for the continuation of the Program. The Bureau of Plant Industry (BPI) will be

shifting to a staff function and may no longer be in a position to serve the operational role called for as a project management unit. The MAF must ultimately decide on where program coordination will be housed.

For the technical role, the development of machines and equipment, however, the review team recommends that the R&D component and its liaison with IRRI be handled by the Agricultural Machinery Development Program (AMDP) with testing assistance from the Agricultural Machinery Testing and Evaluation Center (AMTEC). Two separate memoranda of agreement should be drawn up between MAF and UPLB (AMDP) and between MAF and IRRI. Generally these agreements will reflect:

1. Basic R&D shall be undertaken by AMDP and IRRI, including the design and production of prototypes and initial testing.

2. These R&D insitutions shall assign at least one full time engineer to collaborate with the Program.

3. MAF, through its appropriate central coordinating agency, shall:

- provide the feedback loop in order to orient basic R&D;
- coordinate with MAF Regional Divisions on field testing and extension of equipment;
- act as liaison between the R&D institutions, MAF Regions, manufacturers and consumers.

MAF-IRRI Program on Small Farm Equipment

SUMMARY OF FINDINGS BY REVIEW TEAM
(September 24-30, 1986)

I. Background:

The general objective of the MAF-IRRI Program for Small Farm Equipment is to increase the productivity and profitability of small farms by introducing low-cost agricultural equipment, such as hand tools, animal-drawn implements, and small engine-powered machines, for operations ranging from land preparation to post-harvest processing and storage. The specific objective of the Program is to promote the development, manufacture and utilization of agricultural equipment appropriate for production of basic food crops on small farms.

The Program gives special attention to utilizing the resources of small metalcraft shops located in rural areas because these shops generally have a number of advantages: low costs of production and marketing; readily available parts and service; innovations suitable to the particular local conditions; and employment generation through the use of labor-intensive production methods.

To date, the Program has successfully developed a range of small farm implements and machinery:

- Sipa Pump
- Tapak-Tapak Pump
- Inverted-T Seeder
- Rice Transplanter
- Drum Seeder
- Cono Weeder
- Thresher/Sheller
- Hand-Operated Corn Sheller
- Rotary Dryer
- Seed and Fertilizer Applicator
- Hydro-Tiller
- Transformer Tiller

Many of these have been well accepted by those farmers who have used them. An important achievement of the Program has been the development of synergistic efforts which combine:

- the high-level science and technology of IRRI;
- the regional R&D and extension capabilities of the MAF through the assignment of MAF engineers to the twelve regions;
- the practical know-how and innovations of exceptional manufacturers and farmers;
- the cooperation in the field with officers of the Small Business Advisory Center of the Ministry of Trade and Industry, the Agricultural Machinery Development Program, the NIA and the NFA.

There are 300 collaborators who have joined the Program from all the regions. Over the last five years, a total of 550 blueprints of MAF-IRRI equipment were requested by manufacturers, 130 prototypes were tested and copied, and 1,800 technical assistance visits were made.

From the survey of 70 manufacturers conducted in 1985, product sales for the year were:

- 350 pumps
- 150 seeders and planters
- 1,600 threshers and shellers.

It is the opinion of the review team that the Program is worthwhile and strongly recommends that it be continued.

II. Future Strategy Considerations:

A. Categorization of Program Equipment:

The primary goal of this, as with other programs being developed by the MAF, is to improve productivity, yields, farming efficiency and, consequently, farmer incomes. The Program to date has mainly been limited to machine development, modification and refinement toward the most cost-effective and workable designs. In this regard, the machines reviewed by the team can be divided into three categories:

1. Those that improve productivity without detracting from employment opportunities:-
   Sipa, Axial-Flow Pump
   Tapak-Tapak Pump
   Rotary Drier
   Cono-Weeder

2. Those that improve productivity and, even though displacing workers, can be considered of greater benefit than the adverse consequences they produce:-
   Thresher/Sheller
   Hydro-Tiller/Transformer Tiller
   Seed and Fertilizer Applicator
   Corn Sheller
   Inverted-T Seeder

3. Those whose benefits are arguable in contrast to the workers they displace:-
   Transplanter
   Drum Seeder
   Reaper.

It should be pointed out that the "worker-displacement" should be considered not only in the light of loss of income-production for rural families, but also the social upheaval income loss produces and the subsequent

attraction of the NDF/NPA alternative. Offsetting this is the faster economic recovery attainable in the rural sector through an improvement in farm productivity which, in the longer-term, will provide more sustainable, higher-paying job opportunities to the rural work force.

Consequently, we would recommend major support to category one, which will have little adverse impact on employment. Wide dissemination of the benefits of these products, particularly the axial-flow (Sipa) pump was considered a definite boon to improved productivity. In this regard, we would cite the very successful operation of two 7.5 HP pumps in a 100 hectare cooperative venture in the barrio of Concepcion, Camarines Sur, Bicol. This product and its administrator (Mr. Leonard Hogra) should be highly commended and this work duplicated elsewhere. Introducing other leaders of cooperatives into this program, through visits and semi-formal training, might be well considered. Of note was the high repayment level of the 79 cooperative members (around 95%) of the P1050 seasonal fee for the irrigation service.

B. The Critical Role of Extension and Promotion:

In developing more rapid and effective acceptance of the equipment already developed or in advanced stages of development, prioritized above, the review team recommends that a simple course in salesmanship and selling be developed for use in the program. There are a number of good, private-sector courses that could be tapped. The courses would do much to improve the link that develops farmer acceptance and understanding of the benefits of mechanization.

A number of approaches might be considered:

- Sales training that should be conducted by experienced trainers a private organization is preferred). This training would be given to program engineers, extension workers and cooperating manufacturers. Training could be in regional centers and conducted on weekends, spread over several weeks if necessary.

- A promotional program that is developed to gain the widest coverage for the least cost. This would include machine demonstrations, comic books and simple brochures, short radio announcements and success stories. Awards, prizes, etc. could be considered for farmers who achieve the greatest productivity in the region.

C. Future Equipment Development:

The primary focus and function of the Small Farm Equipment Program over the next five years should be toward extending the use of machinery listed in category 1 and category 2 to as wide a farmer universe as possible. A secondary function should be to continue to refine and improve the basic designs toward longer life, reduced maintenance requirements, greater efficiency and easier use, and to continue to seek new designs.

Greater concentration should be given to the widest possible dissemination of the following:

- Thresher/Sheller
- Hydro Tiller and Transformer Tiller
- Sipa, Axial-Flow Pump
- Tapak Tapak Pump

Once these are successful and widely introduced, similar efforts can be applied to other machines. The experience gained in promoting these four will stand in good stead in introducing the "second batch" of equipment.

In assisting upland development (a priority of the MAF) the Sipa and Tapak-Tapak pumps will greatly assist irrigation efforts and allow expansion of tilled land and more intensive cropping. To complement upland development the Inverted-T Seeder should continue to be developed -- its design is still not fully finalized but is at a stage where continuing design modification can be recommended. Marketing of the seeder would then naturally follow on from successful introduction of the first priority group.

