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REPORT OF ACTIVITIES IN ECUADOR OF DR. JUDSON HARPER AUGUST 7 THROUGH AUGUST 20 AND CHARLES WOMMACK AUGUST 7 THROUGH AUGUST 27

Industrial Development Division
ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
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REPORT OF ACTIVITIES IN ECUADOR
OF DR. JUDSON HARPER AUGUST 7 THROUGH AUGUST 20
AND
CHARLES WOMMACK AUGUST 7 THROUGH AUGUST 27

Upon arrival in Quito in the early A.M., we were met at the airport by Mr. Fred Hubig who is the AID representative assigned to Guayaquil. Mr. Hubig escorted us to the AID mission in Quito where we met with other members of the mission and were briefed on the status of the project to develop an Ecuadorian capacity to produce several of the IRRI-designed agricultural machines, especially the axial flow thresher. The following is a summary of the project status and the immediate needs for assistance:

1. The IRRI thresher plans requested by Fred Hubig were received and used to produce a prototype machine in a large metalworking shop (CONDESI) in Guayaquil.

2. This machine was field tested on the threshing of rice and soybeans.

3. The machine performed very well on rice; however, on soybeans, production of the thresher was very poor due to difficulty with hand feeding and the poor performance of the rotating drum-type grain cleaner on the IRRI-designed machine.

4. Subsequent to this initial field testing of the prototype machine in December 1974, it was decided to leave the prototype thresher in the hands of the Ecuadorian rice farmers for several months in order to be able to judge its acceptability. Upon our arrival in early August 1975, this machine had been in use for approximately eight months, and upon inspection of the machine, it was obvious that it had received heavy use (see following section on examination of the machine).

5. The immediate needs of this project were, first, to correct the difficulties with the existing prototype so that it would perform well on threshing soybeans and, second, to explore ways in which the project can progress from the prototype stage to the initial production stage.

Subsequent to this briefing in Quito on the project status, we visited several companies in Quito that were potential suppliers of components for the IRRI agricultural equipment. It was decided to leave Quito and proceed to Guayaquil

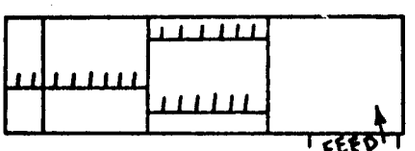
without spending the night in Quito in order to get as early a start on the project as possible.

On our first day in Guayaquil, it was decided to concentrate the project efforts on modifying the existing prototype machine rather than on trying to produce another prototype. The design changes decided upon are described in the following section on thresher modifications made in Ecuador.

Examination of the Thresher

A careful examination was made of the IRRI-designed thresher made by CONDESI in Guayaquil, Ecuador. Based on disassembly, the following difficulties were observed:

1. Pegs on the lower concave were partially missing. Specifically, those present were in the following configuration:



2. The pegs were attached to the lower concave primarily with wire and were loose and not perpendicular to the concave.

3. The threshing drum was severely out of balance. The construction was such that the metal was overlapped on one side causing the imbalance. One peg was badly bent on the threshing drum.

4. Pulleys and idlers were badly misaligned, causing some wear on the side of the drive belts.

5. Mounts for the fan blades had broken loose and had to be rewelded. This was done rather carelessly, which probably caused some fan imbalance.

6. One blade on one fan was broken off.

7. Housings on the fan were badly bent. This was probably caused when the fan blade bracket became unwelded.

8. Pipe between two shaft ends on the fan assembly was bent, probably causing substantial imbalance.

9. Screws holding fan blades in place were nearly all loose. No lock washers had been used in fabrication.

10. The rotary grain cleaner was inoperable. The bracket holding the bearing was loose, so the whole assembly was sagging.

11. The drive belt on the rotary cleaner was not adjusted properly and was slipping.

12. Sheet-metal work on the grain cleaning pan was loose and broken.

13. Grain elevator was not operating due to poor adjustment of rubber belt pieces used to elevate the grain.

14. A new and stronger engine mount had been fabricated to replace the original IRRI design. The mount used channels welded onto a flat mounting plate.

15. Gas tank and air cleaner were nearly falling off the engine.

16. The front tongue assembly was bent so that it was not perpendicular to the rest of the frame. This meant that alignment of pulleys was very difficult or impossible.

