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04850

Distr.
GENERAL
ID/WG.142/8
25 April 1973
Original: ENGLISH

United Nations Industrial Development Organization

Expert Group Meeting on the Design and Manufacture of Wet-land (Rice) ~~Mechanization~~ Harvesting and Threshing Machinery in Developing Countries ~~of Asia and the Far East Region~~

Los Banos, Laguna, Philippines
12-17 March, 1973

REPORT OF THE JOINT UNIDO/IRRI EXPERT GROUP MEETING ON THE DESIGN AND MANUFACTURE OF WET-LAND (RICE) MECHANIZATION, HARVESTING AND THRESHING MACHINERY IN DEVELOPING COUNTRIES OF ASIA AND THE FAR EAST REGION 1/

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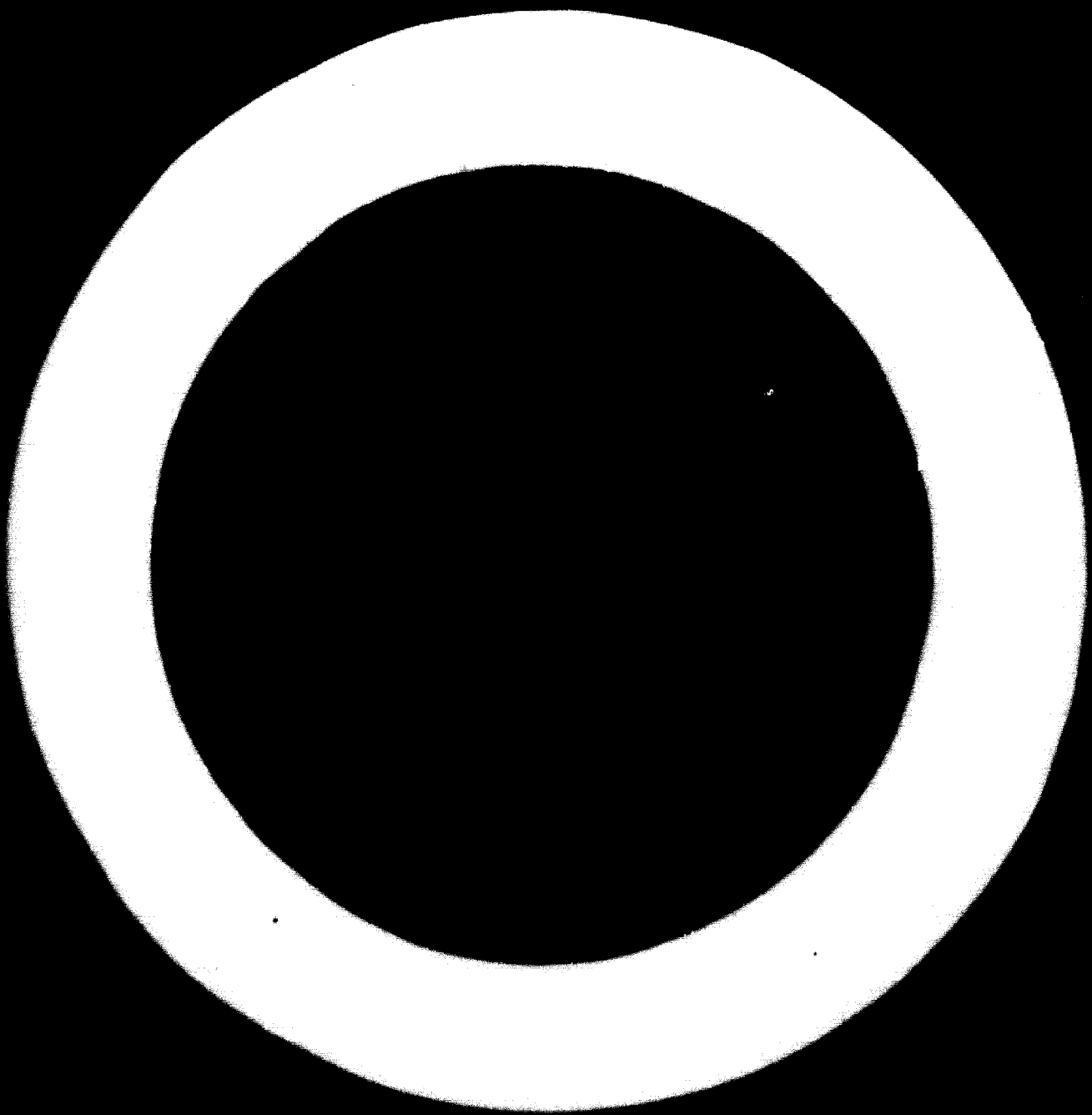

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PREFACE

1 - The Expert Group Meeting on the Design and Manufacture of Wet-land (rice) Mechanization, Harvesting and Threshing Machinery in Developing Countries of Asia and the Far East Region was organized by the United Nations Industrial Development Organization (UNIDO)and the International Rice Research Institute (IRRI) in a joint activity at IRRI, Los Banos, Laguna, The Philippines, from March 12 to 17, 1973.

2 - As preparatory pre-project activities, during 1971, UNIDO commissioned five special studies on design and development, repair and maintenance, storage and transport, manufacturers' organizations and professional agricultural engineering societies, with reference to developing countries in Asia and the Far East. During July-September 1972, a UNIDO team visited nine countries in Asia and the Far East (Burma, India, Indonesia, Iran, Nepal, Pakistan, Philippines, Republic of Korea and Thailand) and prepared a comprehensive country study report and regional report.

3 - UNIDO'S contribution to this meeting was in terms of pre-project activities, international travel and supplementary allowances to the participants from the developing countries, provision of consultants and preparation of selected technical projects. IRRI provided complete host facilities including conference services, lodging and boarding for the participants at the expenses of IRRI, preparation of technical papers, organizing exhibitions of IRRI developed agricultural machines and implements and visits to selected manufacturers in the Manila area.

4 - IRRI has developed a number of agricultural implements and machinery suited to rice cultivation. IRRI is also engaged in the promotion of selected equipment thus developed in a number of developing countries. UNIDO is engaged in assisting the developing countries in the process of industrialization. Local manufacture of suitable agricultural machinery

and implements in developing countries is one of the areas of activities of UNIDO.

5 - The Expert Group Meeting was attended by a total of 78 participants, of which 59 participants were from 14 developing countries (Bangla Desh, India, Indonesia, Iran, Khmer Republic, Laos, Nepal, Pakistan, Philippines, Republic of Korea, Republic of Viet-Nam, Singapore, Sri Lanka and Thailand). 7 participants from industrialized countries (Australia, Italy, Japan, Netherlands, USA) and 11 participants from International Organizations (UNDP, UNIDO, FAO, ECAFE and IRRI).

6 - The general objective of the Expert Group Meeting was to explore ways and means of promotion of local manufacture of appropriate machinery for rice production in the developing countries of Asia and the Far East Region (further in the report referred to as "the Region"). The agenda and the background papers were action oriented with the following specific objectives :

a - Establishment of general guide lines on mechanization policies and manufacturing;
  - Extension of local manufacturing of agricultural machinery in the Region;
  - Research, design, development and adaptation of agricultural machinery;
  - Marketing research, marketing and other supporting facilities;
  - Transfer of technology and manufacturing techniques;
  - Institutional matters and development of regional cooperation and international assistance;

b - Identification of specific machinery developed by IRRI, which may have a market potential in the home country;

c - Identification of manufacturing units in the home country which may take up local manufacturing of such selected specific machinery and equipment;

d - Personal contacts with representatives of international and national manufacturing firms and investigation of the possibilities of investment promotion of selected agricultural machinery and implements in the home country;

e - Formulation of preliminary proposals on possible UNIDO-IRRI home country co-operative programs regarding prototypes and designs and technical information procurement, local pilot manufacturing activities and promotion of local manufacture with reference to IRRI developed products, possible commercial investment promotion projects and expected role of UNIDO and IRRI through co-operative technical assistance towards the realization of these objectives.

7 - The Expert Group Meeting reviewed a number of technical background papers presented at the meeting and discussed specific technical papers presented at the meeting by selected participants. In addition, the group studied, both in the field as well as in the agricultural engineering workshop and laboratory of IRRI, the agricultural machinery developed and designed by the Agricultural Engineering Dept. of IRRI and examined the ways to achieve a more widespread manufacturing and utilization of this equipment in the Region.

Also three local manufacturers of agricultural machinery in the Manila area (Kalayaan,Oberly and Marsteel), plus two local manufacturers of allied products (Francisco Motors and Sarao Motors) were visited and the applied manufacturing technologies were studied and discussed.

8 - In this connection it is interesting to note that IRRI is engaged currently in the promotion of local manufacture of IRRI developed products in some selected developing countries (Philippines, Thailand, etc.) through a subcontracting system on a pilot scale.

It was the opinion of the participants that expanded efforts should be undertaken by UNIDO through implementing activities toward a broader promotion of local manufacture in the developing countries, taking into account the magnitude of the requirments. The participants also recom-

mended that a number of selected manufacturers and a limited number of research and testing stations could be involved in such an expanded activity. It is evident that such a program will not be a duplication of IRRI activities, but an expansion of the opportunities for promotion for local manufacture toward supplementary activities.

9 - Having the above objectives in view, the participants from the developing countries, in consultation with IRRI Agricultural Engineering Staff and UNIDO technical personnel, identified a number of IRRI developed products which may have a potential for local manufacture in their countries and recommended a comprehensive proposal for consideration by UNIDO and IRRI and for follow up through official channels of the Governments towards accelerated development of local manufacture. In this connection the participants recommended provision of prototypes, design drawings, fellowships and expertise technical assistance.

10 - The participants from the developing countries also identified priorities for UNIDO technical assistance in the field of agricultural machinery and implements, that may be followed up by UNIDO through official channels of the Governments concerned.