D. Institutionalizing the Program:

With donor financial support coming to an end in July, 1987, the intervening period must be devoted to institutionalizing the program into the overall plans and goals of the MAF, including regular budget support. The machinery research and development activities that support the program should be drawn primarily from the Agricultural Machinery Development Program (AMDP) of the University of the Philippines at Los Banos. This institution has adequate staff and is part of a regional network for development of agricultural machinery. The Agricultural Engineering Department at IRRI should provide a supporting role through the detailing or assignment of technical staff and the provision of financial support whenever possible. To facilitate the working arrangement between MAF, IRRI and AMDP, a Memorandum of Agreement should be drawn up among the three parties, which will delineate clearly the responsibilities of each party.

The Agricultural Engineering Department of IRRI should continue to make use of its international network to generate new designs and ideas for agricultural machinery being developed in other countries and make these available to the AMDP for further study and local adaptation.

Overall control and guidance of the program should be with an agency of the Ministry of Agriculture and Food which, if possible, can provide the following:

- an effective extension service that can introduce the equipment to farmers throughout the country.
- technical staff that include sales-oriented personnel with an agricultural background.
- a properly funded operation, well managed and staffed.

A core group should be established that is responsible for development of small farm equipment and its dissemination. The staff would consist of marketing, technical and administrative/financial personnel who would co-ordinate the functions of AMDP/AMTEC, IRRI and the role of the MAF Regional Programs. The core group would develop marketing and promotional plans and coordinate technical design in line with the program goals. An IRRI engineer should be delegated with responsibility for liaising with the core group leader and coordinating IRRI's participation in the development of priority equipment. It would be advantageous if an IRRI engineer could devote full-time to this role. Mr. Gonzalo is recommending Mr. G. Salazar for this position since his participation has been crucial to the program thus far and Mr. Salazar's continued participation would ensure continuity to the MAF-IRRI collaboration.

E. Selection of Cooperators:

Over 300 manufacturers have joined the Program and some 100 of these are actively producing MAF-IRRI designed equipment. No special selection or "accreditation" should be used unless, and this is not recommended, some form of subsidies or grants are provided directly to cooperators. In line with this, assistance to participants should be on a cost-plus basis, i.e., a fee should be charged for blueprints, etc. This will automatically weed out those without serious interest.

F. Credit Facilities:

A major, possibly the major constraint, to sale of farm equipment is the lack of credit. Most farmers are too small, of doubtful credit worthiness and difficult (and expensive) to collect from for the formal credit sector to be involved directly. A possible alternative is to look to the cooperator - manufacturer as the credit source and to established cooperatives with a proven track record. Banks can more readily lend to these two groups, utilizing the "support" of the Agricultural Guarantee Loan Fund or the Industrial Guarantee Loan Fund.

Another constraint perceived by the sector is the floating rates imposed by banks which make it difficult for borrowers to predict their costs. A factored fixed interest rate slightly higher than market may be a possible alternative, particularly if commercial banks could discount the loan to the Central Bank, or equivalent entity.

Development of large-scale production by some of the larger manufacturers would necessarily require access to credit resources. One source of funding in these cases could be the USAID-supported PAIDCOR financial institution which is being established to assist agricultural and rural development. Other sources of funds could be PBSP, various PVO's, rural banks and some selected commercial banks.

gV

G. Target Setting and Monitoring:

It is important that the progress of the program be monitored so that the acceptance of machines can be determined and decisions made as to whether individual machines should be further developed and promoted, or dropped. In this regard, setting goals (volume of units sold) should be initiated by the program leader. Initially these may be rough targets, but over time can be refined toward an effective forecast and setting of goals.

H. Technical Features:

Machine design has been developed on the philosophy that machines should be duplicable in even the smallest machine shop. This may not necessarily be a desirable limitation particularly if wide usage is to be accomplished, particularly for more sophisticated units. A machine designed for mass production (with standardized, interchangeable parts and use of longer-lasting superior materials) may be preferable. It might mean that the machine would be built by only a few larger manufacturers and, perhaps, sold, and even assembled by the small local shops. Access to credit would also be easier for larger shops.

The program designs should set the standards -- they should use the best features of all designs (countrywide), and explain why, e.g., "mud flaps" are being added to the power tiller to protect the engine which has a short life of only two years. The lack of mud flaps may be one reason why. Machine design has not given enough consideration to alternative materials. Steel and water don't mix. Use of wood and plastics (especially for bushings etc.) should be given more consideration. As mentioned elsewhere this should be part of the program only after the marketing goals have been achieved.

Except for a cleverly-designed jig and fixture for forming the axial-flow propellers there is little use of dies, jigs and fixtures in production, resulting in an over-reliance on worker skill and a lack of standardization of parts. Patterns are used for some sheet metal work. Fastening is by welding or nuts and bolts only. Little consideration has been given to such alternatives as pop rivets, self-tapping screws, spot-welding etc. Price considerations may have dictated some of this restraint but the review team considers the lack of access to modern techniques and materials -- because of the lack of funds -- weakened the Program.

Machines are generally very heavy; again cost may preclude the use of lighter materials. Tube bending is a simple technique that reduces cost (no welded corners) and improves strength. It has been little used. There is too much welded component, not enough use of readily available shapes.

ANNEX 1

Bicol Field Trip Highlights

Members of the review Team (M. Chen, J. Lim, G. Salazar, S. Tiong-Aquino, P. Wallace) visited the following:

1. RS Power Tiller at Milaor, Camarines Sur owned by Mr. Salvador Reyes.

NOTES: Business started in 1977 with 40 workers but now there are only three laborers due to depressed market. His workers either left him for other manufacturers in Naga or sought out farmers' orders which they fabricated in backyard shops. This arrangement often led to price undercutting to the detriment of his shop. His product lines include tillers, seeders, weeders, rice mills and transplanters. He has been a user of IRRI designs but has modified the tiller and transplanters.

Some of his experiences:
- a government project ordered ₱2 million worth of equipment only to be paid ₱400,000;
- no patent protection for his registered equipment;
- sold only 25 units in 1985;
- accounts receivable during the visit was ₱250,000 and Mr. Reyes thinks he can no longer collect;
- agent's commission is 10%, payable upon receipt of down payment;
- receivables could not be collected due to personal emergencies of creditors. (Note: A tiller is worth ₱7000. An agent puts up ₱700 and the farmer-buyer ₱300 to raise ₱1000 which is the downpayment for one tiller. Reyes delivers, farmer gets tiller but the balance is never paid. The farmers vanishes and the agent tells all sorts of stories like an illness, death, wedding in the family;)
- Reyes does not intend to hire more laborers; and
- Reyes is also in farming and repair service, and in the funeral business.

2. Joe Victa, farmer of Bo. Ibid, Libmanan, Camarines Sur who has been using the IRRI-designed equipment since 1983.

NOTES: Mr Victa
- owns 4 units of transplanters at ₱2,300 each;
- tills 12 hectares;
- saves 50% of transplanting cost (seeds and labor);
- finds applications of herbicides are controllable ;
- experiences loose bushings in the transplanter only after 6 croppings;
- innovates by the use of plastic bushings to replace worn out parts;
- uses sipa pumps extensively;
- trains other farmers to use the IRRI-designed equipment for soil preparation; and
- trains farm laborers although they are not working for him.

