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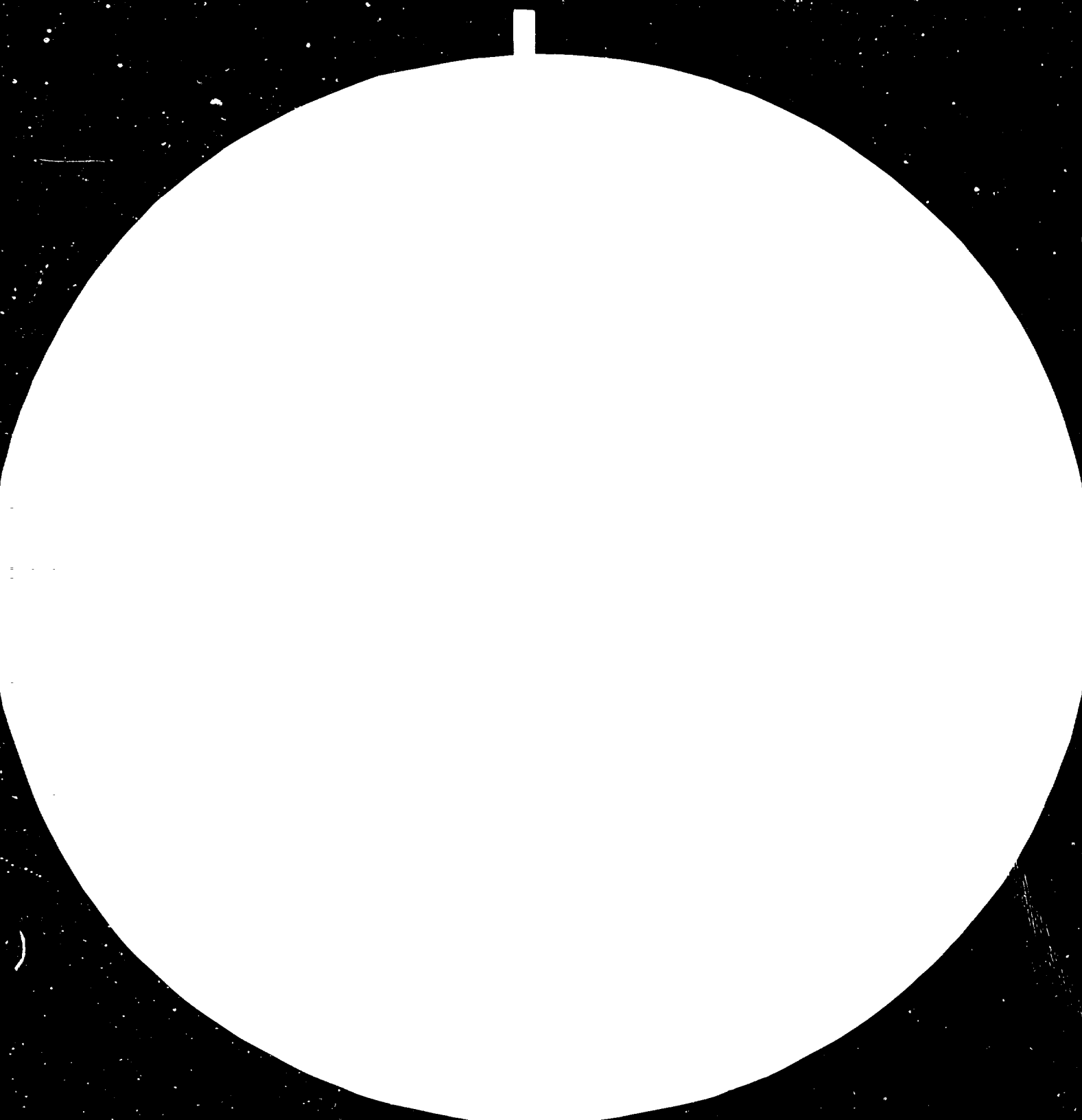

