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UNIDO FACT FINDING MISSION ON AGRICULTURAL MACHINERY,

ANDEAN PACT COUNTRIES

Summary Country Report.

P E R U

by

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Agricultural Machinery

February 25 - 1972

NOTE: This preliminary report has not been cleared by the United Nations Industrial Development Organization (UNIDO) and, therefore, at this stage only represents the points of view of the writer.

INTRODUCTION

The information contained in this report is based on a study of considerable background information on agriculture and Agricultural mechanization in Peru but mainly it is the result of discussions with Peruvian Government officials, private business and international technical assistance personnel with considerable experience in Peruvian Agriculture.

These included the following:

Ministry of Industry and Commerce (Ministerio de Industria y Comercio)
Ing. Italo Zolezzi Odría - Chief, Planning Office
Ing. Hugo Uriarte - Chief, Tractor Manufacturing Project

Ministry of Agriculture (Ministerio de Agricultura)
Ing. Ernesto Velarde S. - Director Production Promotion Dept.

Public Agricultural Services Company (Empresa Pública de Servicios Agropecuarios - EPSA)
Ing. Reginald Ledgard J. - Chief National Farm Machinery Service

Centre for Research and Training in Agrarian Reform (Centro Nacional de Capacitación e Investigación de la Reforma Agraria - CENCIRA)
Dr. Roberto Jordán P. - Project Manager UNDP Project Peru 44

National Agricultural University - La Molina (Universidad Nacional Agraria - La Molina)
Ing. Jaime Gilardi - Head, Dept. of Agricultural Engineering
Ing. Fernando Lecca - Design Engineer, Dept. of Agricultural Engineering
Ing. Luis Maezono - Farm Machinery Section, Agricultural Engineering

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Central Office of Agricultural Cooperatives (Central de Cooperativas Agrarias de Producción Azucarera del Peru - CECOAAP)
Ing. Reynaldo Llosa
Ing. Alfonso Baracco

Comercial Peruana S.A. (CIPSA) - John Deere Distributors-Peru
Roberto Ipince M. - Sales Manager

Massey Ferguson Export Ltd. (Peru)
J. Innes - Regional Manager

The cooperation and assistance provided by all departments and personnel contacted during this study is acknowledged with thanks.

SUMMARY OBSERVATIONS AND RECOMMENDATIONS

The mission hesitates to make any firm recommendations on the basis of a visit of approx. only 10 days in the country and without having had the opportunity to visit many of the main agricultural production zones. It would be appreciated therefore if the following were considered only as "Proposals for further study":

1. The future demand for agricultural machinery will depend on the operational progress of the Agrarian Reform program and on its coordination with the Ministry of Agriculture production promotion programs particularly in the following areas:

   (a) Progress of irrigation development, particularly in the Coastal zone.

   (b) The Agrarian Reform Program of land consolidation and of the more intensive cultivation of natural pastures in the valleys in the Sierra zone.

   (c) The development of the Alto Selva and the construction of all season roads between this area and the main markets in the Coastal zone.

   (d) The promotion of increased feed grain production - particularly maize and sorghum.

   It would appear that a realistic estimate of the number of additional tractors that could be effectively utilized in this program for the next 5 years would be in the order of 1000 units per year.

2. Currently no research is being done on cultural practices and machines for most economic crop production in the country. It would appear that many of the cultural practices and machines are rather outdated compared with modern, low cost minimum tillage and planting practices that are now almost universally used in other countries

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with similar climatic, soil and cropping conditions, particularly Australia, South Western United States and the West Coast area of Mexico.

It is suggested that cultural practices and machines used in these areas should be studied carefully and that the Department of Agricultural Engineering, possibly in collaboration with the National Agricultural Machinery Service should initiate a program to test these methods and machines in Peru.

3. It appears that the national Farm Machinery Service under EPSA is very well organized and is providing a much required service. Without doubt particularly during the next 5 to 10 years this service will need to be expanded to cope with the requirements of the Government land reform and development program. This will require a rather high additional investment in new equipment. The selection of the proper types, sizes and design details of these machines is most important to the future success of this program.

4. The sugar cane producing areas which were visited appear to be very highly mechanized and use more heavy duty type of equipment than most other cane producing areas in the world. The investment in this equipment is very high. It is suggested that the methods and equipment used in other large commercial cane producing areas in the world, particularly Australia, South Africa and East Africa (Tanzania), should be studied carefully.