3. Sixto Aguilar, Jr., farmer from Bo. Pandan, Cabusao, Camarines Sur.

NOTES: Mr. Aguilar
- owns two types of sipa pumps;
- owns a transplanter but does not use it as he prefers farm laborers for security reasons although he admits that labor is more expensive than using farm equipment; and
- encounters threshing problems when there are hay collectors as there seems to be more palay wasted because whatever goes with the hay is considered disposable. Efficiency is then subject to the crowd of hay collectors.

4. Leonardo Nogra of Bo. Concepcion, Cabusao, Camarines Sur, leader of the Irrigation Service Association serving 79 farmers with an aggregate land area of 100 hectares.

NOTES:
- Association has two MAF-IRRI designed axial-flor pumps which are strategically located so that all the 100 hectares are irrigated.
- Nogra has been the Manager of the Association for the past 3 years.
- Experiences of Association:
  - each member pays ₱1050 per cropping season to repay loan for the pumps and its installation;
  - collection experience is 95%;
  - loan from NIA is ₱100,000 to support the ₱115,020 needed to buy the pumps and electrical requirements and its installation;
  - farmers experienced that cost of production ranges from ₱3000 - ₱5000: and
  - The installation of the pumps was necessary as the NIA irrigation system was good only for 1700 hectares. There are 3427 hectares in the contiguous area.

5. Mr. Tolledo, owner of a metalcraft in Bo. Concepcion, Cabusao, Camarines Sur.

NOTES: Aside from being a metal craftsman, he is also a farmer and stated that his shop is giving him more returns. He manufactures transplanters, pumps and threshers; repairs tricycle and farm equipment; and manufactures side cars for tricycles. He sold 20 units of transplanters and about 20 units of sipa pumps in 1986.
- All sales were cash as trade experience showed that installment purchases are very frustrating;
- Laborers are his two sons since business is not very good; and
- He hasn't tried aggressively marketing his products.

6. ABC Rice Mill, which uses the MAP-IRRI rotary drier being developed in Libmanan, Camarines Sur.

NOTES:
- Development work aims to [illegible] drying;
- Wet palay can be dried up to [illegible] re content, therefore, allowing it to be placed in sacks;

ANNEX II

MAF-IRRI PROGRAM FOR SMALL FARM EQUIPMENT

REVIEW TEAM

LIST OF PARTICIPANTS

Name	Institution/Address
1. Sonia Tiong- Aquino	Associate Director Institute for Small-Scale Industries University of the Philippines Diliman, Quezon City Telephone: 989238 or 981034
2. Abelardo F. Baclig	Agrobusiness Consultant Philippine Packing Corporation (retired) Musuan, Bukidnon Telephone: 9218631 (Manila)
3. [illegible]ista*	Assistant Minister for Field Operations Ministry of Agriculture & Food Diliman, Quezon City Telephone: 962706 or 998741
[illegible] Beatriz [illegible]	Program Officer Program Office US Agency for International Development Ramon Magsaysay Foundation Roxas Boulevard, Manila Telephone: 5217116 local 2456
. Melanie M. Chen	Project Development Officer Office of Capital Development US Agency for International Development Ramon Magsaysay Foundation Roxas Boulevard, Manila Telephone: 5217116 local 2449 or 2418 5215232
6. Jon D. Halpern	Agricultural Economist Office of Rural and Agricultural Development US Agency for International Development Ramon Magsaysay Foundation Roxas Boulevard, Manila Telephone: 5217116 local 2404 or 2419
7. Josemari F. Lim	Vice President for Finance and Administration Philippine Cotton Corporation 31 Shaw Boulevard, Pasig, Metro Manila Telephone: 6735175 or 6731476

*Chairperson of Review Team

continued

Name	Institution/Address
8. Zafrullah G. Masahud	Officer-in-Charge Bureau of Small and Medium Industries Ministry of Trade and Industry Industry & Investments Building 361 Sen. Gil Puyat (Buendia) Avenue Makati, Metro Manila Telephone: 8175517
9. Eusebio G. Nicolas	General Manager, Nicotrade & Engineering Vice President for Marketing, Agro-Industrial Management & Consultancy, Inc. 215 Road 2, Pag-asa Project, Quezon City (home) Telephone: 968348
10. Sonia Salguero	Agricultural Research Office (ARO) Coordinator for Region III Bureau of Soils, Manila Telephone: 506214
11. Peter L. Wallace	President AYC Consultants, Inc. 1535 Princeton St., Wack-Wack Village Mandaluyong Telephone: 793687 or 700953

MAF-IRRI PROGRAM FOR SMALL FARM EQUIPMENT

REVIEW TEAM ITINERARY

Wednesday, September 24

8:00 AM	MAF-IRRI Program Office, Bureau of Plant Industry (BPI), San Andres, Malate, Manila. Introductory meeting of review team with MAF-IRRI Program staff and BPI Director Emiliano Gianzon. Visit machine shop and equipment display area.
9:00 AM	Depart from BPI.
9:45 - 10:15 AM	Visit cooperating manufacturer, Mr. Floro Bautista, Poying Welding Shop, in Laguna. Pass by two other manufacturers.
10:45 - 12:00 NN	Field demonstration at IRRI of equipment promoted by MAF-IRRI Program.
12:00 NN	Lunch at IRRI.
1:00 - 1:30 PM	Discussion at IRRI with cooperating manufacturer, Mr. Arsenio Dungo, Atin Engineering.
1:30 - 2:45 PM	Session for review team to ask questions regarding MAF-IRRI Program and objectives of review.
3:00 - 4:00 PM	AMTEC Building, UPLB. Discussion of objectives, experiences, and relationships of AMDP, AMTEC and MAF-IRRI Program. Participants: 1. Dr. Silvestre C. Andales, OIC of Agricultural Machinery Development Program (AMDP) 2. Dr. Carlos del Rosario, Director of Agricultural Machinery Testing and Evaluation Center (AMTEC)
4:00 - 5:30 PM	Return trip to Manila.

continued

Thursday, September 25

Field trips (3 groups):

1. Luzon group departs at 7:00 AM from the Ministry of Agriculture and Food, Quezon City.
2. Bicol and Iloilo groups meet at the Manila Domestic Airport at 8:45 AM.

Note: See attached detailed itineraries.

Friday, September 26

Continuation of field trips.

Monday, September 29

8:00 AM - 5:00 PM	Ministry of Agriculture and Food, Quezon City. Meeting of review team to draft report.

Tuesday, September 30

8:00 AM - 12:00 NN	Ministry of Agriculture and Food, Quezon City Meeting of review team to edit report and prepare for presentation to Advisory Committee.
2:00 PM	Presentation of the review team's report to the MAF-IRRI Advisory Committee in the office of Deputy Minister Carlos Dominguez.

ANNEX E

Republic of the Philippines
MINISTRY OF AGRICULTURE
Office of the Minister
Diliman, Quezon City 3008

04 November 1986

Mr. Frederick W. Schieck
Director
US Agency for International Development
Ramon Magsaysay Building
Roxas Boulevard, Manila

Dear Mr. Schieck:

Enclosed is the final report on the recent review of the MAF-IRRI Program for Small Farm Equipment. The review team was impressed by the Program's performance, as indicated in their following statements on pages 5 and 6:

> "To date, the Program has successfully developed a range of small farm implements and machinery." - "Many of these have been well accepted by those farmers who have used them." - "It is the opinion of the review team that the Program is worthwhile and strongly recommends that it be continued."

