

PB-225 766

NEW AGRICULTURAL EQUIPMENT FROM THE  
INTERNATIONAL RICE RESEARCH INSTITUTE

Amir U. Khan

International Rice Research Institute

Prepared for:

Agency for International Development

1972

DISTRIBUTED BY:

**NTIS**

National Technical Information Service  
U. S. DEPARTMENT OF COMMERCE  
5285 Port Royal Road, Springfield Va. 22151

BIBLIOGRAPHIC DATA SHEET		1. Report No. FEA-631.3-K45c	2.	PB 225 766	
4. Title and Subtitle "NEW AGRICULTURAL EQUIPMENT FROM THE INTERNATIONAL RICE RESEARCH INSTITUTE"			5. Report Date SUMMER 1972		
7. Author(s) AMIR U. KHAN			3. Performing Organization Rept. No.		
9. Performing Organization Name and Address THE INTERNATIONAL RICE RESEARCH INSTITUTE AGRICULTURAL ENGINEERING DEPT. LOS BANOS, PHILIPPINES			10. Project/Task/Work Unit No. 931-17-138-443		
12. Sponsoring Organization Name and Address Department of State Agency for International Development Washington, D. C. 20523			11. Contract/Grant No. AID/csd-2541		
			13. Type of Report & Period Covered RESEARCH REPORT		
15. Supplementary Notes			14.		
16. Abstracts <p>The International Rice Research Institute is attempting to develop an appropriate rice mechanization technology with the development of simple agricultural equipment to suit the manufacturing capabilities of the IDC. This program is primarily focused towards the requirements of the 2-to 10-hectare tropical farms which are too large to work with animals and uneconomic to work with the farm equipment originating from the industrialized countries. Technology to dry and process paddy in large centralized plants is readily available from the industrialized countries. The department's program in this area is, therefore, directed towards the development of simple drying and processing systems for farm and village level operations.</p> <p>The institute is, however, aware of the role that the farm equipment manufacturers from the industrialized countries can play mechanizing tropical agriculture. Continuing efforts are therefore made to encourage these manufacturers in developing special equipment for tropical agriculture. Every assistance is provided in testing and evaluating their prototype and newly introduced equipment.</p> <p>Some of the machinery developed at the Institute are shown in the accompanying illustrations. A number of these machines are now in commercial production in Asia.</p>					
17b. Identifiers/Open-Ended Terms					
<p style="text-align: center;">Reproduced by  <b>NATIONAL TECHNICAL  INFORMATION SERVICE</b>  U S Department of Commerce  Springfield VA 22151</p>					
17c. COSATI Field/Group 631					
18. Availability Statement			19. Security Class (This Report) UNCLASSIFIED		21. No. of Pages 3
			20. Security Class (This Page) UNCLASSIFIED		22. Price \$3.00

towards development.

b) In Japan vegetables culture in green house is getting popular. Research on heater, soil sterilizer, conveying cart, pest control machine in a green house is being gradually developed.

11) Research on safety of agricultural machinery operations

a) As agricultural machinery increases in number, operator's comfort, accidents and physical disability caused, by the machinery become problems which should be studied based on human engineering.

b) By analyzing of strength applied on tractor safety cab and dynamics of overturned tractor, principle of tractor design is established.

Operator seat is redesigned from the human engineering point of view, as tractors of Japanese make are small and compact in size.

As vibration of agricultural machinery often causes operator's physical troubles, research is started on analysis of vibration and prevention of vibration.

c) As dust or trash affects the operator's health in the farm structure such as paddy drying facilities, outbreak of dust is

investigated and the measure to avoid dust is developed.

#### 4. Testing

The testing division conducts OECD test and National & I.A. M. test. The last test is conducted by request of manufacturers and farmers.

The machines put to those tests in 1970 and their numbers are as follows; 9 riding type tractors, 13 walking type tractors, 2 power sprayers, 13 small binders, 2 engines, 5 small combines and 2 large combines.

And in 1971; 7 riding type tractors, 4 power sprayers, 3 power dusters, 7 binders, 8 small combines, 5 transplanters, 4 fertilizers, 11 rubber rolls, and 16 other machines.

#### 5. Educational and training activity

With regards to educational and training activities, there is no division in charge. However we accept postgraduated or qualified researchers and give them training within the period of one year.

Extension service to farmers and training of foreign trainees

are conducted in other organizations.