5. In order to support an agricultural machinery manufacturing industry particularly when it is planned that this will include the manufacture of diesel engines, tractors and earth moving machinery, it would appear that the ancillary

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heavy metal industry needs to be built up considerably and particularly in the following areas:

(a) The production of alloy steels.
(b) The production of high quality large ferrous castings
(c) Forge capacity.
(d) Facilities for sheet metal forming.

SECTION I - GENERAL PATTERN OF AGRICULTURE IN PERU

1. Land Utilization

(a) Land distribution by nature

The total land area of Peru can be divided according to basic utilization as follows:

Total area	128,000,000 Has.
Forests and tropical forests (Selves)	87,000,000 "
Natural pastures	27,610,000 "
Area open to cultivation	2,800,000 "
Other areas (mountains, deserts)	10,590,000 "

From an agricultural and topographical standpoint the country is divided by nature into three very distinct zones. Those are utilized approximately as follows:

Zone	Total Area	Natural Pastures	Area open to cultivation	Area cultivated annually
Coastal plains	13,600,000	2,210,000	726,000	675,000
Sierra	39,100,000	24,560,000	1,674,000	1,000,000
The Eastern Tropical Zone (Selva)	75,300,000	840,000	400,000	325,000
Total	128,000,000	27,610,000	2,800,000	2,000,000

A total of approx. 1,010,000 Ha. is irrigated. This total can be broken down by zones approx. as follows:

Coast	680,000 Ha
Sierra	300,000 "
Selva	30,000 "

Irrigation projects either underway or planned for the near future will provide water for an additional approx. 160,000 Ha. A further area of approx. 200,000 Ha., mainly in the Coastal zone will receive an augmented supply which, in some cases, will permit double cropping.

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The Coastal zone, except for the extreme north receives practically no rain and is virtually a desert except for approx. 50 relatively small river valleys. Temperatures range from 20° - 30°C. As will be noted from the table below , however, it is the area in which the main export crops - cotton and sugar - are grown.

The sierras are made up of the slopes of the Andes and the valleys between the three main ranges. Altitudes range from 8000 - 12000 ft. There is little rain in the Western part but precipitation increases gradually towards the east to approx. 1200 mm per year on the eastern slopes. It is generally made up of low grade pastures land with some fertile valleys and lower slopes.

The Selva is a tropical rain forest with some high sub-tropical valleys on the eastern slopes of the Andes. The climate is hot and humid with an annual average rainfall of 2000-3000 mm.

The wet season for both the Sierra and the Selva is between October and April.

(b) Land distribution by crops

An indication of the principal crops and the main areas of cultivation of each is shown in the following table. Only crops with 25,000 Ha or more total expansion are shown.

Main Crops (over 25,000 Ha) Average Ha's 1966-68

Crops	Total Ha.	Coast	Sierra	Selva
Maiz	358,000	104,300	220,700	33,000
Potato	261,000	7,800	253,700	-
Cotton	243,900	235,000	-	8,900
Barley	177,200	-	177,200	-
Wheat	149,100	2,000	147,100	-
Alfalfa	129,200	25,700	103,500	-
Coffee	121,600	2,000	11,200	108,400

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Crops	Total Ha.	Coast	Sierra	Selva
Sugar cane	87,500	78,800	6,300	2,400
Rice	81,000	62,000	-	19,000
Yuca	49,900	7,300	6,300	36,300
Onions	49,900	5,900	44,000	-
Beans	46,300	27,200	8,500	10,600
Banana	43,800	3,300	2,000	38,500
Tree fruits	33,700	20,200	4,400	9,100
Vegetables	25,500	12,700	12,800	-

Peru is not self sufficient in meat and dairy products and these along with wheat, feed grains (mainly maiz) and vegetable oils constitute the major part of the import of agricultural products. The dairy industry is concentrated around Lima as is commercial pork production and poultry production. Intensive livestock production is, however, greatly hampered by the scarcity and high cost of feed grains.

Livestock production is mainly in the Sierra and particularly in the southern region. Cattle are raised on the rather low producing pastures which are common to that area.