The Ministry is very much interested in continuing the Program. Based on the recommendations of the review team, the following steps are being taken to ensure that the activities will be sustained after termination of the present support from USAID on 31 July 1987.

1. The Assistant Minister for Field Operations, Apolonio V. Bautista, will be responsible for overall coordination of the Program. As part of the present MAF reorganization, he will create a management staff in his office which will assist him in obtaining necessary collaboration between the Regional Offices, BPI Engineering, AMDP, IRRI, and other key participants in the Program.

2. A major recommendation of the review team was to strengthen promotional and marketing effort. The objectives would be to increase farmers' and manufacturers' awareness and understanding of appropriate small-farm mechanization, as well as to facilitate more effective marketing of particular types of equipment promoted by the Program. I have asked a small sub-team, chaired by Assistant Minister Bautista, to identify a qualified person who could develop this idea. I am hoping that USAID would agree to support the initial phase of this effort, with funds of the present grant or other sources.

Cable: "Minagri" Manila Telephones: 998741;-998946 Telex: (722)-27726 MOA-PH

3. The team recommends that a study be made to determine the budget and staff that MAF should provide for sustaining the Program after termination of the present USAID grant in July 198 This will be prepared by BPI Engineer Benito C. Gonzalo for the years 1987, 1988, and 1989.

4. It is recommended that the UPLB Agricultural Mechanization Development Program (AMDP) and the IRRI Agricultural Engineering Department be given the primary responsibility for carrying out R&D which responds to the Program's needs for new and/or improved designs of appropriate small-farm equipment. Engineers Gonzalo and Stickney are collaborating with AMDP on the formulation of a suitable agreement.

5. The review team points out that IRRI's continuing participation is essential to the Program, even at reduced level after termination of the present grant. It is recommended that IRRI continue to provide Engineer Godofredo Salazar on a full-time basis to serve as liaison between IRRI and MAF on Program activities. I sincerely hope that IRRI will agree with this recommendation which will sustain the highly productive MAF-IRRI collaboration.

The Program is a concrete illustration of how government, international organizations, and the private sector may collaborate in the development of small farms and small-scale industry. As chairperson of the Program's Advisory Committee, I will participate in guiding and facilitating the future of this Program. The collaboration of USAID with MAF is greatly appreciated, and I look forward to hearing your response to the recommendations and requests raised in the enclosed report and in this letter.

Very truly yours,

CARLOS G. DOMINGUEZ
Deputy Minister

11-18

Executive Summary enclosed (MAF-IRRI)

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AID-492-CA-1707
Summary
Terminal Financial Report
As of September 30, 1986*

	Actual Expenditures 09/01/80 09/30/85	Actual Expenditures 10/01/85 09/30/86*	Total	Budget	Balance
1. Salaries & Wages	$1,277,549.98	$148,712.52	$1,426,262.50	$1,472,280.00	$46,017.50
2. Overhead	180,027.62	32,040.05	212,067.67	216,108.00	4,040.33
3. Fringe Benefits & allowances	618,216.13	105,673.55	723,889.68	732,066.00	8,176.32
4. Travel & Transportation	388,107.28	71,052.75	459,160.03	492,602.00	33,441.97
5. Equipment, Materials & Supplies	429,190.51	96,577.62	525,768.13	482,445.00	(43,323.13)
6. Training	100,676.24	8,707.13	109,383.37	116,811.00	7,427.63
7. Studies	15,811.61	175.00	15,986.61	15,987.00	0.39
8. Workshop/Evaluation	34,945.92	36,732.94	71,678.86	74,945.00	3,266.14
TOTAL	**$3,044,525.29**	**$499,671.56**	**$3,544,196.85**	**$3,603,244.00**	**$59,047.15**

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Including payments made during the period October 1, 1986 - March 31, 1987.

/mpr
4.15.87

AID-492-CA-1707
Phil. Headquarters
Terminal Financial Report
As of September 30, 1985

	Actual Expenditures 09/01/80 09/30/85	Accrued as of 09/30/85*	Total	Budget	Balance
1. Salaries & Wages	$ 982,599.58	$13,921.91	$ 996,521.49	$1,012,896.00	$16,374.51
2. Overhead	138,590.78	10,305.00	148,895.78	148,896.00	0.22
3. Fringe Benefits & Allowances	553,784.15	21,087.71	574,871.86	565,585.00	(9,286.86)
4. Travel & Transportation	55,581.13	-	55,581.13	55,581.00	(0.13)
5. Equipment, Materials & Supplies	29,235.88	85.37	29,321.25	29,321.00	0.25)
6. Training	27,954.50	-	27,954.50	27,955.00	0.50
7. Studies	-	-	-	-	-
8. Workshop		29,688.43	29,688.43	40,000.00	10,311.57
TOTAL	$1,787,746.02	$75,088.42	$1,862,834.44	$1,880,234.00	$17,399.56

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Payments were made only during the period October 1-December 31, 1985.

/mpr
4.15.87

AID-492-CA-1707
Phil. Headquarters
Schedule of Expenditures
As of September 30, 1985

Schedule #1. **Salaries & Wages**

a.	Senior staff	
	September 1985	$13,884.08
b.	Local staff	
	September 1985	37.83
		$13,921.91

Schedule #2. **Overhead**

- July 1985 - September 30, 1985 (Senior staff)	
July - September 1985 (Local staff)	**$10,305.00**

Schedule #3. **Fringe Benefits & Allowances**

a.	Senior staff		
	1. IIE Perquisites		
	August - September 1985		$12,194.24
	2. Housing & Utilities Allowances		
	August - September 1985		1,322.68
	3. Post Differential Allowances		
	September 1985		1,437.49
	4. Educational Allowance - 1985		(2,740.45)
	5. Vacation Leave - 1985		5,402.73
	6. Medical allowance		57.78
	7. Property Insurance		219.90
			$17,894.37
b.	Local staff		
	1. Cost of living allowances - September 1985	$ 27.95	
	2. Social Security System - September 1985	18.55	
	3. Retirement Savings Plan - September 1985	71.60	

.../over

4.	Insurance - 1985	$ 198.85	
5.	13th Month Pay	21.76	
6.	Accrued VL & SL in 1983	2,854.63	$ 3,193.34
			$21,087.71

Schedule #4. **Travel & Transportation**

Schedule #5. **Equipment, Materials & Supplies**

- GSR supplies issued for the period September 16 - 30, 1985 — **$ 85.37**

Schedule #6. **Training**

Schedule #7. **Studies**

Schedule #8. **Workshop**

Agricultural Engineering Workshop held in the Philippines on Sept. 2-6, 1985

- Accommodations		$ 4,810.62
- Supplies		876.40
- Printing charges		241.97
- B&P charges for fixing and installing things needed for the Workshop		108.77
- Local travel		973.49
- Hourlyhelp rendered during the workshop		263.87
- Honorarium to participants		1,289.00
- Publications and cost of mailing these publications		10,539.84
- Airtickets issued:		
- Nestor Navasero	$1,770.00	
- Ahmed Baghat - ATO#85-1014 Cairo/Mla/Cairo	167.27	
- Joe Campbell - ATO#85-1012 NY/TYO/MLA/TYO/NY	2,103.00	