#### 6. Other organizations

Japan is divided into eight agricultural regions. And in each region, they have a national agricultural experiment station, in which there is one or are two agricultural mechanization laboratories. The main research projects of those laboratories are on the mechanization suited to the agricultural conditions typical of each region, such as rational combination or selection of the machinery and economical utilization of the machinery based on farm management.

Besides those national agricultural experiment stations, there are 46 prefectural agricultural experiment stations. Each station has its own agricultural mechanization section which contributes to the farmers on a prefectural basis in connection with farm mechanization.

There are 32 universities and colleges which have agricultural machinery laboratories. Each laboratory has one to three professor(s), and is concerned with education and research. ■ ■

### ADVERTISERS' INDEX

Central Commercial Company (CECOCO) .....	126	Equipment Mfg. Factory .....	80
Fuji Robin Industries Ltd. ....	76	Nichimen Co., Ltd. ....	8
Hokkoku Noki Co., Ltd. ....	79	Nippon Kreis Co., Ltd. ....	132
Honda Motor Co., Ltd. ....	67	Nippon Reaper Industry Co., Ltd. ....	80
Internat. Farm Machinery Research Service ..	134	Nomura Trading Co., Ltd. ....	129
Iseki Agricultural Machinery Mfg. Co., Ltd. ...	136	Ochiai Cutlery Mfg. Co., Ltd. ....	81
Ishikawajima-Harima Heavy Industries Co., Ltd.	10	Oregon Farm Equipment Co., Ltd. ....	134
Kaneko Agricultural Machine Co., Ltd. ....	72	Oshima Agricultural Machinery Co., Ltd. ....	75
Kinsho-Mataichi Corporation .....	127	Sanriku Noki Co., Ltd. ....	79
Kioritz Corporation .....	135	Satake Engineering, Co., Ltd. ....	130
Kobashi Kogyo Co., Ltd. ....	74	Satoh Agricultural Machine Mfg. Co., Ltd. ....	68
Kubota, Ltd. ....	2	Shinomiya Noki Co., Ltd. ....	79
Kyoeisha Co., Ltd. ....	81	Shizuoka Seiki Co., Ltd. ....	77
Maruyama Mfg. Co., Ltd. ....	128	Tokai Agricultural Works Co., Ltd. ....	135
Minoru Industrial Co., Ltd. ....	133	Toyosha Co., Ltd. ....	82
Mitsubishi Corporation .....	132	Yamamoto Mfg. Co., Ltd. ....	78
Mitsubishi Heavy Industries, Ltd. ....	132	Yanmar Diesel Engine Co., Ltd. ....	124
Nagasawa Industry Co., Ltd. Agricultural		Yushin Seiki Kogyo Co., Ltd. ....	80

# New Agricultural Equipment from The International Rice Research Institute



by Amir U. Khan

The Head, Agricultural Engineering Department, IRRI, and Project Leader, USAID/IRRI Agricultural Machinery Development Contract (Manila, Philippines)

The South and Southeast Asian countries are characterized by small farm holdings, low farm incomes, and low labor costs. Developments sparked by the so-called Green Revolution have created conditions which are conducive to the mechanization of tropical agriculture. Past attempts to mechanize tropical agriculture with imported equipment from the industrialized countries have met with limited success.

There are two distinct agricultural mechanization technologies that have evolved in the world to suit two sets of agro-economic and socio-industrial conditions. The western approach is based on largescale dryland farming with high-powered equipment. It places major emphasis on reducing labor. Mechanization in Japan has not followed the western approach. Rice is a major crop in Japan which is grown under wetland conditions on small farm

holdings. The high price support of rice, rapid industrialization and a widespread practice of parttime farming has helped to mechanize Japanese agriculture with small but highly sophisticated farm equipment. In spite of a high degree of mechanization in Japan, labor utilization for paddy cultivation remains high. Japanese farm equipment, however, is too complex and often uneconomical for the tropical Asian farmers. Paddy transplanting machines, reaper binders and harvester combines, which have gained widespread popularity in Japan, are excellent examples of functionally suitable but economically unacceptable machines for the tropical regions.