11 - At the closing session, all participants and visitors unanimously expressed their great appreciation to IRRI and UNIDO for a most fruitful organisation of the Meeting.

RECOMMENDATIONS

Based on the documents presented and on the discussion developed during the meeting, the participants unanimously approved the following recommendations :

1 - TO THE GOVERNMENTS CONCERNED :

1.1 - as far as agricultural mechanization is concerned, it is recommended that :

1.1.1. - Mechanization should be considered as a basic means of increasing and improving the production of Wet-land rice and related crops, of facing seasonal labour peaks and timeliness in agricultural practices;

1.1.2. - types and sizes of machines most suitable to the development of Wet-land rice and allied crops production, both from a technical as well as economic point of view should be defined, taking into consideration present and future socio-economic conditions of each country;

1.1.3. - financial policies support price strategies, low interest credit facilities to facilitate purchasing capacities of farmers of suitable machines consistant with real needs and able to minimize crops production costs should be established;

1.1.4. - a broad dissemination of technical training for farmers, technical information and demonstration of working machines in the fields should be promoted;

1.1.5. - the establishment of efficient repair and maintenance organizations on a co-operative basis among farmers should be encouraged.

1.2 - as far as industrial sector is concerned, it is recommended that :

1.2.1. - pilot plants for local construction of new machines suitable to Wet-land rice and allied crops production, within the framework of the maximum utilization of local available components and local manufacturing capabilities, should be realized;

1.2.2. - small scale industries for the manufacturing of agricultural machines in rural areas should be treated,

1.2.3. - special financial and administrative facilities and protections in favour of local manufacturers of agricultural machinery should be established;

1.2.4. - specialization in manufacturing of factories also by means of sub-contracting techniques - should be encouraged,

1.2.5. - production standardization and quality control should be improved;

1.2.6. - joint ventures and other ways of cooperation with foreign industries, should be encouraged especially for production requiring sophisticated technologies;

1.2.7. - a rational distribution and supplying of spare parts should be assured.

1.3 - <u>as far as research and teaching is concerned, it is recommended that</u> :

1.3.1. - research, design, prototype construction and testing facilities should be improved and implemented;

1.3.2. - an expert committee at a national level, involving manufacturers, to coordinate research activities, the choice and design of agricultural machines and to avoid duplication should be established;

1.3.3. - a strong practical course of the sandwiched type, involving industries, in university engineering degree courses should be promoted;

1.3.4. - specialization courses for technicians and mechanicians in the agricultural machinery manufacturing sector should be encouraged and developed.

2 - <u>TO THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI) AND/OR ARE RECOMMENDED THAT</u> :

2.1 - activity in the design and realization of new machines most suitable to local conditions of different countries in the Region should be increased;

2.2. - design of a low cost 7-10 HP diesel power tiller preferably with riding attachments for Wet-land culture and a four wheel tractor up to 18 HP should be undertaken;

2.3. - assistance to manufacturers in the local production of IRRI designed machines and in their adaptation to local capabilities and available components of each country in the Region should be extended;

2.4. - broad dissemination of information and design of realized prototypes and future programs should be increased;

2.5. - courses for technical training to technicians of industries involved in the local construction of IRRI designed machines should be promoted.

3 - <u>TO THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO) PARTICIPANTS RECOMMENDED THAT</u> :

3.1. - a broad and coordinated assistance programme to Governments in the selection of types and sized of agricultural machines most suitable for local conditions should be developed, in cooperation with other appropriate international organisations;

3.2. - broader technical and financial assistance in the reinforcement of research and manufacturing existing facilities and in the creation of new ones should be established;

3.3. - assistance in the reinforcement and creation of efficient repair and maintenance organization should be assured;

3.4. - an integrated activity to promote local manufacturing of IRRI designed machines should be undertaken;

3.5. - assistance in the constitution of a regional committee to coordinate research, design, testing and manufacture of agricultural machine and to avoid duplications should be promoted;

3.6. - periodical technical information exchanges among the countries

of the Region by means of meetings of experts should be sponsored;

3.7. - assistance in connection with ECAFE and other international organizations in the establishment of an Asian Agricultural Machinery Institute to maximize the utilization of available resources and facilities and avoid duplication should be assured;

3.8. - any kind of assistance to the Khmer Republic, the Republic of Viet-Nam and Laos and other countries of the Indo-China subcontinent, helping them in rehabilitation programs and in developing of agricultural mechanization and local manufacture of agricultural machines should be assured.

SUMMARY OF THE DISCUSSION AND CONCLUSIONS

1 - THE MAIN SUBJECTS EXAMINED DURING THE GROUP MEETING OF EXPERTS WERE :

- present situation and future trend of Wet-land rice and allied crops mechanization and harvesting and threshing machinery in the developing countries of the Region;
- research, design, development, adaptation and marketing of agricultural machinery;
- manufacturing techniques, problems and technology transfer;
- promotion of institutional facilities, regional cooperation and international assistance.

A short summary is given in the next paragraphs of each of the above mentioned subjects.

2 - PRESENT SITUATION AND FUTURE TRENDS OF AGRICULTURAL MECHANIZATION AND MANUFACTURING IN THE REGION

2.1. - Documents presented

2.1.1. - As a part of the preparation for the Meeting, a fact-finding mission of UNIDO examined the present situation and the development of agricultural mechanization and manufacturing opportunities of agricultural machinery as well as investment promotion possibilities in nine selected countries of the Region (Burma, India, Indonesia, Iran, Nepal, Pakistan, Philippines, Republic of Korea and Thailand) taking into consideretion the present socio-economic and agricultural conditions and the position of their trends of development. At the meeting the regional and country reports of this mission were presented and discussed.

2.1.2. - Further, UNIDO presented an informative document on the functions of this organization and the procedure to obtain assistance. The activities in the field of agricultural mechanization and of agricultural machinery manufacturing were especially mentioned.

2.1.3. - ECAFE presented the conclusions of preceeding teams of experts that recently visited various countries in the Region.
2.1.4. - FAO presented a background paper on the future development of agricultural mechanization in the developing countries and the FAO policies in this sector.

2.2. - Conclusions of the session

Based on these documents and on the discussion during the session of the meeting, the following conclusions were reached :
2.2.1. - To supply sufficient and high quality food to rapidly growing population of the Region, there is an urgent need of increasing the production of wet-land rice and related crops. To achieve this, a shifting of the prevailing types of agriculture to more intensive farming systems is necessary. Such systems include the use of new varieties and a higher level of management and require a higher power input. Although it is estimated that the total labour force in paddy areas will not substantially decrease in the next two decades, such a higher soil productivity can only be achieved by a development and a broad dissemination of mechanization through the improvement and the implementation of mechanical power operated equipment. Animal implements suitable to specific local conditions have to be considered useful and to be improved too.
2.2.2. - The role of such mechanisation applied in the Region should be aimed at covering seasonal labour peaks, at increasing soil productivity by timeliness and quality of the cultural practices improvement as well as reducing losses and cost of paddy production. Introduction of multiple cropping following the development of irrigation systems should accompany an increase of the level of employment. There is the sequence of increased soil production which will increase mechanization and generate development of industry and demand of labour force in this sector.
2.2.3. - As the farming and socio-economic conditions show wide variations in the countries and rural districts concerned, it is evident

that for each country and district there is a need to define specific mechanization policies.

2.2.4. - In defining mechanization policies the following topics should be recognized :

(a) The contribution to the level and quality of food production;

(b) The financial policies involved to facilitate the purchasing capacity of farmers. Such policies have to be established particularly taking into consideration the possibilities of support prices policies,as well as of credit facilities through low interest rate loans and gift contributions to farmers;

(c) The cost/benefit ratio to the individual farmers;

(d) The impact on the level and quality of employment both on the farm, as well as in the manufacturing, distribution and other levels of industry;

(e) The creation and extension of employment in manufacturing and other related sectors and other benefits of introduction of industrial technology in the rural areas.

2.2.5. - From the available information presented, it was evident to the group that substantial increase of available power per hectare will be indispensable to obtain a more intensive agriculture. (To indicate : an increase of the present amount of power per hectare of cultivated land available (0.2 HP/Ha) up to a minimum of 0.5 HP/Ha in the next decade seems desirable. It means, for the 60 million hectares of paddy land in the nine countries visited by the UNIDO team, that an additional minimum power of 18-20 million HP of motorised equipment has to be added).

2.2.6. - Discussion during the Meeting emphasized that the size and type of tractors and other agricultural equipment characteristics depend on the profitable farming systems selected and local economical conditions and have to be chosen in the effort to minimize production costs of paddy and allied crops.

2.2.7. - However, it was evident that because of the small average size of paddy farms in the Region and the often unfavourable condi-

tions for large scale mechanization there is a need to develop and to manufacture low-cost, durable, simple and low power equipment adapted to these conditions.

2.2.8. - Therefore, integrated efforts should be made by all those concerned to assist in the development, the design and the local manufacture of suitable machinery and equipment for agricultural mechanization of the Region, in particular for Wet-land mechanization and harvesting, threshing and drying equipment.

2.2.9. - In order to meet the increasing demand for agricultural equipment the meeting recognized that regional coordinated policies and goals for manufacturing agricultural machinery have to be developed in each country.

2.2.10. - Such policies and goals should be defined in close cooperation between research,design and testing institutes, farm planning and financing institutions, manufacturers and distributors with the assistance and cooperation of UNIDO, FAO and other UN organizations.

Ample attention should be given to find ways to avoid undesirable duplication of design and development activities throughout the Region.

2.2.11. - From the information collected is was evident to the group that the facilities for local manufacturing in a rather large number of small to medium size plants applying intermediate -- not highly sophisticated -- manufacturing technologies, particularly located in rural areas, is a most important step in providing the small farmers with the equipment required for intensive Wet-land culture.

2.2.12. - Therefore, more attention should be paid to the dissemination of information on promising types of implements and simple low-power equipment for local manufacturing.