.../over

- John Farrington - ATO#85-1015 London/Mla/Bkk/Col	$2,184.50	
- Dr. Chancellor - ATO#85-1013 SFO/Hkg/Bkk/Sin/Mla/ Hkg/Honolulu	1,306.00	
- Yoshio Ikeda - ATO#85-1019 Osaka/Mla/Taipei/Osaka	844.00	
- Broche	1,606.00	
- Teter	603.70	$10,584.47
		$29,688.43

AID-492-CA-1707
Phil. Outreach
Terminal Financial Report
As of September 30, 1986

	Actual Expenditures 09/01/80 09/30/85	10/01/85 09/30/86*	Total	Budget	Balance
1. Salaries & Wages	$100,509.62	$ 75,667.06	$176,176.68	$187,260.00	$11,083.32
2. Overhead	13,844.12	12,053.81	25,897.93	27,088.00	1,190.07
3. Fringe Benefits & Allowances	26,352.36	42,496.34	68,848.70	81,516.00	12,667.30
4. Travel & Transportation	121,439.05	32,615.13	154,054.18	168,539.00	14,484.82
5. Equipment, Materials & Supplies	95,865.74	55,981.06	151,846.80	115,966.00	(35,880.80)
6. Training	5,991.14	1,092.54	7,083.68	9,591.00	2,507.32
7. Studies	1,187.77	-	1,187.77	1,188.00	0.23
8. Workshop/Evaluation	574.41	7,044.51	7,618.92	574.00	(7,044.92)
TOTAL	$365,764.21	$226,950.45	$592,714.66	$591,722.00	($ 992.66)

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Including payments made between October 1, 1986 to March 31, 1987.

/mpr
4.15.87

AID-492-CA-1707
Phil. Outreach
Schedule of Expenditures
As of September 30, 1986

Schedule #1.	**Salaries & Wages**		
a.	Senior Staff - October 1985 - September 1986		$54,999.96
b.	Local staff		
	1. Base salaries - October 1985 to September 1986	$ 7,479.83	
	2. Incentive Honorarium (BPI Personnel) for the period October 1985 to September 1986	12,583.70	
	3. Overtime for the period October 1985 to September 1986	395.85	
	4. Hourlyhelp for the period Oct. 1985 to Sept. 1986	207.72	20,667.10
			$75,667.06
Schedule #2.	**Overhead**		
a.	Local staff - August 1985 to September 1986 BPI Personnel - August 1985 to September 1986 Senior staff - October 1985 to September 1986		**$12,053.81**
Schedule #3.	**Fringe Benefits & Allowances**		
a.	Senior staff		
	1. Housing allowance/Utilities October 1985 to September 1986		$13,692.42
	2. Educational allowance SY - 1985 - 1986		7,447.74
	3. Educational travel SY - 1985 - 1986		2,420.97

.../over

4.	IIE Perquisites - October 1985 - September 1986		$12,073.11
5.	Medical Examination 1986		103.91
			$35,738.15

b. Local Staff

1.	Cost of Living Allowances (COLA) October 1985 - Sept. 1986	$3,190.27	
2.	Retirement Savings Plan (RSP) October 1985 - Sept. 1986	900.72	
3.	Social Security System (SSS) Sept. 1985 - Sept. 1986	188.35	
4.	Insurance - 1985-1986	536.69	
5.	Medical - 1985-1986	157.30	
6.	13th Mo. Pay 1985-1986	1,784.86	6,758.19
			$42,496.34

Schedule #4. **Travel & Transportation**

a.	Local travel September 1985 - September 1986		$ 9,853.41
b.	Local travel of BPI/MAF Staff September 1985 - September 1986		10,783.03
c.	Repairs & maintenance of motor vehicles from September 1985 to September 1986		1,506.58
d.	Local airtickets issued for the period September 1985 to September 1986		1,146.30
e.	Internaticnal Travel		
1.	Dr. Robert Stickney		
	- Americal Society to Agricultural Engineers Meeting held in San Luis Obispo (including trip to Washington)		
	- Airticket - ATO#86-0625 - Mnl/ WAS/DEN/SBA/LAX/TYO/MNL	$2,184.00	
	- Travel & misc. expenses June 23 - JUly 4, 1986	691.18	2,875.18

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- Home Leave Trip (Dr. Stickney & Family)			
- Airtickets - MNL/TYO/NY/LAX/ TYO/MNL BOSTON/DENVER/LAX		$3,712.41	
- Travel expenses		202.12	$ 3,914.53
b. Godofredo Salazar - Trip to Sri Lanka			
- Airticket - ATO#86-0168 - Mnl/Sin/Cmb/Sin/Mnl		$1,222.83	
- Travel & Misc. expenses on Feb. 18 - March 2, 1986		1,313.27	2,536.10
			$32,615.13

Schedule #5. **Equipment, Materials & Supplies**

a. Office supplies including supplies issued by IRRI supply room for the period September 1985 - September 1986		$ 948.34
b. Photo & Phocopies for the period September 1985 - September 1986		199.77
c. Raw materials & shop supplies for the period September 1985 - September 1986		5,670.99
d. Shipping/Delivery, mailing services, telegram, etc. for the period September 1985 - September 1986		1,653.33
e. CPD charges for printing & photography for the period September 1985 to September 1986		719.87
f. Various P.O. issued:		
- P.O.85-06576 - 1 copy repair manual for Chev S10 Pick-up & 1 pc. measuring gauge for rotary dryer	$ 14.14	
- P.O.#85-34379 - V-belts & sprockets various models	33.69	
- P.O.#85-05766 - Insurance of starwriter printer	16.00	
- P.O#85-06585 - 1 copy Luecaena Based Farming & 5 copies "2 Ears Corn"	72.25	
- P.O.#85-04934 - 1 Pc. Dust cover with pocket for tray	24.47	
- P.O.#85-04580 - Insurance	3.10	
- P.O.#85-36107 - 1 Unit Hand-tractor Model LS	461.25	

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- P.O.#85-35699 - 1 Unit PT5 power tiller modified with inclined transmission unit less engine & cagewheel for mounting 1.2 meter reaper unit	$ 289.93
- P.O.85-36337 - 5 units Tapak-tapak pump open well type	131.79
- P.O.#86-07240 - 1 copy TPIOE hand Pumps for use in drining water supplies	10.00
- P.O.#86-37899 - 1 Unit Hydro Power tiller	350.88
- P.O.#86-07539 - Various publications	39.50
- P.O.#86-37900 - 6 Units Sipa pump 6" w/o engine	266.54
- P.O.#86-38018 - 1/6 HP Electric Fan motor for 1½ HP carrier airconditioners	73.86
- P.O.#05078 - Brokerage fee	1.47
- P.O.#86-04965 - 50 pkgs. Bruning Revolute Paper size 22" x 34"	2,247.85
- P.O.86-39018 - Equipment repair & fabrication of skid	73.96
- P.O.#86-39040 - 1 Unit Tapak-tapak pump	205.38
- P.O.#86-39740 - 1 Unit Hydro power tiller	366.81
- P.O.#86-37241 - Materials & labor for floater adapter for SM hand tractor	178.48
- P.O.#86-07692 - Reaper knife blade	1,127.98
- P.O.86-07937 - 2 copies "Rice" Post Harvest Technology	28.78
- P.O.#86-07538 - 1 copy "Ag'l. Mechanization in Developing Countries	17.78
- P.O.#86-39465 - Fabrication of PT skid pair of new pontoons	58.91
- P.O.#86-08147 - Various IT publications	106.91
- P.O.#86-40083 - Wooden corn sheller & shelling drum	208.15
- P.O.#86-40807 - 2 units Manual corn sheller	24.55
- P.O.#86-40923 - Various tools for C-271 & P-272	208.14