The inadequacy of the available technologies from the industrialized countries to satisfactorily meet the overall requirements of the tropical regions has been a bottleneck to the mechanization of agriculture. Recent

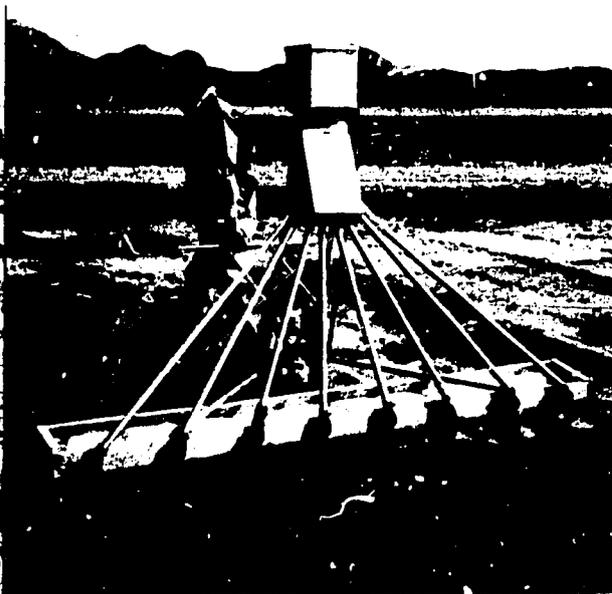
---

• The International Rice Research Institute is engaged in the development of suitable farm equipment for tropical agriculture under a research contract with the U. S. Agency for International Development.





**TABLE THRESHER:** The machine has a flat circular threshing surface with an integral fan on its underside. It is powered by a 3.0 hp air-cooled engine. It can thresh dry or freshly harvested high-moisture paddy. Four to five men can thresh about 350 kg of paddy per hour. The machine is commercially produced in the Philippines.



**SINGLE HOPPER PADDY SEEDER:** This machine can sow pregerminated paddy in rows on puddled soils. Five to seven hours are required to seed one hectare. The machine has a single wheel to facilitate transport on narrow field levees and to provide the motive power for the metering mechanism. It is commercially produced and sold for about US\$45.00 in the Philippines.

developments in the industrialized countries reflect a widening gap between the available mechanization technologies and the needs of the farming communities in the LDC. These developments will, no doubt, further hamper agricultural mechanization in the tropical regions. It seems reasonable to contend that to mechanize tropical agriculture, new technology compatible with the agricultural, social, economic, and industrial conditions of the tropics should be developed.

For a variety of reasons, the development of equipment for the production and processing of rice in the tropics has received little attention. The Institute considers that widespread mechanization of tropical agriculture is only possible through the development and indigenous production of suitable equipment within the region. The establishment of an indigenous farm equipment industry in the tropical region seems a prerequisite for the suc-

cessful mechanization of agriculture. The existing farm equipment industry in the less developed regions has neither the money nor the know-how to develop new technology. Under the circumstances, public research institutions in the region must provide leadership by developing suitable farm equipment which could be manufactured with the available production methods in Asia.

The International Rice Research Institute is attempting to develop an appropriate rice mechanization technology with the development of simple agricultural equipment to suit the manufacturing capabilities of the LDC. This program is primarily focused towards the requirements of the 2-to 10-hectare tropical farms which are too large to work with animals and uneconomic to work with the farm equipment originating from the industrialized countries. Technology to dry and process paddy in large centralized plants is readily

available from the industrialized countries. The department's program in this area is, therefore, directed towards the development of simple drying and processing systems for farm and village level operations.

The Institute is, however, aware of the role that the farm equipment manufacturers from the industrialized countries can play mechanizing tropical agriculture. Continuing efforts are therefore made to encourage these manufacturers in developing special equipment for tropical agriculture. Every assistance is provided in testing and evaluating their prototype and newly introduced equipment.

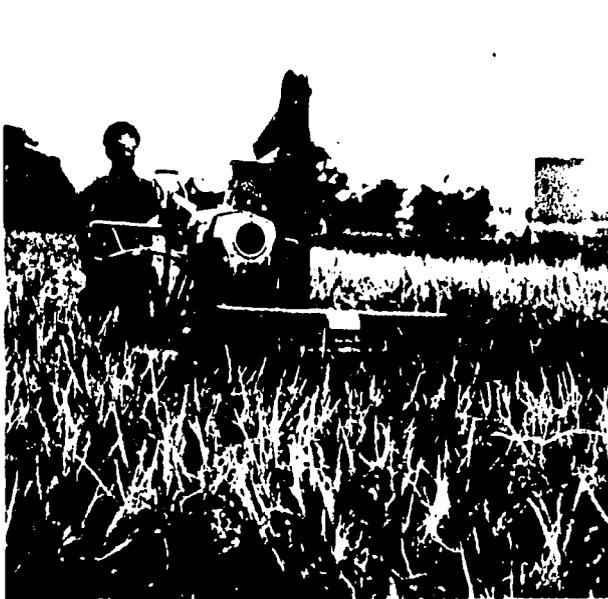
Some of the machinery developed at the Institute are shown in the accompanying illustrations. A number of these machines are now in commercial production in Asia.