The livestock population is estimated to be as follows:

Cattle - beef	2,200,000
dairy	1,500,000
Sheep	14,850,000
Alpacas and llamas	4,170,000
Goats	3,900,000
Swine	1,900,000
Poultry - for eggs	2,650,000
meat (broilers)	10,000,000

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(c) Population and Land Reform

The total population of Peru (1970) is estimated at 13.6 million. Distribution by regions is approx. as follows:

Coast	39%
Sierra	52%
Selva	9%

The latest census indicates that approx. 48% of the total population live outside urban centres and derive their income from agriculture. When we consider, however, that the population of the six largest cities in the Coastal zone total approx. 3.4 million or 25% of the total population, it is evident that the Coastal zone has a relatively low agricultural population whereas the rural population is concentrated in the Sierra.

Previous to the initiation of Agrarian reform in 1964 Peru had followed the traditional South American pattern of a few owners holding most of the land. The following figures published in 1966 illustrate the situation previous to the Agrarian Reform Program.

87% of the land was held by 3% of the land owners with an average size of holding of 850 Ha.

7.4% of the land was held by 14% of the land owners with an average size of holding of 11 Ha.

5.6% of the land was held by 83% of the land owners with an average size of holding of 1.5 Ha.

In addition, it was estimated that 20% of all holdings had less than 1/2 Ha. each.

It is not within the scope of this report to discuss in detail the policy of the Peruvian Government regarding Agrarian Reform. There are, however, several important points in the program related to future trends in agricultural mechanization. The most important of these are as follows:

(i) The maximum legal size of individual holding is 150 Ha of irrigated land or its equivalent.

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(ii) The minimum size family unit is defined as 3 Ha of irrigated land or its equivalent.

(iii) In conjunction with the redistribution and consolidation of land the Agrarian Reform is concerned with the provision of credit, technical assistance, the promotion of cooperatives and the general improvement in rural living conditions.

(iv) The program is active in three types of land development and distribution as follows:

- The expropiation and redistribution to farmers of large land tenures. By the end of 1970 3 million Has had been expropiated and 1,200,000 Ha had been distributed between 65,000 families. The plan is to expropiate approx. 13 million Has. (including natural pastures, forests and abandoned land) and to distribute it to approx. 350,000 families.

  In this part of the program every effort is made to maintain the unity of actively operating farming and agroindustrial enterprises without physical division. Such enterprises are operated on a Cooperative basis.

  Most of the activity to date on this phase of the program has been in the Coastal zone.

- The consolidation of small uneconomical holdings. This part of the program has only basically begun. It will be concentrated mainly in the Sierra region.

- Colonization - The development of new land for agriculture, mainly in the Selva but also in the Coastal zona and in the Sierra through the development of new irrigation schemes and the extension of existing systems.

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(v) Water rights - Under the amended agrarian reform law issued in July 1969 the State now has control of all water rights in the country. This will permit control of the use of water for irrigation and should correct the rather unorganized and wasteful usage of water which has been the situation in the past. A Department of Irrigation and Water Use has been established in the Ministry of Agriculture to carry out programs in this area.

SECTION II - PATTERN OF AGRICULTURAL MECHANIZATION

1. Farm Machinery Population

The following chart shows the approximate number of tractors imported since 1946. It should be noted that these figures are calculated by EPSA on the basis that a 40HP tractor weighs approx. 2000 Kg.

Years	Total Importations	Average per year.
1946 - 1950	4128	826
1951 - 1955	5742	1148
1956 - 1960	2630	526
1961 - 1965	3534	707
1966	1463	1463
1967	1140	1140
1968	367	367
1969	411	411
1970	348 1/	348
1971	391 1/	391

1/ retail sales wheel tractors

The above figures cover all tractors imported. It is estimated that approx. 80% were for use in agriculture. It can be assumed that most of the tractors imported in the past 15 years - since 1956 - are still in use, plus a few imported before that date. On this basis, it is estimated that the current population of agricultural tractors in operational condition in the country is approx. 8,250.

No statistics are available on the breakdown of total imports between track type and wheel type or according to H.P. Up to recent years, however, track type tractors have been popular particularly in the sugar cane and rice areas in the Coastal zone. It is estimated, therefore, that of the total tractors currently in use in agriculture approx. 10% are track type and the remainder wheel type.