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- P.O.#86-41607 - 1 Unit Hydro Power tiller complete w/ accessories	$ 905.10
- P.O.#86-41635 - 4 units MAF-IRRI Transformer Power tiller	1,002.94
- P.O.#86-41717 - 1 Unit MCM Centrifugal Blower Model 7AH	513.37
- P.O.#86-41371 - Fabrication of stage cagewheel & fabrication	73.39
of power tiller	197.66
- P.O.#86-08420 - 1 copy Experiences in Appropriate Technology & 1 copy A Handbook on Approriate Technology	24.60
- P.O.#86-08351 - 3 units Centrifugal Pump Model 3P 551 & 2 Units Pump model 1P 746	1,585.79
- P.O.#86-41386 - Materials for sipa pump & Centrifugal Pump Project	164.70
- P.O.#86-41858 - Various wood, rough apitong & plywood	40.13
- P.O.#86-41559 - 50m. royal cord size 12/3	46.48
- P.O.#86-42175 - 20 units modified tapak-tapak pump complete with frame	978.47
- P.O.#86-42170 - 3 Units Honda Model G3000/4000 gas engine	2,926.62
- P.O.86#-42171 - 1 Unit Rice Hull Gas Gasifier	404.60
- P.O.#86-42172 - Power Hacksaw Model 870	611.55
- P.O.#86-42137 - Drafting table 33 x 48 & drafting chair	79.74
- P.O.#86-42169 - 3 Units Kawasaki 7.5 HP gas engine with reduction gear	1,009.83
- P.O.#86-42176 - 1 Unit Kodak Ektagraphic Projector Model III-E w/Lamp	744.78
- P.O.#86-42177 - 1 Unit Canon Camera body only, zoom lens, speedlite flash	528.38
- P.O.#86-42178 - Assorted drawing instrument & supplies	480.20
- P.O.#86-08504 - 1 Unit Honeywell Rotary type Thermocouple Switch	562.12
- P.O.#86-42247 - 3 units Multiple Hopper Rice Seeder 10 rows	294.84
& 3 Units Animal drawn cono puddler	412.78

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- P.O.#86-42248 - 3 Units Honda G3000 gas engine & 3 units Honda Model G4000 gas engine	$2,939.57	
- P.O.#86-42249 - Various Agricultural equipment	2,385.75	
- P.O.#86-42250 - 3 Units Kawasaki 7.5 HP gas engine w/ reduction gear	1,009.83	
- P.O.#86-42251 - 1 Unit sipa pump	189.19	
- P.O.#86-41523 - 3 units IRRI design 1.2 m. reaper	3,097.34	
- P.O.#86-42173 - Yamatake Honeywell Temperature	774.59	
- P.O.#84-04686 - 1 copy Small Scale Irrigation	60.00	
- P.O.#84-04829 - 1 copy Publication Rice Husk Ash Cement	40.00	
- P.O.#86-08516 - 1 Unit Kett Small Scale Polisher Model Pearlest	337.31	
- P.O.#86-08517 - 1 Unit Wireless Megaphone & 2 units wireless microphone, 2 units type CD-2 Handy Digital type moisture	1,157.45	
- P.O.#86-42258 - 1 Unit Pinoy II Touring Utility Vehicle	9,340.79	
- P.O.#86-08421 - 1 Unit bearing protection system seal & 1 Unit Model PPS2-2" direct drill portable pump with open impeller	1,258.24	
- P.O.#86-05591 - 1 Unit Clutch disc & pressure plate assy. & 1 pc. throw-out bearing	205.86	
-P.O.#86-05575 - 50 pkgs. Bruning revolute white base opaque paper with IRRI plate inc. freight	2,589.55	
- P.O.#86-42266 - 2 units SMGEN Hydrotiller less engine	742.25	$46,358.34
g. Others		
- Bank charges, materials used for making display booth at Invertor's Fair at Philcite, etc. for the period September 1985 to September 1986		430.42
		$55,981.06

Schedule #6. Training

a. Agricultural Engineering Training Course for the period Nov. 18 - Dec 6, 1985:		
- Virgilio Anaud		
- Training charges	$ 945.00	
- Travel expense	49.74	$ 994.74
b. KABSAKA local Training Program held in Iloilo City		97.80
		$ 1,092.54

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Schedule #7. **Studies**

Schedule #8. **Workshop/Evaluation**

a.	MAF-IRRI Workshop held on August 25-29, 1985			
	- Supplies & materials		$ 61.93	
	- Photocopies		6.07	
	- Airtickets issued to participants		218.30	
	- Travel & living expenses		675.38	
	- Snacks served for 5 days		60.34	$ 1,022.02
b.	MAF-IRRI Evaluation/Review Team held in the Philippines on September 24-30, 1986			
	- Meals of participants		$ 323.82	
	- Local Travel & airtickets issued		788.73	
	- Lodging of participants		103.72	
	- Driving services rendered to participants during the evaluation		317.30	
	- Consultancy fee & per diem of the evaluation team:			
	1. Sonia Tiong-Aquino			
	- Per diem	$134.54		
	- Consultancy fee	147.42	281.96	
	2. Abelardo F. Baclig			
	- Per diem	$134.54		
	- Consultancy fee	466.83	601.37	
	3. Apolonio Bautista			
	- Per diem		134.54	
	4. Josemari F. Lim			
	- Per diem	$134.54		
	- Consultancy fee	307.13	441.67	
	5. Zafrullah G. Masahud			
	- Per diem	$134.54		
	- Consultancy fee	208.85	343.39	
	6. Eusebio Nicolas			
	- Per diem	$134.54		
	- Consultancy fee	294.84	429.38	

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7. Sonia Salguero			
- Per diem		$ 134.54	
8. Peter Wallace			
- Per diem	$ 134.54		
- Consulting fee	1,498.53	1,633.07	$ 5,533.49
c. Per diem of Stephen Errey during consultancy to help RES develop cyclone furnace for rotary dryer			489.00
			$ 7,044.51

AID-492-CA-1707
Thailand
Terminal Financial Report
As of September 30, 1985

	Actual Expenditures 09/01/80 09/30/85	Accrued as of 09/30/85*	Total	Budget	Balance
1. Salaries & Wages	$104,638.15	$ 1,944.89	$106,583.04	$106,583.00	($ 0.04)
2. Overhead	14,683.51	984.20	15,667.71	15,668.00	0.29
3. Fringe Benefits & Allowances	23,830.14	2,769.60	26,599.74	26,663.00	63.26
4. Travel & Transporation	80,604.36	5,799.69	86,404.05	91,796.00	5,391.95
5. Equipment, Materials & Supplies	86,917.73	2,215.59	89,133.32	87,708.00	(1,425.32)
6. Training	22,176.54	2,325.14	24,501.68	24,502.00	0.32
7. Studies	14,623.84	175.00	14,798.84	14,799.00	0.16
TOTAL	**$347,474.27**	**$ 16,214.11**	**$363,688.38**	**$367,719.00**	**$ 4,030.62**

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Actual payments made during the period October 1, 1985 - December 31, 1985/reports received only on these period.