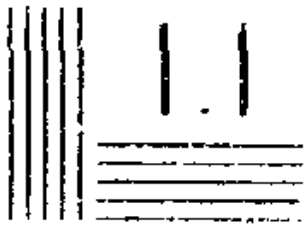

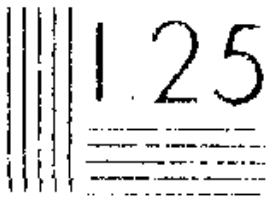

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CAPITAL GOODS PROJECT

IN THE ISLAMIC REPUBLIC OF PAKISTAN

DP/PAK/76/003/11-51/31.2.A

UNIDO REPORT

on the

Pakistan AGRICULTURAL MACHINERY AND EQUIPMENT INDUSTRY

W. J. DZIECIELEWSKI

27th May 1978

C O N T E N T S

I. INTRODUCTION

I.I BACKGROUND

This study of the "Agricultural Machinery and Equipment Industry" in Pakistan, was undertaken as an integral part of the UNIDO Capital Goods Project. The Project, based in Karachi was designed to assist the Investment Promotion Board in its efforts to streamline the Capital Goods Sector. The Investment Promotion Board, a department of the Federal Ministry of Industry, acted as the Counterpart Agency for this project. It was hoped that as a result of the work undertaken, the solution of technological problems, would lead to the enhancement of the production structure in the Capital Goods Sector.

I.2 OBJECTIVES

The aim of this study of the Agricultural Machinery and Equipment Industry, is to review its demand and supply position, draw valid conclusions and to recommend action to improve the existing structure and economic viability. Particular attention was to be given to the discernment of a supply or demand gap, if any, so that through timely action such impediments to the industry's efficiency can be overcome. Detailed objectives of this report are set out in the terms of reference covering this assignment.

I.3 TERMS OF REFERENCE

The terms of reference for this assignment were formulated by UNIDO and were as follows:

a) Review and evaluate existing data concerning production capacity, import and demand of different types of agricultural machinery and parts.

b) Determine the demand trend for each product and the various parts.

c) Consider the optimum size of production in relation to the projected supply/demand gap and assess the production facilities required.

d) Review and evaluate existing information on the condition of the machinery park and facilities, technical know-how and the quality of production.

e) Consider the pros and cons of expansion/diversification, as opposed to the creation of new capacity, to fill the supply/demand gap for each product.

f) Prepare industrial project profiles which should give a preliminary indication of the feasibility of the project

I.4 IMPLEMENTATION

After briefing in Vienna, the expert arrived at the duty station in Karachi on the 3rd of March 1982. The three month assignment was split into two parts. Part one consisted of extensive travel and consultations in Pakistan from the 3rd of March to the 24th of April,

followed by part two in the U.K., from the 25th of April to the 27th of May 1982. The data collected in Pakistan in the course of the many visits to manufacturing plants, government offices, banks and other institutions, was later supplemented in the U.K. with material not available at the duty station. This report was then collated and finalized, incorporating the two sets of data, upon which the findings, conclusions and recommendations are based.

1.5 REPORT LAYOUT

The first part of this report on the "Agricultural Machinery Industry in Pakistan" consists of a brief introduction. This is followed by the section containing the findings, conclusions and recommendations. The main body of the report then follows, which consists of, a description of agriculture in Pakistan as it exists today, followed by an evaluation of the size and structure of the Agricultural Machinery and Equipment Industry.

1.6 ACKNOWLEDGEMENTS

The author would like to take this oppertunity to thank all those who through their advice and assistance, made the completion of this task possible. Special thanks are due to the counterpart Mr. Hamid S. Husain whos help and devotion to duty, made him an outstanding collaborator in the project.

II. FINDINGS CONCLUSIONS AND RECOMMENDATIONS

2.I GENERAL FINDINGS

With a large, poor and mainly illiterate population, which is in excess of 80 million and growing rapidly at just under 3% per annum, Pakistan requires an immediate, substantial improvement and sustained growth, in its agricultural output. Since over 70% of the population still derives its income, either directly or indirectly from agriculture, the achievement of higher yields per acre, would have an immediate beneficial effect on the bulk of the population.

As only slightly less than 50 million acres, or just under 40% of the total land area is cultivated, some increase in food and fibre production can be obtained by bringing additional land under cultivation. With a great deal of effort and substantial investment, some of the 26 million acres of marginal land, could eventually be brought under the plough. For this to occur however, mechanized farming and extensive new irrigation networks would be essential prerequisites.