Further inspection showed that the grease fittings had been well greased and the engine oil was up to requirements.

Despite the problems, several very positive observations should be made.

1. The thresher had been used extensively. The pegs at the feed end of the drum were badly worn as evidence of this heavy use.

2. When we wanted to return the thresher to Guayaquil for mechanical modification and examination, the users were very reluctant to let the machine go because they were in the midst of threshing rice. Despite its mechanical problems, the users felt the thresher was operating satisfactorily.

A short threshing test was conducted on rice before the thresher was loaded for return to Guayaquil. The rice had full heads and the straw was somewhat green.

Despite the poor peg positions on the lower concave, threshing appeared nearly complete. Relatively little grain was leaving with the straw. Some small pieces of straw appeared in the grain which normally would be removed by the grain cleaner, but it was inoperable.

Prior to our operating the thresher, we found the lower concave filled with straw and the auger plugged with straw. This condition was caused by having the deflector board in its uppermost position, which nearly cut the flow of

straw being blown out by the fans. The workers had adjusted the deflector up so that they would "minimize loss of grain." When the deflector was lowered, very little grain was actually being lost via this route; however, adjustments on the fans would have corrected any condition leading to grain loss if they had been present.

It was obvious that the field operators had very little, if any, knowledge of the basic operation of the thresher and its adjustments. The instruction book written for the thresher operation by IRRI is very well done and needs to be translated into Spanish. In addition, the field operators need to be given basic instructions on the machine's use and adjustments prior to actual operation.

Thresher Modifications Made in Ecuador

The original plans were to repair the CONDESI thresher and build additional thresher prototypes for testing, thus increasing interest in Ecuadorian manufacture. Time in the country would not permit building a completed new prototype from scratch. Fabrication of a completely new prototype, which will incorporate all of the new modifications described below, had been started prior to the end of the project.

Examination of the CONDESI thresher showed that many alterations and repairs had to be made prior to its operating properly. Experience had shown that the IRRI-designed rotary cleaner was not satisfactory for the large sticks coming through the machine on soybeans and that it required continued maintenance and adjustment even for marginally satisfactory cleaning when threshing rice.

The trip of Jarrin and Hubig to the Philippines had resulted in their seeing the Kaunlaran modification of the basic IRRI model, which replaced the rotary cleaner with an oscillating screen directly under the lower concave. It was felt that such an approach would greatly simplify the machine, as well as improve its grain cleaning ability on rice and soybeans.

Because plans for the modifications were unavailable, the CONDESI thresher was disassembled and remade with the oscillating cleaner screen. The modifications consisted of:

1. Increasing the height of the machine by 6" to allow placement of the inclined oscillating cleaning screen. (See Illustration #2, page 10.)
2. Making an oscillating cleaning screen and placing it below the lower concave.

3. Lowering and relocating the blowers and grain auger. (See Illustration #4, page 11.)

4. Reworking the belt drive for drives and modifications. (See Illustrations #1 and #2, page 10.)

5. Adding leaf springs and pneumatic tires.

6. Using perforated (slotted) metal for the lower concave and punched plate for the oscillating shaker screen.

7. Redesigning the threshing pin holders on the lower concave. Angle iron threshing pin holders were used to greatly strengthen pin mounts and to assure a positive pin positioning.

All of these modifications were made at Ing. Alexandro DeNoso's machine shop. This work greatly increased Ing. DeNoso's competence in the machine's manufacture. In addition to these modifications, Ing. Denoso also will be copying the Brazilian TRITON thresher.

Most design modifications were successfully resolved and the working prototype completed. Extensive field testing will be required to determine if the sheet-metal perforation of the concave and oscillating shaker and the oscillating action are suitable. If not, minor modifications can be made to correct any deficiencies.

First Trial of Modified Thresher

The modified thresher was given a trial run on the last day of Charles Wommack's stay in Ecuador. Many small additional modifications were needed, as noted in the following section of this report, but the major modifications had been completed. The illustrations on page 10 through page 13 of this report were taken during the first trial run of the modified machine.

The trial was successful and the modifications performed substantially as expected. The only major problem observed was the clogging of the space between the oscillating screen and the sheet-metal housing of the lower concave. (See Illustration #7, page 13.) This problem should be easily solved by increasing the clearance at this point, thus allowing the straw to exit quickly above the screen.