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The situation regarding H.P., particularly, in wheel type tractors has changed considerably over the past 15 years. In the 1950's the majority of imports were in the 30-40 HP class. In recent years however and particularly on the larger private farms and cooperatives in the Coastal area higher H.P. units have become more popular. The breakdown of the current tractor park according to H.P. size can be estimated as follows:

under 40 H.P.	- 55
40 - 60 H.P.	- 35
over 60 H.P.	- 10

For at least the past 15 years all wheel tractors imported have been equiped with 3 point hitch and internal hydraulic system.

It is estimated that the distribution of tractors by zones is Coastal plain - 80% ; Sierra - 15% ; Selva - 5%.

The most popular implements currently in use and the numbers of each in relation to tractors is estimated as follows:

Tractors	100
Disc plows	80
Disc harrows-	
-offset type	30
-tandem type	40
- Rome type	5
Field Cultivators/ Tillers	35
Sub-soilers	3
Ridgers	3
Row crop planters - single row unit	20
Row crop cultivators	10

2. Current Machine Usage and Future Trends

Farming practices, crops grown and the mechanisation of same varies greatly between the three basic agricultural zones. It is basically as follows:

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(a) The Coastal Zone

Agriculture in this area is in the valleys running up from the sea. There is virtually no rainfall , therefore, all crop production is under irrigation. Land holdings have traditionally been large and a considerable portion of the area is devoted to the commercial production of export and agro-industrial crops - sugar cane, cotton, rice.

Because of the topography, soils, size of holding and the main crops grown the area has always been very adaptable to mechanization. It is now considered to be 90% mechanized and approx. 80% of the total tractor population in the country is located in this zone.

As in other countries in the Andean region the disc plow appears to be the basic tillage tool, other than in the sugar cane areas when heavy "Rome" type disc harrows are used almost exclusively for ripping up the old cane fields.

It should be noted that in countries with long experience in mechanization but with similar climatic, soil and cropping conditions as Peru, disc plows have been practically completely replaced by heavy offset type wheeled disc harrows and chisel plows. It is suggested that the introduction of these machines could assist greatly in providing better tractor utilization and lower production costs.

The sugar cane areas appear to be very highly mechanized using heavy duty high cost equipment particularly for field loading and transport. Capital investment in this eqipment is very high, higher it would appear than in most other sugar cane growing areas throughout the world. It was not within the scope of this mission to study cane harvesting, loading and transport costs in detail. It is suggested, however, in that these operations make up such a high percentage of the total cost of cane production that methods used in other parts of the world should be studied carefully.

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(b) The Sierra and the Selva

The mission did not have the opportunity to visit these areas. It is understood however that particularly in the Sierra mechanization has been very much restricted, first by the inaccessability of many of the areas, second by the fact that many of the cultivated crops are on steep slopes and third because the small size of land holdings in the past.

The Agrarian Reform program however includes plans which should assist considerably in augmenting production in the Sierra region. The most important of these are (i) the Consolidation of small subsistance type land holdings and (ii) the more intensive cultivation of the rich valley bottoms, many of which are now only in natural pastures. These programs will permit the more advantageous use of power equipment. It is suggested that to achieve the planned levels of production for the Sierra will require that the tractor population be increased by approx. 50% in the area over the next 5 years. Most of the tractors required are wheel type in the 40 H.P. class.

It is estimated that at this time only approx. 5% of the total tractor population is located in the Selva. To date a large portion of these have been used for land clearing and development work. The Agrarian Reform program includes relatively large colonization schemes in this area. Much of this work will be carried out by the machinery pools operated by EPSA.

One of the major plans for utilization of areas being developed in the Selva is cattle raising. In some areas however there are good conditions for the production of annual crops particularly maiz and rice. The main problem in the development of this area is communications with the other parts of the country.

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3. Forecast Requirements for Agricultural Machinery

(a) Tractors

It is difficult at this time to predict the actual market for tractors in Peru during the forthcoming 5 - 10 year period. A great deal depends on the progress of the Agrarian Reform Program and how it is coordinated with the production promotion program. The increased use of agricultural machinery is only one of the inputs in these programs and, therefore, the rate of increase in machinery usage will depend on the progress of the entire program.