The cultivation of such marginal lands however, can only make a substantial contribution to agricultural production in the long term. For immediate results it is therefore, essential to utilize existing arable areas far more efficiently. As traditional farming

methods cannot hope to achieve the necessary breakthrough in productivity, an accelerated programme for the introduction of farm mechanization is the only viable alternative.

The spread of mechanized agriculture would not only enhance the efficiency of most farms, but would also result in land which had previously been devoted to the growing of animal fodder, being available for the production of food or cash crops. Replacement of bullocks by tractors would result in a 15% to 20% increase in acreage released for the cultivation of staples and fibres.

Mechanization would also greatly assist the development of more effective irrigation and drainage. The limited surface and underground water resources could be put to optimum use, through the improvement of land levelling, ditching, surface flow and water table management. With the increase of available horse power, the above techniques could help to eradicate the twin scourges of irrigated areas in the country, waterlogging and salinity.

It should be borne in mind however, that efforts aimed at the introduction of mechanization into agriculture over the last three decades, have only been partially successful. Slow progress in this field has been largely due to the fragmented nature of agriculture in Pakistan. The continuous subdivision of land

into ever smaller holdings and their consequent loss of economic viability, has reduced over half of the farms in the country to a size, where mechanization becomes virtually impossible.

2.2 ANIMAL DRAWN IMPLEMENTS

Hand tools and animal drawn equipment will continue to be widely used by the majority of small-holders, for many years to come. An evaluation of the implements in current use however, shows that they are of crude design, flimsy in structure and often inefficient in operation. Since many better designed, sturdier and more effective implements exist and are used in other countries, it would be of inestimable value to small-holders, if such improved equipment were to be made available to them.

As local manufacture and assembly of this simple equipment, would not present any difficulty, all that would be required is the import of suitable samples, their field testig and subsequent manufacture. Improved mouldboard ploughs, ridgers, inter-row cultivators, single row planters and spike diamond or tooth harrows, could thus be introduced.

It is recommended therefore, that the Pakistan Agricultural Research Council (PARC), or some other similar institution, obtain sample machines for field testing and when successful, encourage the local manufacture of such improved animal drawn implements.

2.3 TRACTORS

Despite a rapid increase in the tractor population over the last few years, their impact on the extent of mechanization of agriculture has been far more modest. Too many tractors are being misused as road haulage vehicles, substituting for vans and trucks, instead of working in the fields for which they were designed. As long as current import and fiscal regulations remain unchanged, tractor ownership will continue to retain its economic advantages compared to that of other vehicles.

A tractor- trailer combination costing some Rp 80,000 is a good investment for any village haulier, when compared with the cost of a 1½ ton van or small truck. Furthermore, tractors are not subject to import duty, recieve concessional low interest credit and are exempt from taxes levied on the use of other vehicles.

It is recommended therefore, that the competent authorities critically review this situation and tighten existing regulations, so that only those tractors which are genuinely used as prime movers in farming operations, enjoy the benefits envisaged for this purpose.

Such an approach would reduce the number of tractors used purely for haulage purposes and make them available for work on the farm.

With a limited market which can at best absorb some 30,000 tractors per annum, the decision to allow four plants to assemble is fraught with difficulties for the future. Pressure on costs will intensify, once low volume assembly from C.K.D. packs begins to incorporate higher percentages of locally manufactured parts.

It is recommended therefore, that no additional assembly operations be authorised, as the existing plants will in any case suffer from considerable underutilized capacity.

By restricting all four assemblers to the same horse-power range, the authorities have imposed an additional burden on their potential ability to break-even. This arbitrary imposition of the 45 HP to 60 HP range, takes no account of the actual needs of the farming community which often requires bigger and smaller tractors for different operations. At the same time it prevents local assemblers from supplying the optimum size of tractor in many instances. It is understood that a recent decision will allow the import of smaller tractors. Although a step in the right direction it does not go far enough, since the need for larger, more powerful tractors is even more pressing.

It is recommended therefore, that the restrictions on the import or assembly of tractors falling outside the 45 HP to 60 HP range, should be lifted in the interest of efficiency in farming.