2.2.13. - In planning the development of local manufacturing it is desirable to take into account :

- that at present the potential capacity of various enterprises is not used to its full extent;
- that the application of production engineering and product planning

principles and techniques require strengthening;

- that training and extension on adeguate use, maintenance and repair of the products require more attention. In many cases the need of a supply of spare parts is not sufficiently recognized;
- that standardization of machine parts and types to reduce production costs and swarfs, within the framework of the maximum utilization of the local available components is one of the more important steps in the development of rational manufacturing;
- that the problems of economy of scale of production units, specialization and coordination in manufacturing, application of the principles and techniques of modern business and workshop management (quality control, plant layout, cost analysis, unit metric system, etc.) have to be taken into serious consideration;
- that opportunities offered by the construction of tractors and agricultural machinery locally have to be evaluated in the context of the ratio of national level cost-benefits taking into account the displacement of labour at the farm level, the general development of the industrial sector and the increase of national income.

2.2.14. - Joint ventures and other ways of cooperation with foreign industries are in many cases valuable alternatives and have to be considered especially if sophisticated technologies are required. Any way, the real content of possible local contribution has to be carefully evaluated.

It is a matter of fact that the problems of agricultural mechanization of the small rice farms in the Region do not allow for copying the mechanization of agriculture in the highly industrialised countries as has been developed during the last two decades. However, if it is economical to apply more sophisticated equipment techniques in the manufacturing of engine parts, for example, the development of adequate systems of cooperation that fit both the objectives of the local and foreign partners concerned is recommended.

2.2.15. - For the above mentioned reasons the meeting recognised at it would be desirable for the national Governments in the respective

countries, with the assistance of UNIDO and allied international organizations, to promote agricultural mechanization and the manufacturing of agricultural machinery locally through various activities and particularly :

(a) supporting the establishment of pilot plants;

(b) promoting of training and extension facilities both on the manufacturing and the farm level;

(c) enlarging crediting and other facilities for these purposes.

2.2.16. - In order to develop the desired manufacturing policies and practices described before, the group agreed to invite UNIDO to take action and to promote, in cooperation with other international organizations like FAO and ECAFE, specific projects in the Region directed :

- to identify gaps in the production line according to the findings and results of feasibility studies on the required development of mechanization of intensive Wet-land cultivation;
- to technically and financially assist on research, training and extension in the fields of marketing research product planning, production engineering, industrial engineering, quality control, cost and financing, sub-contracting and service management;
- to coordinate development, design, testing and evaluation of adequate agricultural machinery and to assist in the creation of pilot plants;
- to improve the dissemination of information, experiences and vital data on the previous fields by any appropriate public and private means.

3 - RESEARCH, DESIGN, DEVELOPMENT, ADAPTATION AND MARKETING OF AGRICULTURAL MACHINERY

3.1. - Documents presented

Five reports were presented, concerning :

3.1.1. - general and particular problems in the research, design and

development of agricultural machinery, with special regard to the connection between activities in the research units and universities and manufacturers;

3.1.2. - the development of an appropriate mechanization technology, discussing the strategies that densely populated countries in the Region must follow to avoid adverse social and employment effects and expressing in favour of the development of indigenous farm equipment manufacturing capabilities;

3.1.3. - the national policies for research and development, with particular reference to the conditions of India, whose development needs to pay specific attention to coordination of research, assessment of most suitable machines and evaluation of their performances;

3.1.4. - the manufacturing potential in the developing countries, potential which will be fully utilized in the future development of the Region, through appropriate production technology and machine design;

3.1.5. - the problem of marketing of locally manufactured farm equipment with the definition of the basic functions of marketing, and the discussion of the introduction of new products, alternative channels of distribution and promotion strategies.

3.2 - Conclusions of the session

Based on these documents and on the discussions during the sessions of the meeting, the following conclusions were reached :

3.2.1. - Various developing countries have many research and development institutes carrying out design and development of rice mechanization machinery and even in the same country different institutes may be duplicating the same work. The meeting recognizes the need for better coordination through the establishment of a committee to help rationalize the designs and types of agricultural machinery most suitable for the Region considering social, farming and economic conditions. This committee would coordinate results of functional and economic feasibility studies, prototype testing, improvement and production and avoid duplication.

The committee also has to operate in strict connection with IRRI, so as to study the suitability of manufacturing IRRI prototypes in all the developing countries from the point of view of manufacturing capability, availability of raw materials, etc..

3.2.2. - Also study has to be made for the suitability of using IRRI developed rice mechanization machinery for developing countries. For these purposes, prototypes would have to be tried out in various developing countries for evaluation of performance for the conditions prevailing.

Designs will also have to be examined and modified if necessary from the point of view of easy maintenance and durability and manufacturing facilities available in respective countries.

In this sector, design engineering services should be involved right from the design stage, prototype manufacturing, testing, evaluation till the product is manufactured commercially and reaches the market.

3.2.3. - It is generally found that research institutes do not have or cannot always afford to have the various facilities, expertise and knowhow required to come up with really reliable and durable products, though concept of design may be patentable and novel. The design should be for simple manufacturing processes.

3.2.4. - For these purposes the meeting recognized also that design and development institutes should have the knowhow of tool engineering metallurgy and quality control to enable them to do real design and development work from a commercial manufacturing point of view, as well as considering the need of the farmer. This will avoid considerable waste of time and money when commercially manufactured.

3.2.5. - Testing of product to establish durability level should be carried out before it is commercially manufactured to judge over design or under-design of various components of the product and to ensure product reliability and to avoid all wastage of amount invested on toolings, etc..

3.2.6. - Rice mechanization machinery constitutes a wide spectrum of products which ranges from hand tools to power machinery and various production technology.

The production consists, in small, medium and large scale sectors. There is a need to assist small and medium scale manufacturers in design and development activities. Small and medium scale factories have to be encouraged and to be considered in national policies because of their labour-intensive and their versatility in production lines.

In this sector, too, manufacturing engineers should be involved in the design project at the design stage. Correspondingly, the design engineer's responsibility does not end when his new product enters the manufacturing stage and should continue until the product is manufactured an a commercial basis.

3.2.7. - The existing agricultural machinery design and development facilities are in :

- Agricultural engineering and educational institutes;
- Agricultural engineering and farms mechanization research institutes;
- Private industries.

All the three above areas have places for contribution and there is a need to identify existing drawbacks and to reinforce the existing facilities with a view to provide an integrated service to the industry and to the consumer.

3.2.8. - From the informations collected, it was evident to the group that there is a need for rationalization and standardization of products from the import as well as from the local manufacturing points of view to be put in the research and development activities. Policies should include establishment of national repair and maintenance program, central workshop, spare parts inventory control.

3.2.9. - As far as marketing problems are concerned, consumer or market surveys should be undertaken before launching production of

new products. Most of the product failures can be attributed to poor marketing. Broad dissemination has to be recommended, for, at the demonstration of the machines in action in the fields. The new product should have exclusive rights to make up for initial losses. It is also extremely important that the operators and purchasers are trained properly in handling and maintenance of the machine.

3.2.10. - The degree of rice mechanisation and selection of type of machinery would depend upon the following major factors

- manpower availability and labour rates;
- physical characteristics of land and availability and conditions;
- social and economic conditions of the country;
- man-skill availability, etc..

In this context, the expert group recognised the necessity of placing emphasis on making aware the inter-relationship between design, manufacture and consumer utility.

3.2.11. - As far as UNIDO assistance is concerned, the meeting recognized the necessity :

a - that UNIDO promote an integrated activity in the developing countries either through reinforcement of existing facilities or establishing new facilities, and UNIDO should place emphasis on making aware the inter-relationship between design, manufacture and consumer requirements;

b - that UNIDO initiate a program to assist the governments of developing countries in the selection of the right type of mechanisation machinery to ascertain the level and degree to suit local conditions and needs by providing experts and data on the machinery already designed and developed by some of the countries;

c - that UNIDO promote establishment of a committee to help rationalise the designs and types of agricultural machinery most suitable for the Region, considering social, farming, and economic conditions. This committee would coordinate results of functional and economic feasibility studies, prototype testing, improvement and production, and avoid duplication;

d - that UNIDO, at a national level, promote technical consultation meetings between industry and design and development institutions and assist in the formulation of practical industry oriented development work program and also make sure the consumer is represented;

e - that UNIDO assist the developing countries and their manufacturing sectors to establish rational and complete repair, maintenance and after-sales service programs.

4 - MANUFACTURING TECHNIQUES, PROBLEMS AND TECHNOLOGY TRANSFER

4.1. - Documents presented

Six documents were presented concerning the following subjects :

4.1.1. - capital vs labour intensive manufacturing strategies, discussing the advantages in the present social and economic situation in the Region of small scale labour intensive industries;

4.1.2. - techniques of subcontracting, explaining the advantages coming from a broad dissemination of this technique in the promotion of the manufacture of agricultural implements and machinery and the dangers coming from an insufficient production quality control;

4.1.3. - institutional credits, with particular reference to the problems of small business loans, guidelines for borrowing and lender requirements;

4.1.4. - promotion, techniques and problems of agricultural machinery manufacturing in different countries, discussing different problems met by different manufacturers in their own countries (India, Pakistan and Sri Lanka). The same problems were also discussed in a panel involving three manufacturers in the Philippines.

4.2 - Conclusions of the session

Based on these documents and on the discussions during the session of the meeting, the following conclusions were reached :

4.2.1. - Regarding the choice of manufacturing techniques, the consensus of opinion was that it should be carefully done by taking into

consideration the capital available, labour, expertise, volume of manufacturing, etc.

4.2.2. - Sub-contracting has to be considered a very useful technique in increasing manufacturing capacity, offering advantages of specialization and less cost. However the quality of product and time of delivery have to be ensured by the sub-contractors. At present, sub-contracting in the Region has to be considered negligible. It needs to be introduced quickly in this area, if necessary with the assistance of local Trade Associations and other allied Organizations.