All of those present at the trial run agreed that the performance of the modified machine was superior and that the minor problems encountered could be easily solved.

Additional Modifications Needed on Prototype Machine

The following is a list of the modifications which were to be made immediately following the first trial of the machine and included in future prototypes:

1. Grease fittings for the lower pivots of the rocker arms of the oscillating cleaning screen assembly.
2. Idlers mounted on drive assembly to provide tension adjustment on drive belts.
3. Feed tray added to facilitate feeding machine.
4. Dampers added to blowers to permit adjustment of air flow through the cleaning screen in order to minimize grain loss and maximize cleaning efficiency.
5. Pneumatic tires and leaf springs need to be added to facilitate transport of the machine.
6. Clearance between sheet-metal housing of the lower concave and the oscillating cleaning screen assembly needs to be increased to solve the clogging problem observed in the first trial run.

Analysis of DeNoso's Machine Shop

Ing. DeNoso is capable of manufacturing the IRRI-designed thresher or its modified model. His shop is missing several key items of equipment for extensive manufacture. They are:

1. Power hack saw or band saw
2. Power roll
3. Sheet metal shear
4. Sheet metal break

Most of the workers at the shop were willing to work and capable of performing the necessary machine and manufacturing operations. Some additional training is required, and the shop needs substantial cleanup and reorganization if it is to have a manufacturing capability.

DeNoso's major problem is the lack of working capital and an incentive to tool up for production at a rate greater than making a single prototype.

Examination of TRITON Thresher

A visual inspection of the Brazilian thresher TRITON was made. It sells for $5,000-$6,000 and can thresh approximately 400-500 pounds of soybeans in one hour.

The machine is of an old design. It is very heavily built with a high feed hopper and an "automatic feeder" which is self-cleaning. The threshing drum is very small which should limit capacity. Cleaning was done by reciprocating shaker screens. The model appeared only marginally portable.

The Columbian Perfect machine is also used in Ecuador. This machine is very slow and unsatisfactory. Meals for Millions used it on soybeans at a rate of about 200 pounds per hour.

Based on these observations, the IRRI thresher should offer a substantial edge in price, output, and grain cleaning ability.

Development of Production Capability in Ecuador

During the time spent in Guayaquil, efforts were made to identify the major problems to be overcome in order to get the thresher into production. The local problems certainly do not seem to be insurmountable, and the economic feasibility of establishing production certainly appears to be positive and, in fact, could prove to be highly profitable at a selling price well below the competing imported machines described above. The major problems identified stem primarily from the economic structure found in Guayaquil and are set forth below:

1. The large metal fabricating firms which could establish production quickly do not have any interest in devoting time to the development of the prototype or in investing in the development of the jigs and fixtures needed prior to starting production. This lack of interest stems primarily from the fact that these large companies already have all the work that their facilities can handle, and they are not set up for production work but are structured for custom job shop work.

2. The cost of raw materials is extremely high when purchased from local supply houses because of high markup, high import duty, and high local taxes. This high cost of locally purchased materials dictates that, prior to initiating production, arrangements must be made for the manufacturer to import the raw materials directly. Since the materials

are for agricultural use, they would be exempt under Ecuadorian laws from all import duties and local taxes. This direct importation should reduce materials cost by a minimum of 25% and probably much more.

3. The small shops which are very interested in producing the thresher, such as Ing. DeNoso's shop, are critically short of capital. They are not presently adequately equipped nor do they have the expertise to set up production type jigs and fixtures. In spite of the financial and technical shortcomings of these small shops, they appear to be the best available resource to use in developing a production capability in Ecuador.

4. If initial production is started in some small shop as described above, some solution must be found to the problem of marketing the product since there is obviously no immediate prospect of developing a sales type organization within these shops. The agricultural equipment dealers in Ecuador are poorly suited to the sale of the IRRI type thresher since their current sales activities are concentrated on the large scale farmer who would not be the type customer which would buy this small thresher. Due to these factors, it appears that it would be necessary to develop a companion sales organization which would work with the producer or for the producer to associate with an existing equipment distributor who would develop the appropriate type sales organization.