Such a move would allow the local tractor assemblers to diversify their range in terms of tractor size and horse-power. At the same time it would let them concentrate on the assembly of those types and models, which are most attuned to their particular technical and marketing strength.

Up to the very recent past, all tractors sold in Pakistan were imported. With the establishment of local assembly facilities however, the open import policy currently in vogue requires some adjustment. The import of fully built up tractors under barter arrangements or bilateral aid programmes, introduce large numbers of machines into the country. The prices of such imports are often fixed at cost or even lower for political motives, bearing little or no relation to real production costs. These tractors when sold in direct competition with locally assembled units, disrupt the sales and production plans of the assemblers and their local parts suppliers.

It is recommended therefore, that the imports of tractors under barter or bilateral aid deals be discontinued, as soon as local assembly plants become fully operational. This would remove a source of unfair competition, with its disruptive effects on local producers and would prevent the introduction of types and models, for which no adequate repair facilities or spares exist.

It cannot be emphasized too strongly, that adequate provisions for repairs, maintenance and after sales service of tractors and implements are an essential prerequisite for the successful expansion of agricultural mechanization. Unfortunately, existing facilities are generally inadequate, in the quality of service and geographical coverage.

It is recommended therefore, that the tractor assemblers take steps to expand their dealer and distributor networks, to ensure a more adequate coverage of the whole country, with spares supplies and repair workshops.

To function effectively, the repair and maintenance centres, whether government sponsored or in the private sector, need to be staffed with adequately trained mechanics and supervisors. Such men are in short supply in the country and there is a constant drain on their numbers, as many of the best qualified among them leave for better paid employment in other countries. Considerable effort will therefore be required from the authorities and the few existing institutions charged with training, to step up their programmes for repair and maintenance mechanics.

It is recommended therefore, that the competent authorities spare no time or effort to expand and improve the training courses now available, in terms of numbers and quality.

2.4 TRACTOR DRAWN IMPLEMENTS

Farm mechanization in Pakistan, has so far progressed on a very narrow front, affecting a few implements and a minority of farmers. Implements and machines such as cultivators, levelling blades and threshers are widely used, while the introduction of most other types of equipment is still in its infancy.

Relatively few, expensive, but good quality implements have been imported, because the market for such high class machines is very limited. This widespread reluctance by the majority of customers to invest in good quality equipment is undoubtedly a major obstacle to the proper mechanization of agriculture. As it stems largely from a lack of adequate funds and ignorance, it is not suprising that farmers tend to buy the cheapest implements, at the expense of product quality and durability in service.

It is reccmmended therefore, that an effort be made by the authorities, through education and agricultural extention services to inform potential equipment buyers of the advantages of good quality products. A very effective contribution to this flow of information, could be obtained through specially designed series of educational programmes on radio and television. These would explain to the farmers the advantages of using the right good quality implement for each specific job on the farm.

In a country where a large proportion of the rural population is illiterate, the spread of information through sound and vision, supplemented with field demonstrations in the villages, is a very effective method of introducing new implements and showing their proper functions in the mechanized farming process

It is recommended therefore, that a serious attempt be made to exploit the educational capabilities of radio and television, through the use of practically oriented programmes on improved agricultural practices, correct use of implements, advantages of good quality equipment and all other aspects of farm mechanization.

The prevailing reluctance on the part of farmers to show any preference for quality demonstrated by their very marked price conciousness, has had a marked effect on the development of local implement manufacturers. Unable to sell good quality machines at a reasonable profit, due to a lack of sufficient demand, most of them sacrifice quality and try to undercut the prices of their competitors. It must be said however, that even if demand for high quality equipment existed, most of the manufacturers of tractor drawn implements, would in any case be unable to meet it. Like their customers, they also have no real quality conciousness and little incentive to acquire it in present circumstances. In this situation even those companies that have the reouired technical know-how, are

quite naturally reluctant to produce good quality high priced equipment.

It is recommended therefore, that the Pakistan Standards Institute, together with other relevant institutions should take the initiative and enforce higher quality standards. A system of product inspection and quality testing should be devised, which would eliminate the worst products through the enforcement of minimum standards. Such a system would only allow the continued manufacture of those products, which meet these standards.