4.2.3. - Sub-contracting needs good quality control, proper organization, standardization, engineering expertise and other infrastructure which should be created by technical services organizations in the Region.

4.2.4. - From the information collected, it was evident to the Group that institutional finance needs to be made available to the entrepreneurs for the establishment of factories and workshops for manufacture of agricultural machinery and implements. The establishment of special facilities and protections also have to be recommended.

The Governments of developing countries should allocate special quota for foreign exchange to be allotted to agricultural machinery manufacturers in case they have to import capital goods or raw materials and samples of products or prototypes.

4.2.5. - The expert group also recognized that the governments in the Region should give special concessions for introduction of newly designed machines, and should simplify the licensing procedures for industries.

4.2.6. - Careful market survey should precede actual selection and implementation of any manufacturing project. In this sector a general lack of statistics has been noted. Encouragement should be given to invent new ideas and to introduce new innovations; governments should provide for improving statistic services considered of a basic importance to establish the suitability of new products.

4.2.7. - In the Region intermediate technology may be applied wherever possible. This is necessary because special and sophisticated types of

tools are required for applying mass manufacturing techniques adopted in industrially developed countries.

4.2.8. - The establishment of small scale industries in rural areas should be encouraged. Among the various advantages that such a type of industry presents, the versatility in the production seems one of the most important. However broad specialisation of products has to be undertaken on an international basis cooperating both in production and sales.

4.2.9. - Many difficulties were pointed out by the manufacturers regarding overcoming problems in the transition period between a simple and a more complex management stage. This was considered a very critical stage, particularly for small firms. In consequence the meeting recognized the utility of taking on management and technical persons on Advisory Councils of Research Stations to solve this problem.

4.2.10. - As far as University Engineering degree courses are concerned the meeting recognized the utility of a stronger practical bias and suggest that courses of a sandwiched type should be promoted to train engineers in the developing countries. Industries should be more involved in this field.

4.2.11. - As far as IRRI activity is concerned, the meeting recognized the need of the Engineering Department of IRRI to increase its activity and proposed that IRRI undertake designing of a low cost 7-10 HP diesel power tiller preferably with sitting riding attachements for Wet-land culture and a four-wheel tractor up to 18 HP.

4.2.12. - In this connection it was recommended that UNIDO make available to IRRI information that has been collected and investigate possibilities of cooperative activities in the promotion of ultimate local manufacturers.

5 - PROMOTION OF INSTITUTIONAL FACILITIES

5.1. - Documents presented

A panel discussion was made on the establishment of an Asian Agri-

cultural Machinery Institute, on the basis of a UNIDO paper analyzing the scope and the possible activities of such an Institute.

5.2. - Conclusion of the session

Based on this document and on the discussion during the session of the meeting, the following conclusions were reached :

5.2.1. - The Group of Experts, representing both the public and the private sector, noticed with great interest the concept of the establishment of a Regional Agricultural Machinery Institute for Asia, and the preparatory activities carried out by UNIDO, ECAFE and IRRI and allied international organizations.

5.2.2. - From the presented information and discussions of the Meeting of the Experts it was strongly recognized by the Group that there is a need for coordinated activities at the regional level with a view to support the national activities and to promote international cooperation in the Region.

5.2.3. - Therefore the Group fully supported the establishment of this Institute as a most adequate instrument for conducting activities, to maximize the utilization of available resources and facilities and to avoid duplications.

5.2.4. - The Group strongly recommended the international organizations concerned as well as the national governments concerned to take all future steps for the proper implementation of this proposal as soon as possible, taking into account the available funds and by application of a pragmatic approach on this matter.

5.2.5. - The Group considered it highly desirable for a formulation committee to be set up to prepare the terms of reference, the work program and other institutional matters of the Institute. It also recommended that the public and the private sectors of the agricultural machinery industry should be involved in that committee.

6 - REGIONAL COOPERATION AND INTERNATIONAL ASSISTANCE

6.1. - Conclusion of the session

An open discussion on the subjects was made and the following con-

clusion were drawn :

6.1.1. - The Expert Group Meeting recognized the contribution of UNIDO and other international Organizations in contributing to the development of agricultural machinery industry at national and regional level. The Expert Group also recognized the limitation of finances at the disposal of United Nations including UNIDO. However the Expert Group recommended that technical personnel of the developing countries should assist the Governments concerned to include programs in agricultural machinery for United Nations and UNIDO assistance in cooperation with allied inrernational organizations.

6.1.2. - The Expert Group also recommended that UNIDO together with ECAFE and IRRI assist the Governments of developing countries in working out programs for technical assistance.

6.1.3. - The Expert Group commended the work undertaken by IRRI in development of manufacturing prototypes of agricultural machinery and implements for rice mechanization and identified this activity worthy of promotion for manufacture in other developing countries of the Region. In this connection it was recommended that UNIDO initiate an integrated activity for promotion of manufacture through provision of IRRI prototypes, providing fellowships and assistance in manufacturing at a local industry level through appropriate UNIDO financial resources.

6.1.4. - The Expert Group identified that information dissemination among developing countries and recommended that UNIDO explore the possibilities of commercial publications through private publishers and sales channels.

6.1.5. - There is a need for dissemination of information on a wider basis not only among Government officials but also among the manufacturers, distributors and end-users of agricultural machines. Serious consideration must be given to have periodic publications circulated in the Region both through the existing commercial publication channels as well as through international organizations which would peri-

odically give reports and news on all kinds of development that are taking place in the Region. Also market surveys, if any conducted, and imports from developed countries could be included in this publication.

6.1.6. - The Expert Group recognized that any regional activity should incorporate all the national organization and activities. In this connection there is a need to reinforce national organizations, manufacturing activities, research and development institutions, professional agricultural engineering societies. Therefore the Expert Group recommended that UNIDO undertake an integrated activities for strengthening national professional organizations and make each such national organization a nucleus of regional and technical communication system. In this connection the Expert Group recommended that participants from the developing countries take an active initiative in establishment of such professional organization or reinforcement of existing ones through involvement of manufacturing, Government and UNIDO.

AGENDA

Monday, March 12, 1973

Inaugural Session

8.00-8.30 - Registration	
8.30-8.45 - Welcome Address	D.S.Athwal, Associate Director, IRRI A.A.Swamy-Rao, UNIDO
8.45-9.20 - Election of Chairman, Vice Chairman and Rapporteur	
9.20-9.30 - Adoption of Agenda	

1st Session - Presentation of UNIDO, IRRI, ECAFE and FAO Activities

9.30-10.00 - The Role of Mechanization in Agriculture	W.J.van Gilst, FAO
10.00-10.15 - Coffee Break	
10.15-10.45 - Rice Mechanization and Machinery Manufacture in the ECAFE Countries	V.M.Subramanian, ECAFE
10.45-11.15 - IRRI's Program Objectives	A.U.Khan, IRRI
11.15-11.45 - Role of UNIDO	A.A.Swamy-Rao, UNIDO
1.00-3.15 - IRRI Machinery Demonstration	
3.15-3.30 - Coffee Break in Ag.Engineering Dept.	
3.30-4.15 - Country Studies and Regional Report	G.Pellizzi, UNIDO Consultant
4.15-5.00 - Discussions	

APPENDIX A

Tuesday, March 13, 1973, 8.30-12.00

2nd Session - Research, Design, Development and Adaptation of Agricultural Machinery

8.30-9.15	Design, Development : General	C.V.Paul, India
9.15-10.00	Development of an Appropriate Mechanization Technology	A.U.Khan, IRRI
10.00-10.15	Coffee Break	
10.15-11.00	National Policies for Research and Development	D.N.Kherdekar, India
11.00-12.00	Discussions	

Tuesday, March 13, 1973, 1.30-5.00

3rd Session - Research, Design, Development and Adaptation of Agricultural Machinery

1.30-2.00	Marketing of Locally Manufactured Farm Equipment in a Developing Country	E.A.Uichanco,Philippines
2.00-2.30	Manufacturing Potential in the Less Developed Countries	F.Nichols, IRRI
2.30-3.00	Discussions	
3.00-3.15	Coffee Break	
3.15-5.00	Review and Discussion of IRRI Machines (Ag.Engineering Dept.)	IRRI Staff

Wednesday, March 14, 1973

4th Session - Manufacturing Techniques, Problems and Technology Transfer

8.30-9.00	Capital vs Labor Intensive Manufacturing Strategies	B.Duff, IRRI
9.00-9.30	Techniques of Sub-contracting	C.Follosco, Philippines
9.30-10.00	Institutional Credit in Manufacturing	B.Catane, Philippines
10.00-10.15	Coffee Break	
10.15-12.00	Open Forum on Investment Promotion Activities in Local Agricultural Machinery Manufacture	A.A. Swamy-Rao, UNIDO

1.30-2.00	Problems and Promotion of Agricultural Machinery Manufacture in India	V.R. Reddy, India
2.00-2.30	Problems of a Manufacturer	D.M. Khan, Pakistan
2.30-3.00	Manufacturing Techniques, Problems and Promotion of Local Agricultural Machinery Manufacture	T.N.Jinasena, Sri Lanka
3.00-3.15	Coffee Break	
3.15-4.00	Panel Presentation on Problems and Techniques of Manufacturing in the Philippines	T.Kaubang, Philippines C.Viaplana, Philippines R.Lahoz, Philippines
4.00-5.00	Discussions	

Thursday, March 15, 1973, 8.30-12.00

5th Session - **Promotion of Institutional Facilities - Regional Cooperation and International Assistance**

8.30-9.15	Panel Discussion on Asian Agricultural Machinery Institute	V.M.Subramanian,ECAFE A.A.Swamy-Rao, UNIDO A.U.Khan, IRRI
9.15-10.15	Discussions	
10.15-10.30	Coffee Break	
10.30-12.00	Discussions	