In spite of the above problems observed in Guayaquil, it appears that the following positive factors point to the conclusion that production of the thresher can be achieved at an early date in the future.

1. The IRRI type thresher appears to be right for Ecuadorian type agricultural conditions. The large-scale U. S. type equipment is poorly suited to the agricultural conditions observed but is widely used because of the absence of alternative type equipment on the market.

2. The prototype machine does work and the ability of the Ecuadorian farmer to use and maintain the thresher has been proven with the prototype. Not only has the prototype machine proven itself to be reliable, but the acceptability of the thresher to the Ecuadorian farmer also has been proven by the extensive use of the machine during the eight months since its initial field test.

3. The "Banco de Fomento" assured us that any shop capable of manufacturing the thresher could get a loan for the venture with very little delay. The officials of this agency of the Ecuadorian Government were very impressed with the results achieved with the first prototype and were anxious to receive an application from a potential producer.

4. The "Banco de Fomento" also assured us that they would purchase the thresher directly from any producer for resale through their program of equipment loans to farmers. This organization has over sixty branches which sell agricultural equipment to small farmers and, therefore, would be an excellent sales channel. These direct sales to the "Banco de Fomento" would enable a small producer to develop a sales capability to other customers while producing to orders from the "Banco de Fomento."

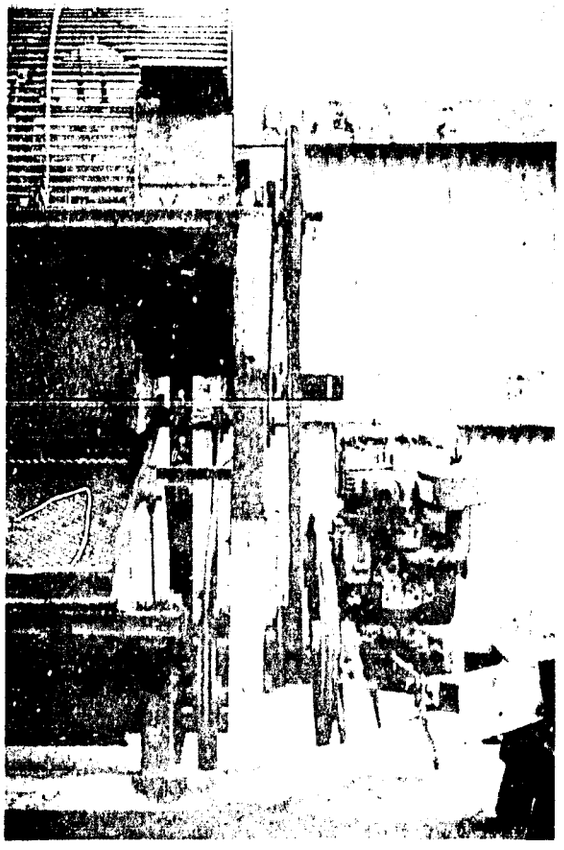


Illustration #1

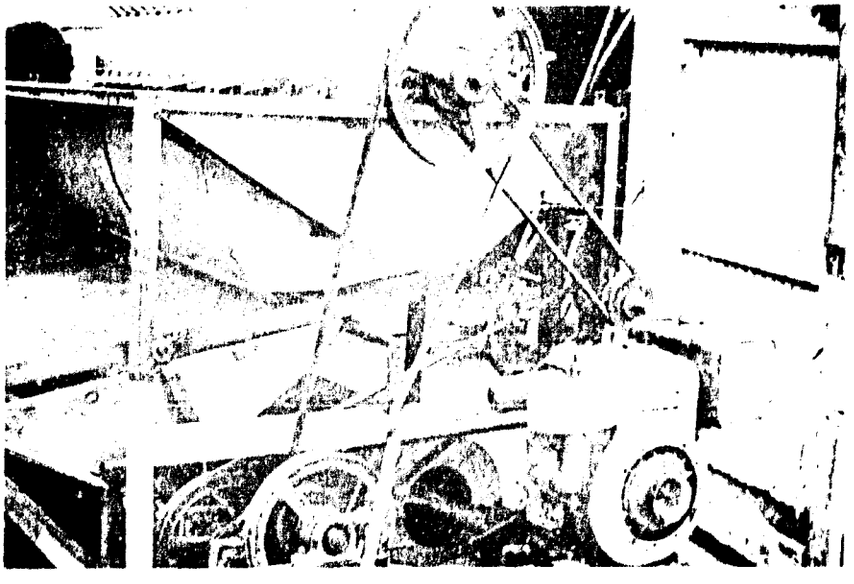


Illustration #2

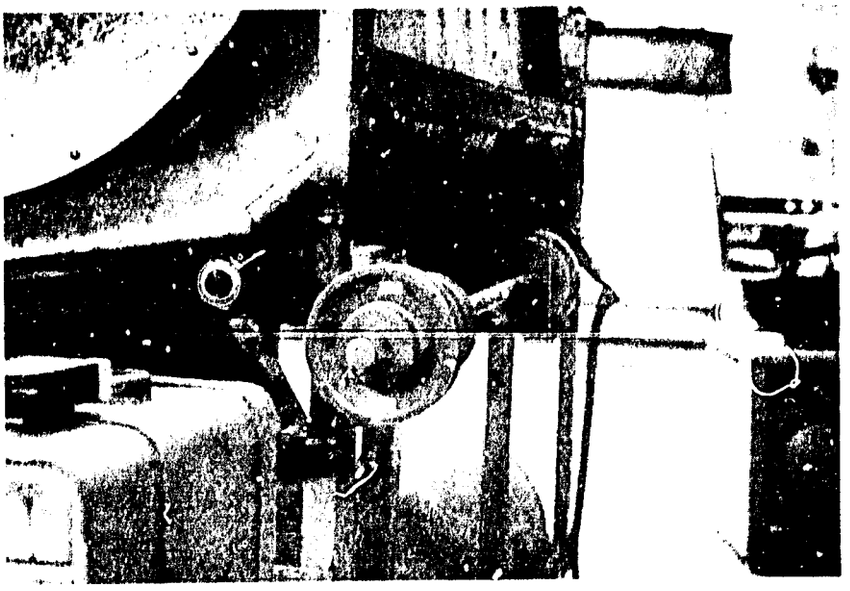


Illustration #3

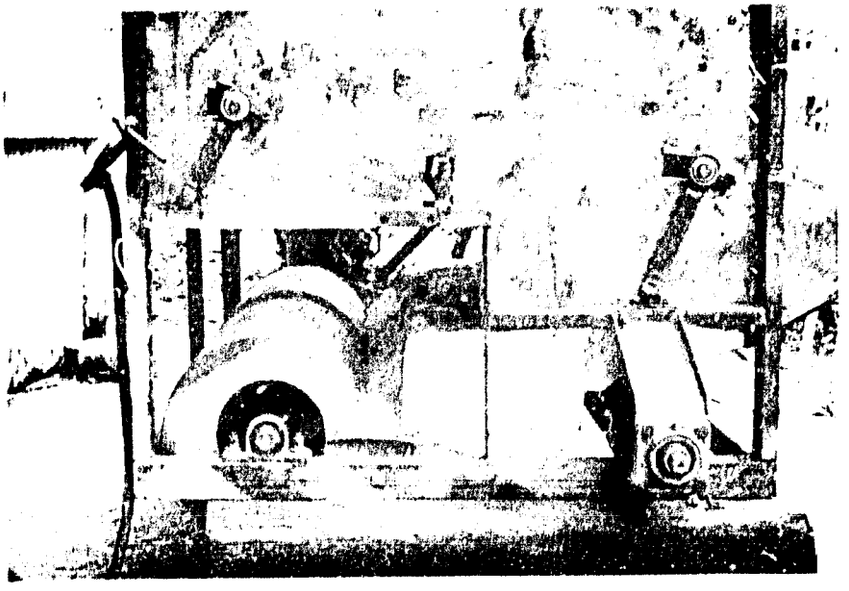


Illustration #4

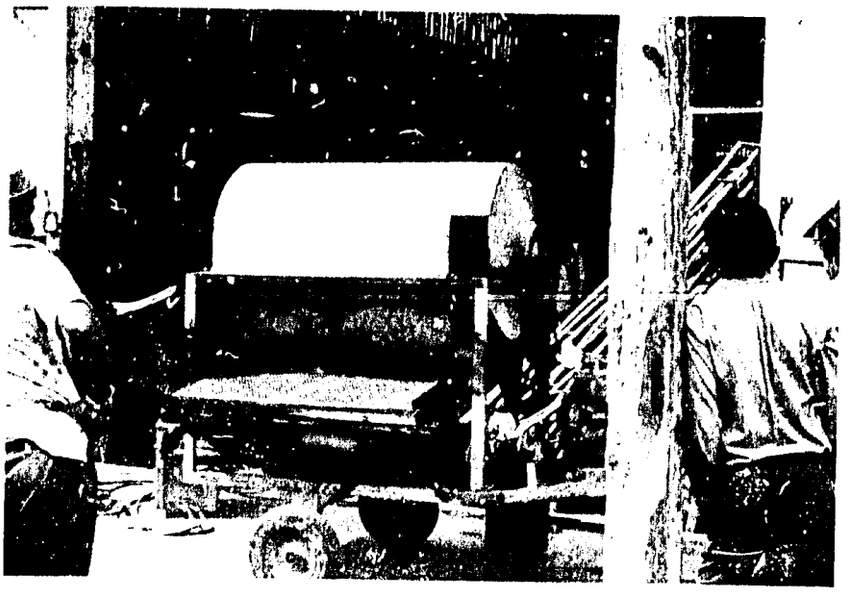


Illustration #5

Illustration #6

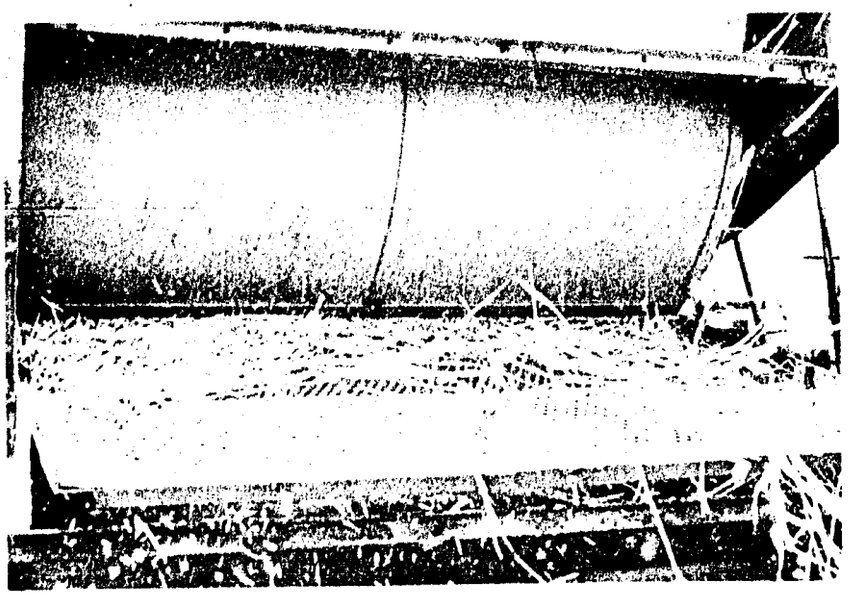


Illustration #7

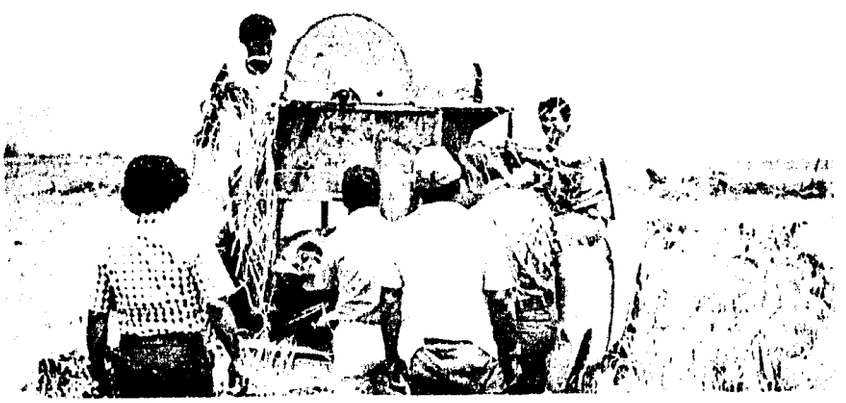


Illustration #8