Although this would result in the elimination of many of the current producers, their disappearance would undoubtedly benefit the industry and its customers. With the existance of some 400 mostly very small manufacturers, the industry suffers from a considerable amount of underutilized capacity. It would therefore, benefit from any reduction in numbers, especially if this involved the elimination of the least efficient producers.

It is recommended therefore, that the enforcement of production and quality standards, should be accompanied by changes in fiscal policy which would act as an incentive to company mergers and amalgamations. By limiting the payment of such incentives, to only those companies that are willing to improve quality, overcapacity and low quality products could be eliminated from the industry.

III. AGRICULTURE IN PAKISTAN

3.I AREA UNDER CULTIVATION

Out of a total area of 133 million acres, arable land, currently under cultivation, accounts for some 50 million acres. The bulk of this is concentrated in the Indus River Basin and particularly, in Punjab Province. Outside this area, low yeild subsistance type agriculture predominates, with an emphasis on grazing rather then crop raising. Large tracts of the country are either mountainous or arid, where climate and topography combine to make arable farming arduous, or indeed impossible without the use of irrigation.

In the rain-fed, un-irrigated areas however, farmers are wholly dependent on inadequate and often unpredictable amounts of rainfall. This can and often does, have disastrous consequences on crop yeilds. Additionally, these areas and particularly those in the semi arid regions, suffer from soil erosion. This impedes even further, the profitable persuit of arable farming in such regions.

Land utilization in Pakistan is currently approximately as follows: Apart from the 50 million acres of arable land, a further 50 million acres is unusable consisting of mountains and deserts, 7 million acres consist of forests, while a further 26 million acres are marginal lands that could be brought under cultivation.

3.2 IRRIGATION

Irrigation is a long established and widespread practice in Punjab Province, where irrigated lands account for the bulk of cash crops and subsistance agricultural output. In other provinces, the extent of existing irrigation, as well as oppertunities of adding substantial new areas of irrigated land are however, much more limited. There is a general lack of sufficient surface water in large parts of Sind, North West Frontier Province and Baluchistan. This confines irrigated areas in these provinces in the main, to river valleys.

These inadequate flows of surface water have to be supplemented by the use of underground water resources, through the widespread installation and use of tube-wells. Even in the Punjab where surface water supplies are far more adequate in quantity and quality, tube-wells are widely used.

Although an undoubted blessing, without which only a fraction of actual agricultural output could be attained, irrigation has also had some damaging effects, whose consequences, have had a negative influence on the long term prospects of agriculture in Pakistan. These negative aspects of the indiscriminate use of irrigation, are seen in the often damaging effects this can have on the chemical and mechanical composition of the soil.

3.3 SOILS

It is to be expected that in a country as large as Pakistan, a wide variety of soils would occour. This is in fact the case and soils of differing type and quality can be discerned. Apart from the rich alluvial clays and loams of the Indus River Basin, the majority of the soils in the rest of the country are of poor quality, thin, leached, low in organic matter and prone to erosion. Furthermore, large areas of even the best arable soils have been spoiled by indiscriminate irrigation, often resulting in increased levels of soil salinity and/or waterlogging.

Salinity and /or alkalinity occur, as a result of irregular flows of irrigation water, due to inadequate land levelling. This results in a build up of salt levels due to repeated evaporation in hot climatic conditions. This tendency towards soil salinity has often been aggravated by the use of tube-wells pumping brackish water on to the land.

Waterlogging occurs in poorly drained clay soils. The lack of lateral drainage channels in such circumstances has contributed to waterlogging, salinity and leaching, with consequent damaging effects on the already low crop yeilds of the majority of farmers in Pakistan. The above problems underline the need for carefull water-table and flow management, at the farm or even field micro-level.

To avoid the negative aspects of irrigation detailed soil analysis is an absolute prerequisite. Such tests ensure that the correct type and method of irrigation is adopted in each locality, The following data taken from recent soil surveys in the Punjab, illustrate the gravity and extent of salinity, alkalinity and waterlogging in irrigated areas.