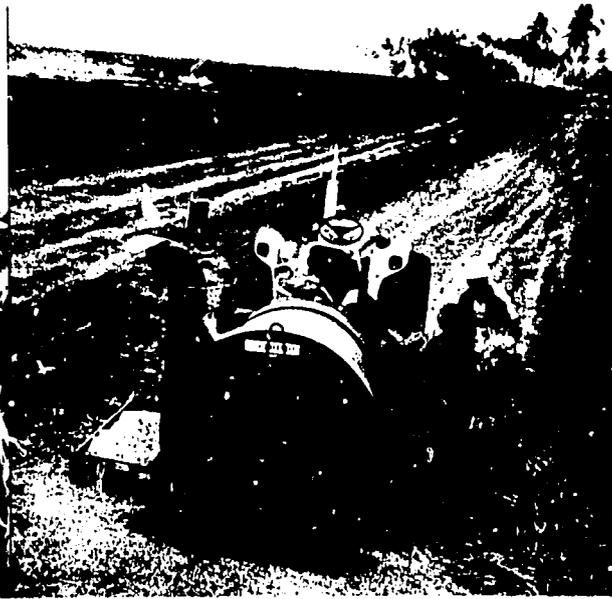
**MULTIHOPPER PADDY SEEDER:** This is a low-profile seeder with six independent hoppers for seeding pregerminated paddy on puddled soils. No cut-off mechanism is used to meter the seeds which minimizes damage to the sprouted seed. The machine has been released for commercial production in the Philippines and is expected to sell for US\$40,000.



**POWER GRAIN CLEANER:** Dirty grain is screened first for large and small impurities in two concentric rotary screens. The screened grain is then tumbled as it moves through an airstream in a counterflow direction to remove lighter impurities. Output of up to 3 tons per hour has been obtained with the cleaner. The machine is commercially available in the Philippines.



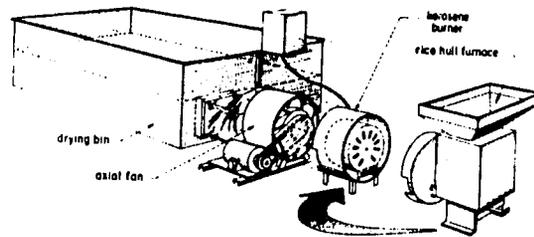
**STRIPPER HARVESTER:** This four-row machine can harvest paddy in the field without cutting plants. Since straw is not handled through the machine, it is light and compact. Combined scattered and unthreshed grain losses of only 1.5 percent have been obtained in some tests with this stripping principle in a laboratory machine. Further development work is underway.



**TRACTOR PTO THRESHER:** This machine has been developed for custom threshing of rice and other grain crops in Asia. It can thresh dry as well as freshly harvested crop. The thresher is mounted on a tractor three-point linkage and is light enough for lifting with standard hydraulic systems. This feature provides easy field maneuverability. Threshing output of 1.5 tons per hour has been obtained.



**SIMPLE POWER TILLER:** This simple 4-6 hp power tiller is designed for fabrication in the Asian countries by small workshops. It has a sealed oil-bath chain transmission. Different attachments for dry and wetland cultivation have been developed. The machine has been released for production in the Philippines. It is expected to sell for less than one-half the price of comparable imported power tillers in the Philippines.



**RICE HULL OIL FIRED BATCH DRIER:** A simple batch type drying system is being developed for the Asian farmers. The system will have interchangeable furnace for oil, rice hull, or LPG and other fuels. The rice hull furnace has a 9-in. square combustion chamber with louvered walls on all sides. Air is sucked through the louvers which results in multi-layered combustion and a compact design. Further development is continuing.



**HEATED-SAND CONDUCTION DRIER-PAR-BOILER:** This machine is being developed to meet the drying and parboiling requirements at the village and farm level. The unit mixes wet paddy with heated sand in a drying-parboiling chamber for about 20 seconds and then automatically separates them. Sand is returned to a heating pan and is recycled through the drying-parboiling chamber. The continuous-flow machine can remove 12 percent moisture in a 20-second grain-sand exposure. If sufficient moisture is initially present in the paddy grain, starch granules are gelatinized and a parboiling effect is obtained.