Thursday, March 15, 1973, 15.00-17.30

Final Session

15.00-17.30 - Conclusions and Recommendations

Friday, March 16, 1973

8.00-12.00	Field trip to agricultural machinery and allied implement manufacturers in the Manila area
12.00-1.30	Lunch at Plaza, Makati
1.30-5.00	Resumption of field trip
5.00	Return to Los Baños

APPENDIX B

LIST OF OFFICE BEARERS

In the inaugural session were unanimously elected :

Meeting Chairman :	Mr.Dante B.De Padua - The Philippines
Meeting Vice Chairman :	Mr.Ishtiaq Ahmad Kari - Pakistan
Meeting Rapporteur :	Mr.Giuseppe Pellizzi - Italy (UNIDO consultant)

For the different sessions were unanimously elected :

1st Session :

Chairman :	Mr.Chul Choo Lee - Republic of Korea
Secretary :	Mr.Adrian Moens - Netherlands (UNIDO consultant)

2nd Session

Chairman :	Mr.Afandi Dachlan - Indonesia
Secretary :	Mr.Heerachand Mutta - India (UNIDO consultant)

3rd Session

Chairman :	Mr.Gholam Hossein Fouladion - Iran
Secretary :	Mr.V.R. Reddy - India

4th Session

Chairman :	Mr.Vo Van Nhung - Republic of Viet-Nam
Secretary :	Mr.Dinkar Neelkanth Kherdekar - India

5th Session

Chairman :	Mr.V.M.Subramanis - ECAFE
Secretary :	Mr.Cyril Vincent Paul - India (UNIDO consultant)

LIST OF DOCUMENTS PRESENTED

Volume I

The Role of Mechanization in Agriculture	W.J.van Gilst
Rice Mechanization and Machinery Manufacture in the ECAFE countries	V.M.Subramanian
The Role of UNIDO in Promoting the Agricultural Machinery and Implements Industry	A.A.Swamy-Rao
Regional Report on Rice Mechanization Machinery and Implements Manufacture in Nine Selected Countries of Asia and the Far East Region	G.Pellissi

Volume II

Country Study Reports on Rice Mechanization Machinery and Implements Manufacture in Nine Selected Countries of Asia and Far East Region	G.Pellissi and M.Turrini
Interrelationships among Agricultural Mechanization, Industrialization and National Employment in the Developing Countries	UNIDO
Development of an Appropriate Mechanization Technology	A.U.Khan
National Policies for Research, Development and Adaptation of Agricultural Machinery	D.N.Kherdekar
The Role of Design, Development, Adaptation and Testing in the Manufacture of Agricultural Machinery and Implements in Asia and the Far East	G.W.Giles
The Development of Engineering Design Capabilities in Developing Countries	UNIDO

Volume III

Marketing of Locally Manufactured Farm Equipment in a Developing Country	E.Uichanco
Manufacturing Potentials in the Less Developed Countries	F.Nichols
The Role of Effective Repair and Maintenance in the Agricultural Machinery and Implement Field in Asia and the Far East	A.B.Behr
Capital-vs Labor-Inteneive Manufacturing Strategies	B.Duff
Techniques of Subcontracting : Promotion of Local Manufacture of Agricultural Implements and Machinery in Asia and the Far East	C.Pollenco
Inetitutional Credit in the Manufacture of Agricultural Implements	B.Cotome
Problems and Promotion of Manufacture of Agricultural Implements and Machinery in India	V.Reddy
Manufacturing Techniques, Problems and Promotion of Local Manufacture of Agricultural Implements and Machinery	T.N.Jinasena
Encouraging the Manufacture of Improved Grain Storage and Transport Facilities in Asia and the Far East	J.Wimberly
The Role of Manufacturers' Organisation and Development Organizations in Promoting the Manufacture of Agricultural Machinery and Implements in Asia and the Far East	Y.Kishida
The Role of Professional Societies in Development of Agricultural Machinery in Asia and the Far East	B.K.Jain
Analysis of the Scope and Possible Activities of the Proposed Asian Agricultural Machinery Institute	UNIDO

During the meeting were also presented the following papers :

Local Implement Manufacture in Thailand	C.Chaikaphak

APPENDIX C

Manufacture of Paddy Implements and Machines	D.N.Kherdekar
Design Future of a good Power-Tiller for South-East Asian Countries	D.N.Kherdekar
Bottlenecks in Manufacture and Development of Agricultural Machinery required for Paddy production in South East Asian Countries	D.N.Kherdekar

LIST OF IRRI DEVELOPED AGRICULTURAL PRODUCTS (AGRICULTURAL MACHINES AND IMPLEMENTS) WHICH HAVE A POTENTIAL FOR LOCAL MANUFACTURE IN THE DEVELOPING COUNTRIES OF ASIA AND THE FAR EAST

1 - During the Expert Group Meeting (Philippines, March 12-17, 1973), the participants from developing countries reviewed the operation of the following machines that have been developed at IRRI.

2 - Category A

Commercially released products (prototypes and designs available)

(i) 7 HP gasoline engine powered power tiller with cage wheels, plow, harrow, pneumatic tires and trailer.

(ii) 1 HP gasoline engine power driven weeder (mini cultivator).

(iii) 3 HP gasoline engine powered table thresher.

(iv) Foot operated bellows irrigation pump.

(v) Manually operated multi-hopper seeder.

(vi) Multipurpose single hopper seeder

(vii) 3 HP gasoline engine driven batch drier (1 ton/3-4 hrs capacity).

(viii) 3 HP gasoline engine operated drum type seed cleaner.

Category B

Machines that will be ready for commercial release within six (6) months

(i) 6.5 HP gasoline engine driven axial flow multi crop thresher.

(ii) Tractor PTO driven thresher.

(iii) Rice Hull Furnace.

Category C

Machines which will be ready for commercial release within one (1) year

(i) 8-12 HP power tiller.

(ii) Non-selective herbicide applicator.

(iii) Heated-sand drying and paraboiling equipment.

(iv) Self propelled 10-12 HP stripper harvester.

APPENDIX D

3 - The participants from the developing countries have identified the following machines and implements developed by IRRI as products which have a potential for local manufacture in their countries and have requested UNIDO to initiate a programme for supply of prototypes and drawings as follows :

COUNTRY	CATEGORY A	CATEGORY B	CATEGORY C
BANGLADESH	Power tiller	Axial flow thresher	
	Table thresher	- -	- -
	Power weeder	- -	- -
	Multi hopper seeder	- -	- -
	Single hopper seeder	- -	- -
	Bellows pump	- -	- -
	Batch drier	- -	- -
INDIA	Single hopper seeder	Axial flow thresher	Paraboiler
	Multi hopper seeder	PTO thresher	Stripper harvester
	Power weeder	- -	8-12 Power tiller
	Power tiller	- -	- -
	Batch drier	- -	- -
INDONESIA	Table thresher	- -	8-12 Power tiller
	Power weeder	- -	- -
	Single hopper seeder	- -	- -
	Multi hopper seeder	- -	- -
	Bellows pump	- -	- -
	Grain cleaner	- -	- -
IRAN	- -	Axial flow thresher	- -
	- -	PTO thresher	- -
KHMER	Table thresher	- -	- -
	Single hopper seeder	- -	- -
	Multi hopper seeder	- -	- -
	Bellows pump	- -	- -
	Batch drier	- -	- -

APPENDIX D

COUNTRY	CATEGORY A	CATEGORY B	CATEGORY C
LAOS	Bellows pump	Axial flow multi-crop thresher	- -
NEPAL	Bellows pump	Axial flow thresher	- -
	Batch drier	- -	- -
	Single hopper seeder	- -	- -
	Multi hopper seeder	- -	- -
PAKISTAN	Power tiller	Axial flow thresher	- -
	Multi hopper seeder	- -	- -
	Bellows pump	- -	- -
REPUBLIC OF KOREA	Power tiller	Axial flow thresher	Stripper harvester
	Grain cleaner	PTO thresher	- -
	Multi hopper seeder	- -	- -
	Single hopper seeder	- -	- -
	Batch drier	- -	- -
REPUBLIC OF VIET-NAM	Power tiller	Axial flow thresher	- -
	Bellows pump	PTO thresher	- -
	Table thresher	- -	- -
	Batch drier	- -	- -
	Multi hopper seeder	- -	- -
SRI LANKA	Batch drier	Axial flow thresher	Sand drier
	Power tiller	PTO Thresher	8-12 Power tiller
	Grain cleaner	Rice Hull Furnace	- -
THAILAND	Power tiller	Axial flow thresher	- -
	Grain cleaner	- -	- -
	Power weeder	- -	- -

4 - The participants have also indicated firms which may have a potential capacity and may be interested in the production of the above products

APPENDIX D

in their countries.

5 - They have also indicated the government organization/agency under which a comprehensive programme may be initiated for local manufacture.

6 - The participants have indicated that such a comprehensive manufacturing promotions activity should include provision of fellowship (for training in IRRI and with Philippines manufacturers) and the need for short-term experts to assist local manufacture in their development and trial production programs. These requirements have been detailed by each participant in specific terms.

7 - The participants have also indicated which government organization/agency/institution may have a maximum potential for involvement in this activity and assist the local manufacturers in further adoption, local testing and commercial manufacture.

8 - It is the opinion of the expert participants that UNIDO, through appropriate financial resources and in cooperation with IRRI, develop such an integrated projects involving provision of prototypes, fellowships and experts. The general opinion of the experts is that such a programme could be initiated and implemented at an early date if UNIDO could find appropriate financial resources on a priority basis.

9 - It is the opinion of the experts from the developing countries that all the above recommendations made are in their personal capacity and recommend to UNIDO that UNIDO may initiate the necessary action with the governments concerned through appropriate channels for concurrence and implementation.