/mpr
4.15.87

AID-492-CA-1707
Thailand
Schedule of Expenditures
As of September 30, 1985

Schedule #1. **Salaries & Wages**

- Local staff	
- September 1985	**$ 1,944.89**

Schedule #2. **Overhead**

- Local staff	
- September 1985	**$ 984.20**

Schedule #3. **Fringe Benefits & Allowances**

- Provident fund (Retirement Savings Plan)	
- September 1985	$ 3,270.96
- Insuance (Refund)	(501.36)
	$ 2,769.60

Schedule #4. **Travel & Transportation**

a.	car lubrication		$ 16.56
b.	Insurance premium (refund)		(92.83)
c.	Local travel- Sept. 1985		1,174.75
d.	International Travel for BJC		
	- Travel per diem for trip to Indonesia and Manila on August 25 - September 11, 1986		1,170.39
e.	Terminal Travel		
	- Return ticket of BJC Bkk/Tyo/SFO/Dalla/Baton Rouge	$1,206.67	
	- Shipment of household goods	2,324.15	3,530.82
			$ 5,799.69

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Schedule #5. **Equipment, Materials & Supplies**

a.	Share in Bangkok Office Expenses - September 1985	$ 492.07
b.	Telex & Telephone charges in July, August & September 1985	44.30
c.	Customs duty for IBM computer from Thailand to Philippines	1,401.95
d.	Film developing	5.19
e.	Office supplies - September 1985	272.08
		$ 2,215.59

Schedule #6. **Training**

- Local Training - BAAC Training Course held in Chainat on Sept. 24-26, 1985 (Local travel, gasoline, per diem general stationery supplies, and photocopying charges	**$ 2,325.14**

Schedule #7. **Studies**

- Post departure allowance of Phanee Panichagon - Manila to Bangkok and salary for the period Sept. 2-13, 1985	**$ 175.00**

AID-492-CA-1707
Indonesia
Terminal Financial Report
As of September 30, 1985

	Actual Expenditures 09/01/80 09/30/85	Accrued as of 09/30/85 *	Total	Budget	Balance
1. Salaries & Wages	$ 83,862.72	$ 1,838.35	$ 85,701.07	$ 86,201.00	$ 499.93
2. Overhead	11,969.43	628.63	12,598.06	12,672.00	73.94
3. Fringe Benefits & Allowances	14,249.48	1,952.39	16,201.87	16,202.00	0.13
4. Travel & Transportation	106,299.20	8,783.71	115,082.91	115,103.00	20.09
5. Equipment, Materials & Supplies	167,466.05	5,938.10	173,404.15	169,745.00	(3,659.15)
6. Training	28,001.06	209.01	28,210.07	28,210.00	(0.07)
7. Studies	-	-	-	-	-
8. Workshop/Evaluation	34,371.51	-	34,371.51	34,371.00	(0.51)
TOTAL	**$446,219.45**	**$19,350.19**	**$465,569.64**	**$462,504.00**	**($ 3,065.64)**

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Payments/Reports were made/received only during the period October 1-December 31, 1985.

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4.15.87

AID-492-CA-1707
Indonesia
Schedule of Expenditures
As of September 30, 1985

Schedule #1. **Salaries & Wages**

a.	Base salaries for the period August - September 1985	$ 779.77
b.	Hourlyhelp for the period August - September 1985	434.92
c.	DITPROD Personnel honorarium for the month of August & September 1985	623.66
		$ 1,838.35

Schedule #2. **Overhead**

- As of September 1985	**$ 628.23**

Schedule #3. **Fringe Benefits & Allowances**

a.	Severance Pay for the month of September 1985	$ 1,931.44
b.	Retirement Savings Plan for the month of September 1985	55.65
c.	Medical, Insurance etc. for the month of September 1985	(34.70)
		$ 1,952.39

Schedule #4. **Travel & Transportation**

a.	Local Travel for the month of September 1985		$ 1,133.92
b.	International Travel of Dr. Venkat Ram Reddy		
	1) Trip to Manila		
	- Airticket - Jkt/Mnl/Sin/Jkt	$ 475.00	
	- Per diem & travel expenses on August 31 - Sept. 9, 1985 to attend Workshop in Agricultural Engineering	522.06	997.06

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2.	Terminal Travel for Dr. & Mrs. Reddy		
	- Airticket - Jkt/Sin/Maa/Hyd	$1,206.00	
	- Shipment of personal effects	5,396.85	
	- Exit Permit fee, Airport fee & airport tax	44.88	$6,647.73
			$8,783.71

Schedule #5. **Equipment, Materials & Supplies**

a.	Jakarta office rental for the months of August & September 1985	$ 709.81
b.	Raw materials for the months of August & September 1985	205.40
c.	Photography charges and slides for the months of August & September 1985	560.83
d.	Delivery/Postage charges for the months of August & September 1985	644.64
e.	Shipping charges of 2 units wheel tractor and 1 hand tractor plus accessories to Indonesia	3,658.93
f.	Telex & telephone charges for the months of August & September 1985	104.55
g.	Supplies for the months of August & September 1985	29.45
h.	Subscription for the month of Sept. 1985	24.49
		$5,938.10

Schedule #6. **Training**

-	Agricultural Engineering Training Course from May to June 1985	
-	Mr. Astu Unadi	
	- Exit permit fee	$ 133.81
	- Pre-departure allowance	75.20
		$ 209.01

AID-492-CA-1707
India
Terminal Financial Report
As of September 30, 1986

	Actual Expenditures				
	09/01/80-09/30/85	10/01/85-09/30/86*	Total	Budget	Balance
1. Salaries & Wages	$ 5,939.91	$ 55,340.31	$ 61,280.22	$ 79,340.00	$18,059.78
2. Overhead	939.78	8,068.41	9,008.19	11,784.00	2,775.81
3. Fringe Benefits & Allowances	-	37,367.51	37,367.51	42,100.00	4,732.49
4. Travel & Transportation	24,183.54	23,854.22	48,037.76	61,583.00	13,545.24
5. Equipment, Materials & Supplies	49,705.11	32,357.50	82,062.61	79,705.00	(2,357.61)
6. Training	16,553.00	5,080.44	21,633.44	26.553.00	4,919.56
TOTAL	$97,321.34	$162,068.39	$259,389.73	$301,065.00	$41,675.27

Certified Correct:

Paul A. Cooper
Director, Budget & Accounts

* Including payments made between October 1 1986 to March 31, 1987.