Due to soil conditions, topography and cropping conditions, the useful life of a tractor particularly in the Coastal area should be quite long - approx. 15 years. To only maintain the current tractor parc would therefore require the replacement of approx. 7.5% of the parc each year. If we consider the current parc to be approx. 8250 units, this would mean the addition of approx. 620 units per year.

Due to unusually low sales since 1967 however the current park of tractors is considered to be approx. 2000 units below normal requirements. Also to effectively carry out the Government production programs including new lands to be developed or brought under irrigation it would appear that the "normal" parc of approx. 10,000 units should be increased by at least 25% or to approx. 12,500 units within the next 5 years; or at the rate of approx. 800 units per year. Theoretically, therefore, the annual demand for the period 1973-1977 should be in the order of approx. 1400 units per year.

It can be anticipated however that machines with somewhat higher H.P. will be more popular. This will affect the total number of units required. It is considered that a more realistic forecast of the actual demand might be approx. 1000 units per year.

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(b) Implements

The market for implements will depend mainly on whether or not new/cultural methods and machines are introduced. The current types of machines - disc plows and disc harrows- will normally outlive the tractor they are operated on so sales of these machines can be estimated at approx. 50% of tractor sales. If on the other hand chisel plows and heavy duty offset disc harrows were introduced it can be predicted that they would to a large extent replace disc plows and therefore their sales at least for the first few years would approximate tractor sales.

Due to the Government promotion program for increased feed grain production, particularly maiz and sorghum, the market for row crop planters and row crop cultivating equipment in general should increase.

SECTION III - MANUFACTURING INDUSTRIES AND ANCILLARY FACILITIES

1. Farm Machinery Manufacturers

There are only two manufacturers of farm machinery in the country namely, MECATEC S. A. and FIANSA S.A. Both are located in Lima and both manufacture basically the same type of machines, namely Disc plows, disc harrows and tool carriers. These machines have practically 100% local content with the exception of the discs and, in the case of the disc plows, the bearings.

Neither plant has any basic engineering facilities. The designs of the machines made are adaptations of designs of similar European or North American produced models. Workmanship is however quite good and the machines has a satisfactory reputation for field performance and serviceability. The total volume of production of the two plants would appear to be in the order of approx. 300 disc plows and a similar number of disc harrows per year. All are sold within the country.

In addition to the above, the Company CAMENA in Lima have a considerable business in the manufacture of heavy trailers for the sugar cane areas.

It should be noted that the Ministry of Industry plans to establish an automotive industry and has received proposals from international firms for the establishment of factories to construct the following types of equipment:

(a) diesel engines
(b) agricultural tractors
(c) earth moving equipment.

2. Other Engineering Industries

The main engineering industries in Peru to date are in the area of light metal fabrication and welded assemblies. There are five companies currently assembling automobiles and trucks.

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It is reported that the local content in these vehicles is approx. 30%. No engines are manufactured in Peru.

There is local production of tires (limited sizes), batteries, radiators, steel tubing and electrical wiring (limited types and sizes). Practically all the bus and truck bodies are also made in the country.

3. Raw materials and ancillary industries

Peru has large reserves of good quality iron ore and other minerals required for the production of high grade ferrous and non-ferrous metals.

It is reported that the total smelting capacity - blast furnace, steel converter and electric furnace - is approx. 450,000 tons per year. It appears,however, that the mill - at Chimbote - is operating at considerably below capacity as it is reported that 1970 production was in the order of 113,000 tons.

Only mild steels in the 1040 range are produced in the following forms: steel billets, round and rolled sections, wire rods, flats (plates), hot and cold rolled sheets and galvanized sheets.

There are two rolling mills, at Lima and Arequipa, with a total capacity reported at 80,000 tons per year.

Foundry capacity (mainly at Callao) is reported as follows:

a) Ferrous	
(i) Cast Iron	125 tons/day
(ii) Cast steel	50 " / "
b) Non-Ferrous (Brass, bronze, etc.)	2 tons/day

There is very little installed forge capacity in the country.

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4. Availability of Technical Personnel

There appears to be a fairly good supply of academically qualified engineers in different fields. Unfortunately, most have not had the opportunity to gain the technical and managerial background and experience which similar personnel in highly industrialized countries acquire by working up through the ranks and in association with long-term experienced people. Certainly considerable guidance and assistance will be required in this area.