LIST OF PROBABLE AREAS OF UNIDO TECHNICAL ASSISTANCE IN THE FIELD OF AGRICULTURAL MACHINERY AND IMPLEMENTS AS IDENTIFIED BY THE PARTICIPANTS FROM THE DEVELOPING COUNTRIES WITH SPECIFIC REFERENCE TO THEIR OWN COUNTRY

1 - During the Expert Group Meeting (Philippines, March 12-17, 1973) participants from developing countries reviewed the UNIDO Document ID/96 "Role of UNIDO in the Promotion of Agricultural Machinery and Implements Industry" and discussed the various potential areas of UNIDO technical assistance. The specific or areas discussed are as follows :

A - stationary repair workshop, mobil repair units and technical service center

B - design, development, adaptation and testing center

C - pilot demonstration engineering workshop and foundry for the manufacture of agricultural machines and implements and metal products

D - manufacture of knapsack sprayers (local product development and manufacture)

E - manufacture of grain storage bins and equipment (local product development and manufacture)

F - investment promotion; establishment of new plants

G - assistance to existing industry.

2 - The participants from the developing countries indentified the two areas in the order of priority, which in their opinion require UNIDO's integrated technical assistance :

	COUNTRY	I	II
a -	Bangladesh	Design & Development	Repair & Maintenance
b -	India	Repair & Maintenance	Design & Development

APPENDIX L

COUNTRY	I	II
c - Indonesia	Design & Development	Assistance to existing industry
d - Iran	Design & Development	Assistance to existing industry
e - Khmer Republic	Pilot Plant	Repair & Maintenance
f - Laos	Pilot Plant	Repair & Maintenance
g - Nepal	Design & Development	Assistance to existing industry
h - Pakistan	Repair & Maintenance	Design & Development
i - Philippines	Design & Development	Investment Promotion
j - Republic of Korea	Design & Development	Pilot Plant
k - Republic of Viet-Nam	Design & Development	Repair & Maintenance
l - Sri Lanka	Investment Promotion	Grain storage equipment manufacture
m - Thailand	Assistance to existing industry	Design & Development

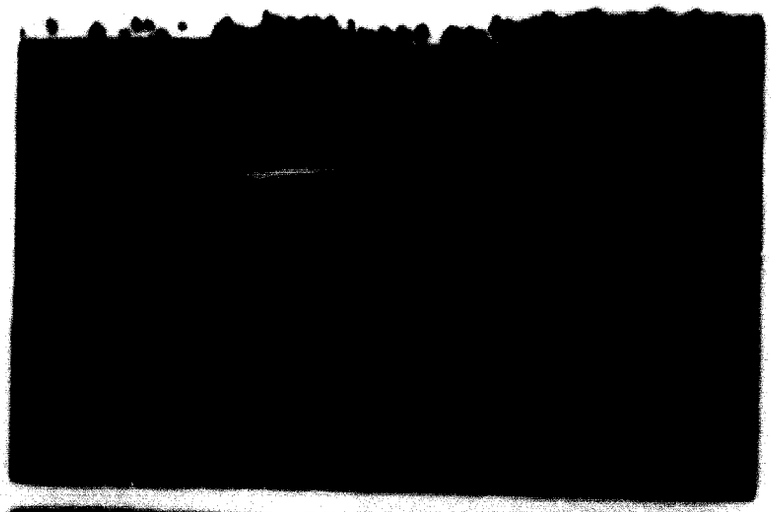
3 - In addition, the participants have specifically indicated the details of the UNIDO Experts, Fellowship and equipment needed for the successful implementation of the Priority I area recommended. It is the opinion of the experts that these recommendations which are presented in their individual capacity may be followed up by UNIDO with the respective Governments through appropriate official channels.

4 - The participants recognized the need for inclusion of such an activity in the country programming under IPF finances. They also felt that such an activity could be incorporated during the annual review. However it was their personal opinion that UNIDO may initiate such an activity, preferably under UNIDO's own resources in order to start the project at an early date : in addition to initiating steps that may be necessary for inclusion in the country programming through appropriate communications between the concerned activities of UNIDO and Governments through official channels.

APPENDIX - F

PHOTOGRAPHS OF SELECTED PRODUCTS DEVELOPED OR BEING DEVELOPED BY IRRI

Category A: commercially released products



(i) 5-7HP 4cycle gasoline aircooled Engine Power Tiller, with pneumatic tyre and trailer

approx. sales price: US$ 600 *

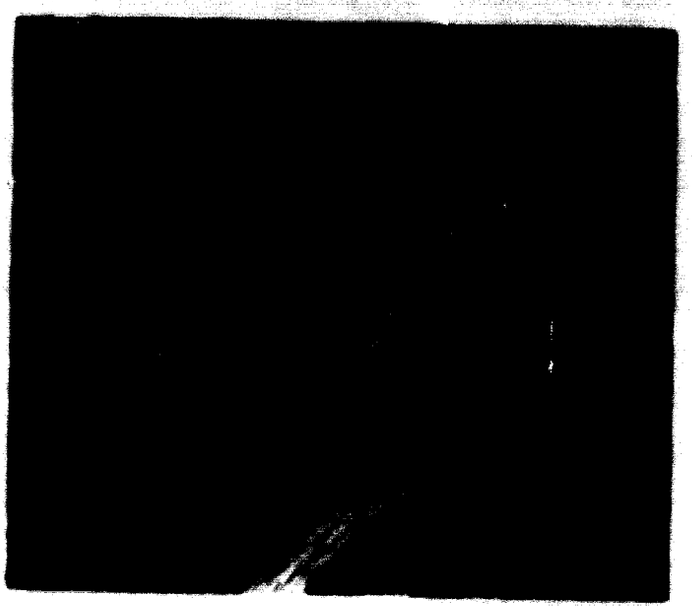
- with paddy cagewheel and counter weight; also mouldboard plow, and comb harrow available
approx. sales price: US$ 500

The power tiller has a sealed oil-bath chain transmission and employs attachments for both dry and wet-land cultivation

* all sales prices indicated are approximate as indicated by manufacturers in the Philippines

(ii) 1 HP gasoline engine driven <u>power weeder</u> (mini cultivator
- weeding rotors through a worm reduction box
<u>capacity:</u> 17 man/hours/ha against 70 man hours for manual rotary weeding and 120 man hours for hand weeding
approx. sales price US$ 140 (in Japan)

(iii) 3 HP gasoline engine powered <u>table thresher</u>
- can thresh dry or freshly harvested high moisture paddy
<u>capacity:</u> with 4-5 men 350 kg of paddy/hour
approx. sales price US$ 375



(iv) foot operated low-lift <u>bellow irrigation pump</u>
<u>capacity:</u> 90 gpm at 1.5 meter pumping head
approx. sales price US$ 40

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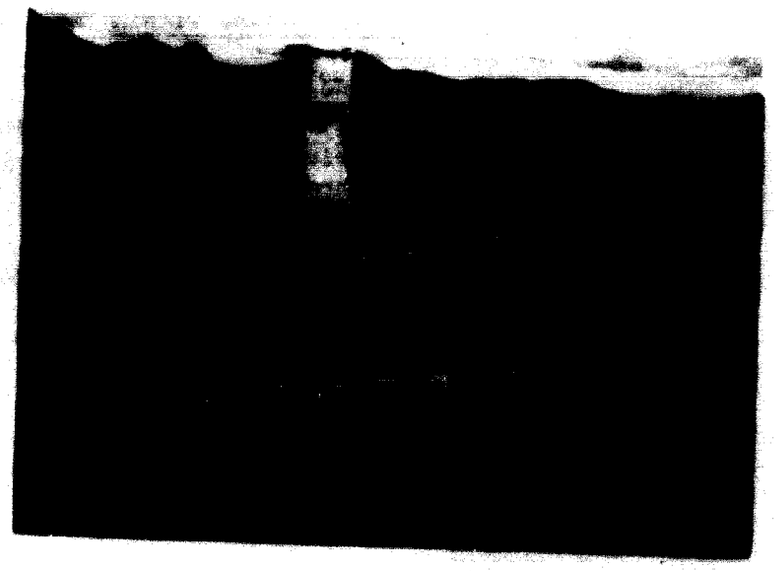
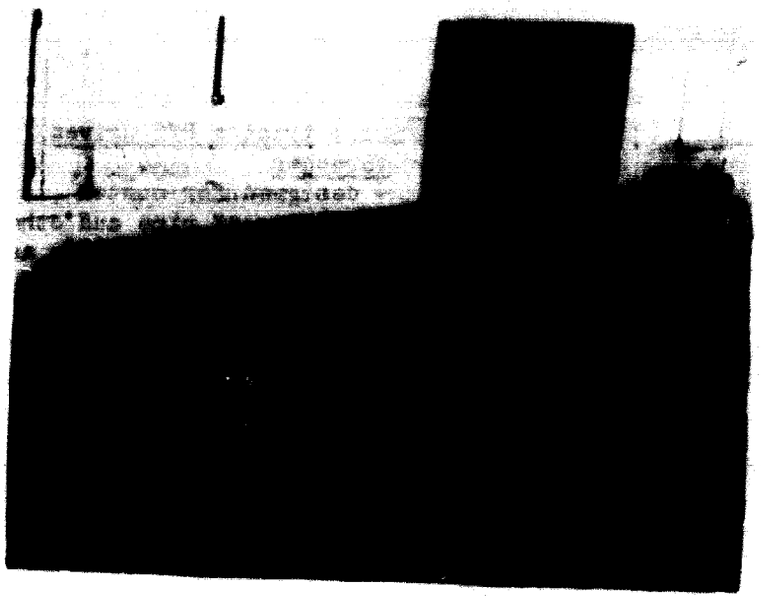
(v) manually operated multi-hopper seeder
directed sowing of pre-germinated rice is low cost alternative and 20 times faster than manual transplanting
capacity: 50 kg seed per HA in 5-7 hours
approx. sales price: US$ 40