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4.15.87

AID-492-CA-1707
India
Schedule of Expenditures
As of September 30, 1986

Schedule #1. **Salaries & Wages**

a. Senior Staff - October 1985 to September 1986	$ 47,499.96
b. Hourlyhelp - September 1985 to September 1986	635.65
c. Government of India (personnel) - January 1985 to September 1986	7,204.70
	$ 55,340.31

Schedule #2. **Overhead**

January 1985 - September 1986	**$ 8,068.41**

Schedule #3. **Fringe Benefits & Allowances**

a. Senior staff - IIE Perquisites October 1985 - September 1986	$ 10,921.16
- Post differential allowance October 1985 - September 1986	11,874.96
- Housing/Utilities Allowance October 1985 - September 1986	1,436.18
- Insurance	260.41
- Physical Examination (Terminal)	85.00
- Vacation Leave	4,104.43
	$ 28,682.14
b. Government of India personnel - Dearness allowance, bonus, etc.	8,685.37
	$ 37,367.51

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Schedule #4. **Travel & Transportation**

a.	Local Travel for the period September 1985 - September 1986		$10,813.19
b.	Local travel of the Government of India personnel for the period January 1985 - September 1986		1,363.25
c.	Repairs & maintenance of motor vehicles from September 1985 to September 1986		534.59
d.	International Travel		
	1) Fred E. Nichols		
	a) Trip to Manila to attend Symposium on the Role of Engineering Technologies on Small Farm Agricultural Development and R&R Travel on August 27 to October 5, 1985:		
	- Airtickets	$1,131.96	
	- Per diem & travel expenses	756.92	
	- Driving services	11.86	1,900.74
	b) Trip to Bangkok - Travel & Misc. expenses on April 25 - May 13, 1986		1,506.48
	c) Trip to IRRI (Philippines) & U.S.A. - Airticket - CJB/MAA/SIN/MLA TYO/LAX/SBP/LAX/CHI/TYO/SIN/ MAA/CJB	$2,053.54	
	- Per diem & travel expenses to attend ASAE meeting in San Luis, Obispo, California on June 23 - July 25, 1986	1,118.02	
	- Driving services	6.46	3,178.02
	d) Terminal Travel - Airticket - CJB/MAA/SIN/MLA/ CHI/TULSA	$1,248.95	
	- Per diem & travel expenses	869.16	
	- Shipment of Household goods & personal effects	474.16	
	- Driving services	3.24	2,595.51
	2) P. Datt - Airticket to Manila/IRRI DELHI/MNL/DELHI	$ 959.43	
	- Per diem & travel allowance	998.20	
	- Driving services	4.81	1,962.44
			$23,854.22

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Schedule #5. **Equipment, Materials & Supplies**

a.	Telex, Telephone & Telegrams for the period September 1985 to September 1986		$ 652.91
b.	Photo & Photocopies for the period September 1985 to September 1986		231.38
c.	Office Supplies for the period Sept. 1985 - September 1986		2,824.33
d.	Raw Materials for the period September 1985 - September 1986		359.61
e.	Freight charges for the period September 1985 - September 1986		1,132.83
f.	Printing for the period September 1985 to September 1986		201.93
g.	Various equipment/farm machineries purchased:		
	- 1 Unit TR-4 Transplanter, 6-row transplanter	$ 134.57	
	- P.O.#86-35650 - 1 Unit Kato Rice Thresher/Corn Sheller Model TH8 w/o engine	1,212.28	
	- 1 Unit Mitsubishi HP8 - Aircooled diesel engine Model Shakti w/o generator assy. , Engine#AV8-E 16333	754.36	
	- 1 Unit 1.0 RE 2 Vertical conveyor Reaper PT5 tiller w/o engine	743.15	
	- 3 Units TR4 - 6-row transplanter	413.71	
	- 1 Unit TR5 8-row transplanter	144.51	
	- 3 Units - Greaves Lombardine Model LDA 510 Diesel engine	3,348.34	
	- 6 Units - Greaves Lombardine Model 523 diesel engine	3,597.07	
	- ATV Axle & tires for thresher	167.22	
	- V-belts for threshers & reapers	27.80	
	- Water can	3.14	
	- 3 Units TH8 Axial Flow Thresher without engine	4,430.88	
	- 2 Units 1.0 M Re vertical conveyor reaper on PT5 power tiller w/o engine	1,879.77	
	- 2 units - TH Axial Flow Thresher w/o engine	2,682.08	

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- 2 slip joint pliers	$ 5.30	
- Sale of 1 Unit Transplanter Prototype to FIM Scheme MBR	(179.64)	
- 2 units Fertilizer Applicators/ Injectors	170.32	
- P.O.#86-08156 - Various supplies shim, clamp, holder & clips	23.06	
- 1 Unit Ambassador Sedan	(7,031.39)	
- 10 Units Double-Row Rice Weeder	361.16	
- 10 Units Single Row Rice Weeder	200.64	
- 1 Unit IRRI Model 1.0M RE 2 vertical conveyor reaper on PT 5 Power tiller w/o engine	913.48	
- 1 Unit Paddy Thresher (New Model) w/3 pneumatic wheels & V belts	3,210.27	
- 1.2M reaper spare parts	246.79	
- 1 Unit 7" Cap Mechanical Hacksaw machine w/ 1HP 3Ø electic motor	350.32	
- 1 Unit 6-row transplanter IRRI model	78.82	
- 1 Unit Grade I Heavy Duty Portable Drill	158.84	
- 1 Unit Flexible Grinder Portable 4"	192.28	
- 2 Pcs. Steel Senior Cupboard Plain 78x36x19"	332.76	
- 4 Pcs. - Steel file tray 15 x 10 x 4"	15.34	
- 1 Unit T.W. Jr. Clerk Table 4½ x 2½ x 2½	85.01	
- 1 Unit Typist table Model ATV top	78.11	
- 1 Unit - Typist chair	23.04	
- 1 Unit Best Indian Make "BEST"brand 0.5 HP, 0.375 stage monoblock (Centripetal)	119.43	
- 1 Unit Best Indian Make "BHARAT" brant 150 amp, 3KVA, 100% copper aircooled welding transplanter	171.97	
- Welding accessories (10 mts. cable, glass, holder gloves, etc.)	39.81	
- 1 Unit No. stopwatch Range 30mm least count 0-1 sec.	47.77	
- 1 Unit spray gun for painting	37.97	$ 19,190.34
h. Others		
- Bank charges, visual display board for demos etc.	$ 324.04	
- Other tools & equipment	7,440.13	7,764.17
		$ 32,357.50

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Schedule #5. **Training**

- Agricultural Training Course held in the Philippines on May 26 - June 13, 1986:

1)	Jairam Chandore		
	- Airticket - Bombay/Delhi/ Bombay	$ 958.00	
	- Training charges	525.00	
	- Pre & Post departure allowance	150.00	$ 1,633.00
2)	Mahendra Sharma		
	- Travel expenses	$ 116.15	
	- Training charges	525.00	
	- Pre & Post departure allowance	150.00	
	- Driving services	1.69	792.84
3)	N. Khandelwal		
	- Airticket - Luckhow/Delhi/ Mla/Delhi/Luckhow	$1,927.60	
	- Travel expenses	52.00	
	- Training charges	525.00	
	- Pre & Post departure allowance	150.00	2,654.60
			$ 5,080.44