At the production level - welders, machinists, etc. - there appears to be a good supply of well qualified workmen. The mission was advised also that, in general, Peruvian people are very adaptable to metal working industries and with even limited training are very good workmen.

SECTION IV - POLICY REGARDING FARM MECHANIZATION

As in most countries, developing or otherwise, the Government of Peru do not have any definite stated policy regarding agricultural mechanization. The objectives of the mechanization program are, however, very well summarized in a report prepared by EPSA in 1970. They are as follows:

(a) To promote the use of agricultural machinery as a means of increasing the productivity of cultivated lands and to extend the frontiers of the agricultural area;

(b) to increase the installed capacity of state operated machinery services and, at the same time, to adapt these services in a form in which they can participate directly in the agrarian reform program;

(c) to establish a technical assistance service on the use and maintenance of farm machinery at the national level;

(d) to establish centres of investigation dedicated to the study of the agricultural implements and machines most appropriate for the Coastal, Sierra and Selva zones;

(e) to orientate the use of agricultural machinery in such a way as not to cause the indiscriminate displacement of rural labour.

1. Incentives by the Government

It can be said that not in any spectacular way but through various programs over the past 30 years the Government of Peru has contributed greatly to the advancement of agricultural

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mechanization in the country. The main contribution in this area can be stated as follows:

(a) The establishment of farm machinery pools to provide machinery services to farmers. Machinery pools were just established by the Government in 1945 under S.C.I.P.A. and are still continued by the Ministry of Agriculture under DPSA. This service has done much to introduce power equipment in the country, to bring more land into production and to train operators and maintenance and service staff.

(b) The provision of low interest loans for the purchase of farm machinery. The Banco de Fomento Agropecuario started this program in 1956 and is still providing this service.

(c) The exemption from import duties of tractors and machines to be used in agriculture. This has permitted the availability of low cost equipment to Peruvian farmers.

(e) The establishment of training facilities at a professional level at the National Agricultural University-La Molina.

2. Research and Testing Institutions

This work is concentrated in the Department of Agricultural Engineering at the Universidad Nacional Agraria - La Molina (The National Agricultural University) located near Lima. This Department has a full time staff of 8 professional people plus on the average approx. 3 to 4 part time workers. No specific staff is engaged full time on research but each staff member does teaching plus some research and extension in his specific fields.

Most of the research work is carried out by students in the form of a thesis which is required for a B.S. or M.S. degree in Agricultural Engineering. To date this has mainly been in the area of studies on the mechanization of various crops and crop production processes and on the establishment, equiping and operation of farm machinery pools. The department is now planning a research project on different tillage practices and machines.

The Department is very well equiped and well staffed from a technical academic standpoint. Their work is, however, restricted by the following:

(a) Shortage of funds.

(b) Shortage of sample machines for field work.

(c) Lack of opportunity for staff to study in a practical way the cultural practices and types and designs of machines used in highly mechanized countries with similar climatic, soil and cropping conditions.

(d) Lack of industry in the country to put into production machine designs which may be developed.

3. Education and Training

(a) At the University Level

There are currently 12 universities in Peru which grant degrees in Agriculture. All of these provide some courses in Agricultural Engineering including power and machinery.

The National Agricultural University - La Molina is the only university which offers a 5 year degree course specializing in Agricultural Engineering. The department of Agricultural Engineering at La Molina has excellent classroom and laboratory facilities and it offers a very good curriculum in agricultural power and machinery.

(b) At the Secondary School Level

The Ministry of Education operates 4 technical agricultural schools at the diploma level. Some basic information is provided in the curriculum at these schools. The department of Agricultural Engineering at La Molina conducts short courses for these secondary agricultural school teachers.

(c) For tractor drivers - This type of training is provided mainly by local machine distributors. The department of Agricultural Engineering at La Molina also conducts some short courses for tractor drivers between semesters.

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(d) For Mechanics

Training of mechanics is mainly through an apprentice system at local automotive repair shops. The Servicio Nacional de Aprendizaje y Trabajo Industrial - SENATI - under the Ministry of Labour operates 3 senior level apprentice training centres. These are organized in conjuction with private and government industrial enterprises and provide senior level technical training to industrial technicians including automotive mechanics.