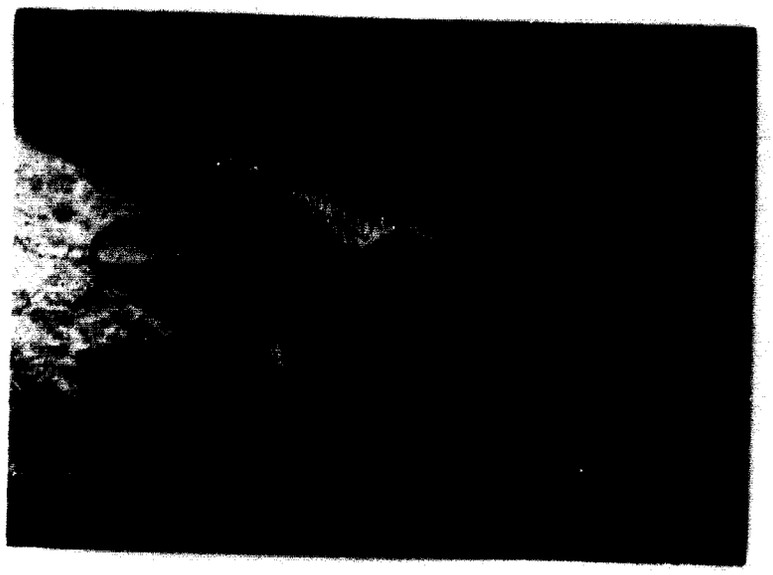
(vi) manually operated multipurpose 6-8 row seeder (dry and wetland)
- 25 times faster than manual transplanting
- with proper attachments the basic unit can be used manually or animal or tractor drawn
capacity: 50 kg seed/HA in 5-7 hours
approx. sales price US$ 45



(vii) batch type drier
with Kerosene burner;
a diesel oil burner under development
3 HP engine
capacity: 1 ton of paddy in 3-4 hours of continuous operation
approx. sales price US$ 450

(viii) power operated rotary grain cleaner with 3 HP engine and transport wheels
capacity: 3 tons of paddy per hour
approx. sales price US$ 475

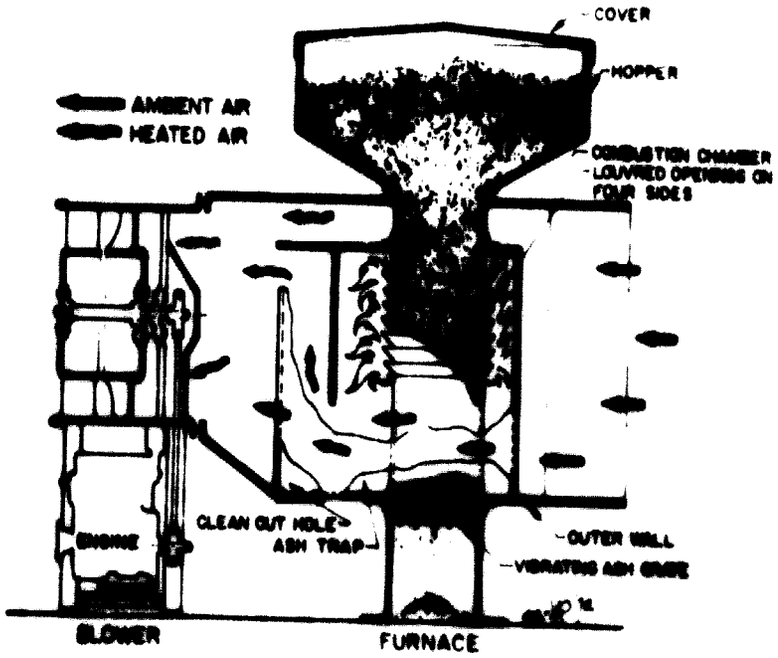
Category B: machines that will be ready for commercial release within six months



(i) 5-6 HP gasoline engine driven axial flow multi-crop thresher
capacity: 650 kg/hour
the output of 150 kg of threshed grain/hour compares favourably with other imported threshers; cleaning quality about 98 %
approx. estimated sales price US$ 600 - 700

(ii) tractor PTO driven thresher
- designed for custom threshing of rice and other grains; can thresh dry as well as freshly harvested crop
capacity: about 3tons/hour
estimated sales price: not yet calculated

APPENDIX - F

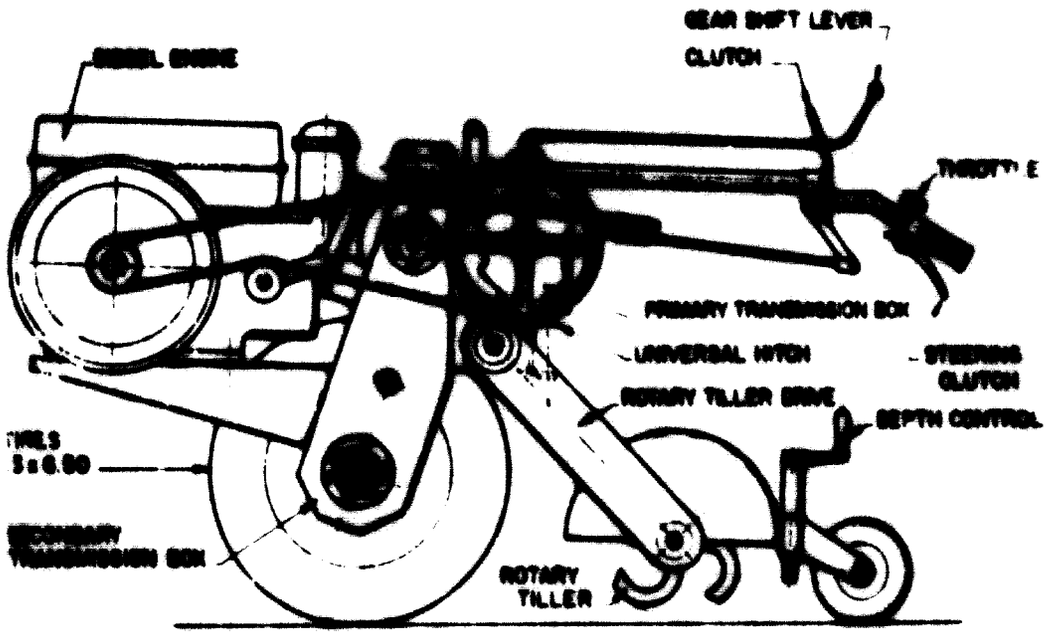


(iii) Rice hull furnace (louvered columnar type) used in conjugation with axial-flow blower of batch type drier

capacity: hull consumption of 3-4 kg/hour at air temperature of 43 degree C at air flow rate of 45m^3 per minute against a static pressure of 1.9cm water; maximum drying air temperature of 60^0 C at hull consumption of 8 kg/hour

schematic drawing - note: two types of furnaces designed, prototype manufactured and tested; further modifications under progress

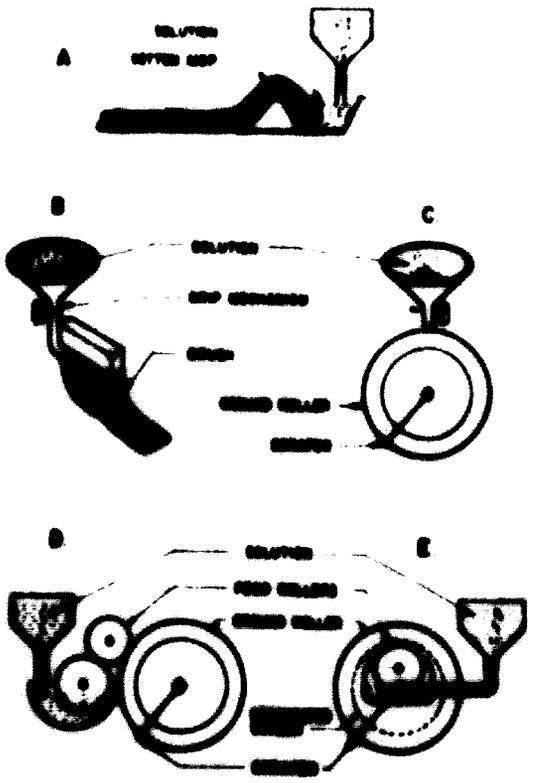
Category C: machines which will be ready for commercial release within one year



Schematic drawing of 8-14 hp IRRI power tiller

(i) 8 - 14 HP power tiller

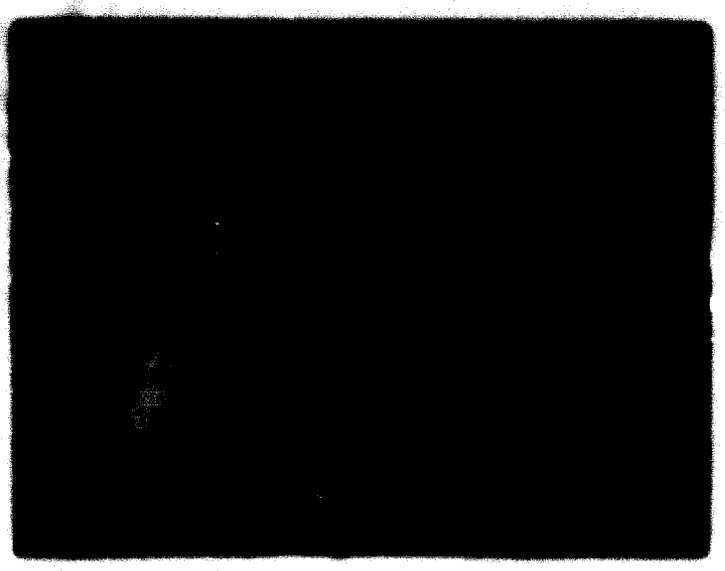
note: first prototype designed, prototype manufactured and tested: further modifications under progress