I. Dense saline-alkali soils (2.2 million acres)

2. Porous saline-alkali soils (3.5 million acres)

3. Porous saline soils with saline-alkali surface (0.3 million acres)

4. Porous saline soils with slight surface salinity/alkalinity (I.5 million acres)

5. Strongly saline soils containing gypsum (6.0 million acres)

6. Waterlogged non-saline soils with water-table within two meters (0.7 million acres)

7. Waterlogged non-saline soils, seasonally imperfectly drained (2.I million acres)

The above data shows that, on the basis of soil chemistry, salt affected soils are either sodium carbonate or gypsum saturated. It is also evident that salinity is not always associated with a high water-table, but can often occor due to a shortage of irrigation water. The current drive to extend irrigation, without a corresponding increase in water supply, needs therefore carefull reconsideration.

3.4 MAJOR CROPS

The main cash crops are sugarcane, cotton and oilseeds. In normal years the cotton crop is sufficiently large to supply the needs of the substantial cotton textile industry and leave a surplus of raw-cotton for export. The output of sugarcane, ensures the country's self--sufficiency in most years. In the case of oilseeds however, local production falls well short of annual demand, necessitating net imports to make up this deficit.

The main food grains grown in Pakistan are rice and wheat. Whereas, the country is self-sufficient in rice, producing a surplus for export in recent years, wheat production has tended to lag behind. Smaller volumes of other crops such as, maize, vegetables, potatoes, sugar-beet and other root-crops are widely grown. The only other crop of any economic significance is animal fodder.

The level of output of these crops in terms of yield per acre is generally low. The yields compare unfavourably not only with those achieved in developed countries, but also with those attained by farmers in many developing countries. The only crop whose output per acre has shown a significant improvement in recent years, has been rice. The successful introduction of improved seed varieties, together with a determined government drive to achieve self-sufficiency in rice, has attained its aim.

3.5 LAND TENURE AND FARMING TECHNIQUES

The relatively low levels of agricultural output per acre in Pakistan, are primarily due to the system of land tenure on the one hand, together with the farming techniques employed on the other. The dominant feature of the existing system of land tenure, is the preponderance of small to very small land holdings. This can be illustrated by the following;

DISTRIBUTION OF FARMS BY SIZE AND AREA IN PAKISTAN

FARM SIZE IN ACRES	CLASSIFICATION	% OF FARMS	% OF AREA
Less than 5	Very Small	28	5
5.0 to I2.5	Small	39	25
I2.5 to 25.0	Small	2I	27
25.0 to 50.0	Medium	8	I9
50.0 to I50.0	Medium	3	I5
I50.0 and over	Large	I	9
	Total Holdings	I00%	I00%

The above table shows that, very small and small farms, that is holdings with less than 25 acres per unit, account for 88% of the total number of farms and 57% of the total cultivated area. Medium sized holdings, of over 25 acres but less than I50 acres,

account for only 11% of the total number of farms, but 34% of the area under cultivation. Large farms, account for a mere 1% of farms and 9% of the total area.

The predominance of very small subsistance farms, together with the small holdings of less than 25 acres, has helped to perpetuate traditional and inefficient farming practices in the country. As the majority of holdings are too small to generate an adequate level of income to sustain investment, most small-holdings are grossly under-capitalized in terms of farm buildings, storage facilities, equipment and above all draught-power.

The progressive subdivision of holdings between a farmers sons with the passing of each succeeding generation, leads to the creation of progressively smaller farms. Such units become economically less viable, until only subsistance type agriculture is possible on such farms. These holdings are not only too small, but tend to consist of a number of seperate strips of land scattered throughout the village. This further inhibits the possibility of farming such holdings on an economically viable basis.

This trend towards the creation of ever smaller land holdings in Pakistan, is common and affects all sizes of existing farms. Even medium and large farms are being broken up into smaller units, many of which are farmed by tennants as small-holdings. Under such conditions,

it is hardly supprising that traditional, subsistance type farming methods still dominate agriculture in Pakistan.

In the absence of adequate incomes from their small-holdings, farmers have begn forced to continue to till the soil and harvest their crops, using crude outdated animal drawn equipment. Bullocks have remained the main source of drought-power, on the majority of small-holdings. An estimated 8 million bullocks are currently still used for this purpose, despite their slowness, limited power and the need to be fed.

This last point assumes particular importance in the case of very small farms, where the limited and already inadequate acreage has to supply food for the family as well as their bullocks. Thus animal fodder competes directly with staples and cash crops, for the limited acreage available on each farm.