Mainly as a result of the above programs there does not appear to be any shortage of trained automotive mechanics. In general, service facilities are good in the large urban centers. The main problem in this regard is in the outlying and newly developing areas.

4. Extension

The Ministry of Agriculture maintains extension centres and staff in all departments of the country. There is no specialized extension work in power and machinery, however, the Department of Agricultural Engineering at La Molina provides special short courses in Agricultural machinery for these general agricultural extension staff personnel.

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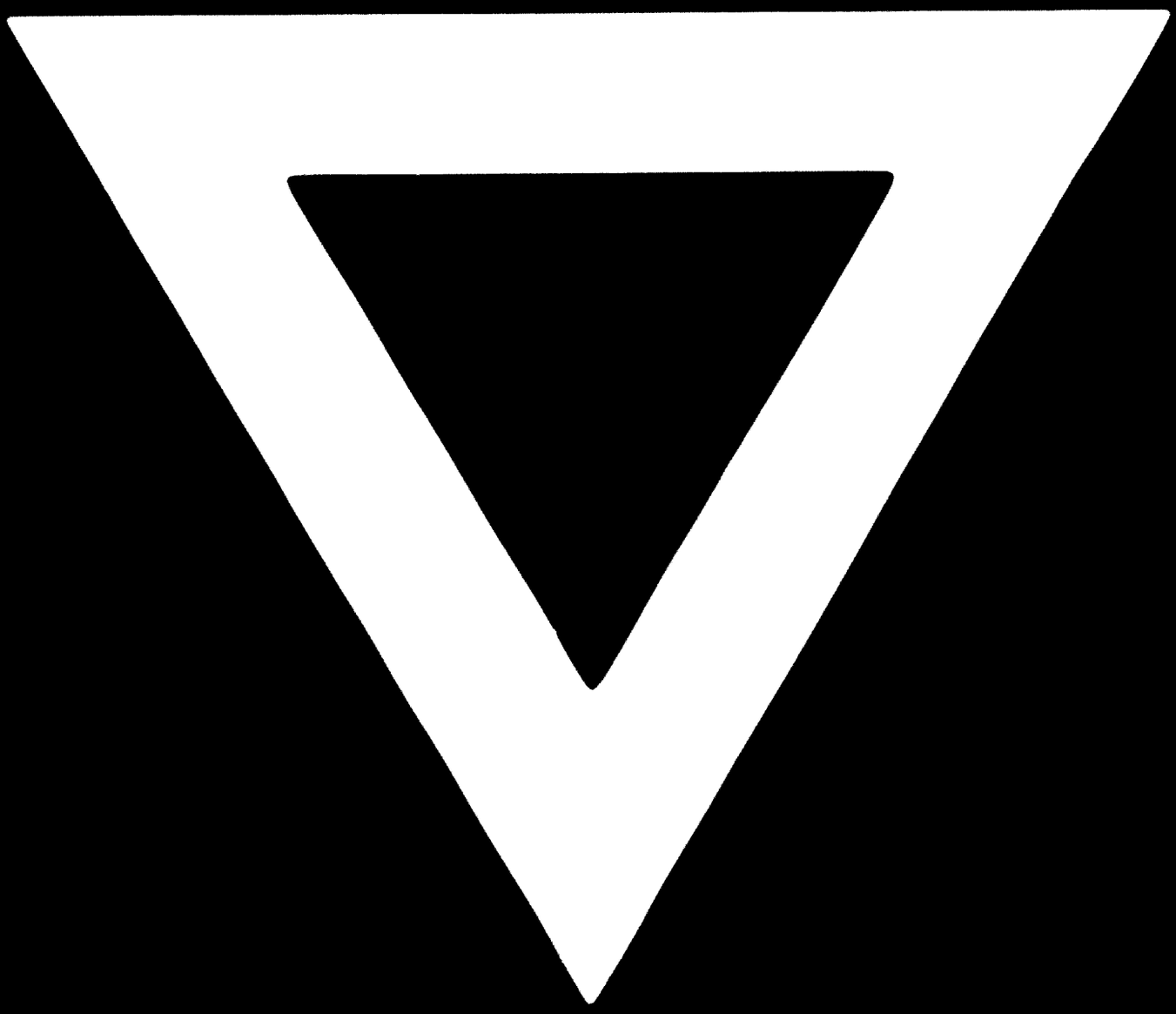

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