Concepts for contact application of non-selective herbicides

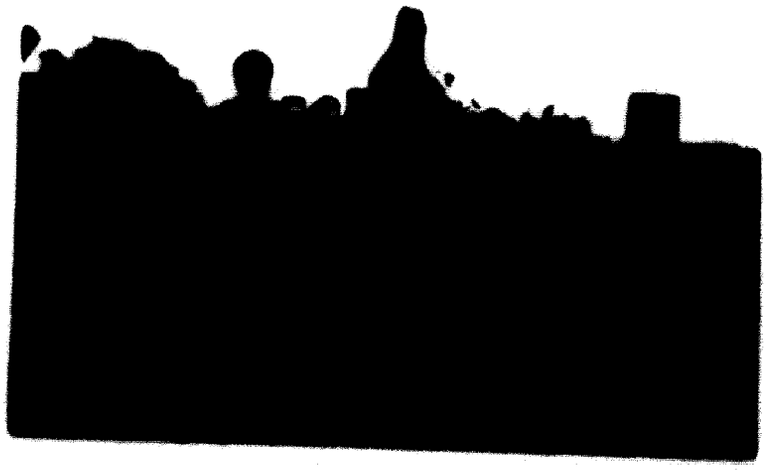
(ii) non-selective herbicide applicator

- tests for evaluation of various applicator concepts under progress; if successful, concept is developed, the design of a commercial machine will be undertaken



(iii) [illegible] processing 12 % moisture [illegible] with a 20 seconds exposure; further tests under progress

APPENDIX - F



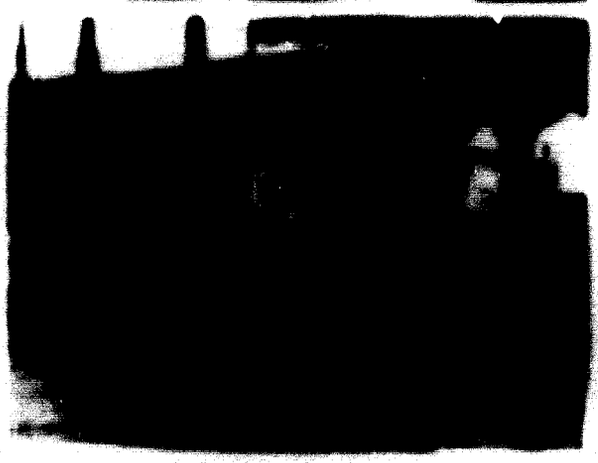
(iv) Self propelled 6-12 HP stripper harvester

- 2 furrow machine harvests paddy without cutting the plant; further development work is under progress

APPENDIX - G

EXAMPLES OF MANUFACTURING PROGRAMME OF IRRI DEVELOPED PRODUCT BY MANUFACTURERS IN THE PHILIPPINES (POWER TILLER)

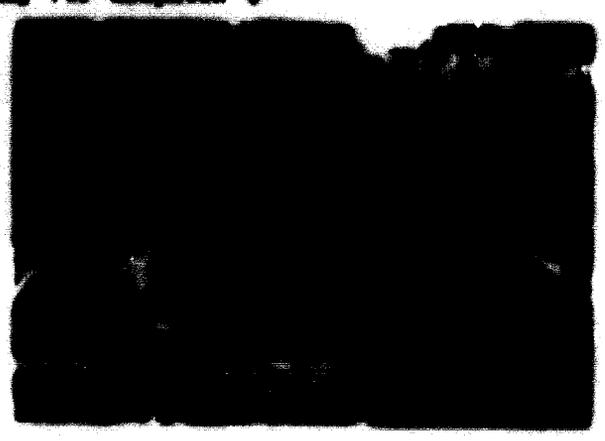
1. transmissions assembled



2. handles assembled

3. cage wheels assembled

4. ready for dispatch



APPENDIX --

COMPANIES IN THE PHILIPPINES CURRENTLY MANUFACTURING IRRI LEVEL[illegible] AGRICULTURAL MACHINES

TABLE THRESHER

Oberly & Co.
63 Mayon St., Sta. Mesa Heights
Quezon City
(Approx. P3200 complete with
3-hp aircooled engine)

SINGLE-HOPPER BOX SEEDER, 6-ROW

Kalayaan Engineering Co., Inc.
4255 Emilia St., Makati, Rizal
(Approx. P300.00)

Trans-Pacific Steel Industries, Inc.
6091 M. Dimetimbangan St., Bangalo
Parañaque, Rizal
(Approx. P300.00)

MULTI-HOPPER BOX SEEDER, 6-ROW

Kalayaan Engineering Co., Inc.
4255 Emilia St., Makati, Rizal
(Approx. P270.00)

GRAIN CLEANER

Kalayaan Engineering Co., Inc.
4255 Emilia St., Makati, Rizal
(Approx. P3,300 complete with
3-hp aircooled engine)

RICE HULLER

Chitose Kouki Seisakusho Co., Ltd.
Nakajima, Chiharu-kuro
Aunegun, Aichi, Japan
(Approx. $150 in Japan)

BELLOWS PUMP

Kalayaan Engineering Co., Inc.
4255 Emilia St., Makati, Rizal
(Approx. P200.00)

BATCH DRIER

A. P. Rodrigues Agro-Industrial Machineries
Bitas, Cabanatuan City
(Approx. P3,000.00 with 3 hp gasoline
engine)

Kalayaan Engineering Co., Inc.
4255 Emilia St., Makati, Rizal
(Approx. P3,000.00)

POWER TILLER

Maretsol Corporation
CIBA Bldg., 666 T.M. Kalaw St.
Ermita, Manila
(Approx. P3,900 complete with 7-hp engine,
cage wheels, comb harrow, and front coun-
terweight. Pneumatic wheels, plow, trailer
and other attachments extra)

Oberly & Co.
63 Mayon St., Sta. Mesa Heights
Quezon City
(Approx. P3,800 with 5-hp engine and
P3,900 with 7-hp engine, complete with
cage wheels, comb harrow, and front coun-
terweight. Pneumatic wheels, plow, trailer
and other attachments extra)

note: 1 US$ = P. 6.70 (Philippines Peso)

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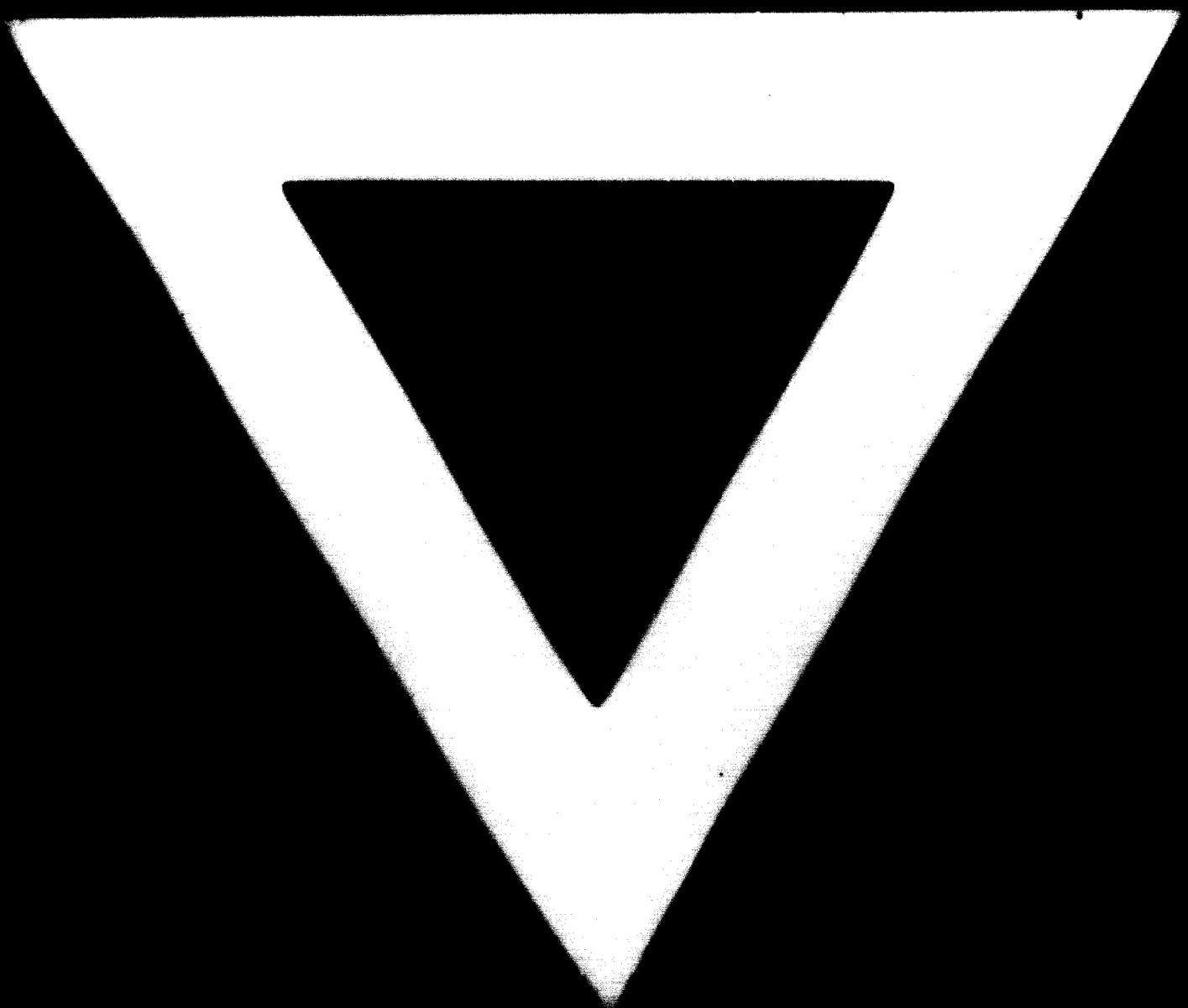

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