**LOW-LIFT BELLOWS PUMP:** This simple pump is designed for lifting water through 1 to 1.5 meter heads. The pump delivers 50 to 80 gal min at 1-meter head. The pump uses two canvas bellows with metal reinforcements. Each bellow has an inlet and exhaust flap valve. The pump is placed in the water source. The operator transfers his weight from one footrest to the other and water is alternately sucked and pumped by the bellows. The machine has been released for manufacture and is expected to be marketed at about US\$10.00 in the Philippines.

# BACK NUMBERS

## AGRICULTURAL MECHANIZATION IN SOUTH EAST ASIA (Spring, 1971)

Preface (Yoshiyuke Kishida).....13  
 Introduction of Writers.....14  
 Message (Takekazu Ogura).....18  
**Chapter I How to Promote Agricultural Mechanization in South East Asia -- Various Approaches by International Experts**  
 A Proposal for Agricultural Mechanization in the Developing Countries of Southeast Asia (Howard F. McColly).....21  
 Some Problems on Policy for Agricultural Mechanization (Chujiro Ozaki).....26  
 Agricultural Mechanization and Rural Welfare in South and Southeast Asia (Robert D. Stevens, Bashir Ahmad).....29  
 International Cooperation of Agricultural Engineering for Mechanization in South East Asia -- from the standpoint of ASAE (Robert E. Stewart).....33  
 Machinery Development for Tropical Agriculture (Amir U. Khan).....35  
 International Cooperation of Agricultural Engineering for the Mechanization in Southeast Asia--from the standpoint of Japan (Hideo Kaburaki).....38  
 Agricultural Machinery and Implements Industry in South East Asia and Related Activities of UNIDO (A.A. Swamy-Rao).....40  
 Establishment of the Plan to Promote Agricultural Mechanization in Southeast Asia and Problems on Growing Agricultural Machinery Industry (Yoshikuni Kishida).....45  
 Promotion of Agricultural Mechanization on an Energy Concept (Lloyd Johnson).....50  
 The Importance of Mechanization Indicated by Agricultural Production Function in the Rice Region of Taichung Area, Taiwan (Ming-Wu Wu).....52  
 Mechanized Maximum Cropping System for the Small Farms of the Rice Belt of Tropical Asia (Richard Bradford).....55  
 The Tractor Contractor System in Southeast Asia and the Suitability of Imported Agricultural Machinery (William J. Chancellor).....58  
 Proposals for the Development of Economic Models of Rice Mechanization (K.H. Friedrich, W.J. van Gilat).....61  
 A Second Generation Problem of the Green Revolution--Food Grain Storage--(Merle L. Esmay).....64  
**Chapter II Present Situation and Future Prospects of Agricultural Mechanization in South East Asia**  
 II. 1 *Reports from Each Country*  
 Agricultural Mechanization in Cambodia and its Problems (Te Sun Hoa).....85  
 Ceylon-Mechanization of Agriculture, The Present Position and Future Development (V.E.A. Wikramanayake).....89  
 Agricultural Mechanization in Laos and its Problems (Takeji Nakata).....93  
 Mechanization of Agriculture in Pakistan, Present Status and Fu-

ture Prospects (N. Ahmed).....97  
 The Present Problems and the Future of Farm Mechanization in the Philippines (Reynaldo M. Lantin)..... 103  
 Present Problems and the Future of Agricultural Mechanization in Taiwan, Republic of China (Tien-song Peng)..... 109  
 The Present Problems and Future Agricultural Mechanization in Thailand (Anusorn Boon-It)..... 113  
 Present Situation and Future Problems on Farm Mechanization in Vietnam (Truong Dinh-Huan)..... 118  
 II. 2 *Summarized Reports by Farm Machinery Industrial Corp.*  
 Present Situations and Future Problems on Farm Mechanization in India, Indonesia, Malaysia and Nepal..... 121  
 The Status Quo and Problems of Farm Mechanization in the Developing Countries..... 125  
**Supplement**  
 Main Indicators for Agricultural Mechanization in South East Asia..... 131

## AGRICULTURAL MECHANIZATION IN ASIA (Autumn, 1971) (How to Grow Agricultural Machinery Industry 1. Production Problems)

Preface (Yoshiyuke Kishida).....13  
 Proposal (Makoto Saito).....16  
**Part I General Remarks**  
 How to Promote Agricultural Machinery Production in Asia (G.W. Giles).....19  
 Outline of the Policy Government for the Development of Agricultural Machinery Industry in Asian Developing Countries (Keisaku Kobayashi).....25  
 Historical View of the Development of Agricultural Machine Industry in Japan (Yoshikuni Kishida).....34  
 Key Role of Implement Manufacturers/From American Experience (Harold B. Halter).....42  
 Some Points to Improve Machinery for Rice Production in Asian Developing Countries (Morio Kamijo).....46  
 Some Critical Steps in Agricultural Mechanization in Developing Countries (Ernest T. Smerdon).....53  
 Basic Index for System Analysis of Agricultural Mechanization in Japan (Farm Machinery Research Corp.).....60  
**Part II Reports from Asia**  
 The Present and Future of the Farm Machinery Industry in Korea (Sung Kum Han).....85  
 Jeepney Manufacturing in the Philippines, a Model for Developing the Agricultural Machinery Industry (Phil Cabanos).....91  
 Multiple Characteristics of Farm Implements and Machinery Production in Taiwan, the Republic of China (Tomotake Takanaka)..... 98  
 Production of Agricultural Machinery in Pakistan (B.K.S. Jain)..... 105  
 Need of National Farm Equipment Industry in Pakistan (Mohammad Rafi)..... 110  
 Present Status of Agricultural Machinery Industry in Thailand (Yoshikuni Kishida)..... 112

**Part III Reports from Asia**  
 The Latest Mechanization of Rice Transplanting in Japan (Shin-Norinsha Co., Ltd.)..... 119  
 The Recent Tendency toward Mechanized Harvesting of Rice Plant (Shin-Norinsha Co., Ltd.)..... 125  
 Transportation Manual in a Steep Land developed by Japanese Technology (Small Self-propelled Track Carriers) (Shin-Norinsha Co., Ltd.)..... 134  
 Agricultural Mechanization in Japan "Yanmar Farm Village Factory" (Masazo Kanazawa)..... 141

## AGRICULTURAL MECHANIZATION IN ASIA (vol.3 no.1) (How to Grow Agricultural Machinery Industry 2. Marketing Problems)

Preface (Yoshiyuke Kishida).....13  
**Marketing Problems of Agricultural Machinery**  
 History of Marketing of Agr. Machinery in U.S.A. and the Role of NFPEIA (C.R. Frederick).....17  
 Product Planning for Developing Nations (C.J. Mackson, C.T. Hausmann).....23  
 Establishment and Improvement for Marketing System of Agr. Machinery in Asia (Yoshikuni Kishida).....27  
 A System Approach to Technical Training in Developing Countries (Cernyw K. Kline, C.J. Mackson).....32  
 The Present Status and Problems of Marketing Farm Machinery in Korea (Chul Choo Lee).....38  
 Mechanization as a Factor in Agr. Change--Potentialities and Limits (Theodor Bergmann).....46  
 History of Farm Machinery Sales in Japan (Junichiro Fujimura).....54  
 Appraising and Improving Vocational and Technical Agr. Education Programs (Cernyw K. Kline).....75  
 Some Suggestions for Rice Mill Modernization in Developing Countries (Yasumasa Koga).....90  
 Present Situation and Problems on Marketing of Agr. Machinery in India (A.M. Michael).....95  
 Model Layout for Repairshop of Agr. Machinery (Information Dept., Shin-Norinsha Co., Ltd.)..... 100  
 Manufacturers' Opinion..... 111  
 David Brown Tractor (Sales) Ltd., Mitsubishi Heavy Industries Ltd., Auto Tractor, Ishikawajima Harma Heavy Industries Co., Ltd., Toyosha Co., Ltd., New Holland International Div., Yanmar Diesel Engine Co., Ltd., Iseki Agricultural Machinery Mfg. Co., Ltd., Satoh Agricultural Machine Mfg. Co., Ltd.,  
**Visiting Industry**  
 KUBOTA's Technical Training System and its Practical Condition (Branch Office, Shin-Norinsha Co., Ltd.)..... 120  
**Report from Research Organization**  
 What is C.E.E.M.A.T. doing on Agr. Mechanization in Tropical Countries (Ch. Gaury)..... 123  
 Agr. Engineering International Program of Michigan State University (Merle L. Esmay)..... 127