The general low levels of output per acre and the resultant shortage of funds, prevent small farmers from investing in improved agricultural methods and techniques. It is therefore, difficult for them to adopt new techniques,or to participate fully in government sponsored fertilizer, pest control or improved seed campaigns. The introduction of mechanized farming methods, which require far larger amounts of investment capital, is even more difficult for them. Some progress in farm mechanization has nevertheless occured.

3.7 FARM MACHINERY AND IMPLEMENTS IN USE

a) ANIMAL DRAWN EQUIPMENT

All animal drawn equipment currently in use in Pakistan, is produced locally by village blacksmiths. This consists for the most part, of simple ploughs, cultivators, harrows, etc., copied from traditional designs. Such implements are usually of poor or indifferent quality, often cumbersome and inefficient in their use and charac'erized by a short working life due to breakage.

Despite the abovementioned shortcommings, this equipment has an overriding advantage for the small farmer, that is, its low initial cost. For the vast majority of small-holders it is the only type of farm machinery, that they can really afford to buy with the limited resources at their disposal.

The other main advantage stems from the simplicity of design. This ensures that even illiterate peasant farmers can operate these simple implements and that repairs and maintenance, when required are uncomplicated and cheap. The simplicity of this equipment however, endows it with operating limitations stemming from their design.

Being animal-drawn, the equipment can only operate as fast as a team of slow moving bullocks can drag it through the soil. Since a pair of bullocks has limited power and endurance, the

implements have to be limited in size, operating width and weight. Single furrow ploughs, narrow three-tine cultivators and light spiked harrows are therefore, in common use.

Only shallow-depth tillage is possible with such machinery. This is to the detriment of adequate seed-bed preparation and often results in lower yields per acre than necessary. Furthermore, since these operations are time consuming, farmers are often unable to complete ploughing in time, to take full advantage of optimum climatic conditions. This invariably impedes successful germination and subsequent plant growth.

Although small-holders can least afford any sort of mechanized farm equipment, they would gain substantially from its introduction. As they represent the largest group of farmers in Pakistan, the at least partial mechanization, of this section of the agricultural community would have a very positive impact on farm yields and income. A large proportion of these small-holdings are too small to ever justify the sole ownership of a tractor with a range of tractor-drawn implements. Tractor hire or sharing, to perform the most difficult operations, such as ploughing or sub-soiling, has began to be practiced by some of these farmers in different parts of the country.

b) TRACTORS

The diesel powered agricultural wheeled tractor, has evolved into the ubiquitous, mobile power unit that is at the centre of all mechanized farming operations. A tractor by itself however, is at best a highly versatile power-pack on wheels. It can only attain its full potential, in the field of farm mechanization, if fitted and operated with a complete range of implements and attachments.

In Pakistan, the growth and spread of mechanized farming has however, been rather slow, despite the fact that some 70% of the population, depends either directly or indirectly on agriculture. The best indication of the slow rate of growth, can perhaps be gauged from the number of tractors in use in the country. This shows very slow growth up to 1975, when the tractor population stood at a mere 35,000 units. Since then, the rate of growth has accelerated considerably, thereby resulting in the more widespread use of tractors in agriculture.

As a result of this trend, some 130,000 tractors are now estimated to be in use. Although this represents a quadrupling of the tractor population in recent years, the total number in use today still falls far short of the actual requirements of the country. So far, only the larger holdings have been mechanized to any extent, while small farms have yet to benefit from mechanization.

Most small farmers would like to take full advantage of the benefits that accrue from the use of tractors. This would enable them to tackle deep-ploughing, dry-ploughing, sub-soiling, etc., operations which cannot be done without the use of a tractor. It would also enable them to replace draught animals with tractors, thereby releasing 15% to 20% of the land previously devoted to the production of animal fodder. The land thus released, could then be brought under cultivation to produce food crops and fibre thereby raising the economic viability of the small-holdings.

The full benefits brought about by the introduction of an increased number of tractors, have unfortunately not been attained to-date. In the first instance, the total number of tractors in use in agriculture, is still far below requirements. Secondly, a large proportion of the existing tractor population, is underutilized.

In this context, it should be noted that very few tractors are equipped with a full range of implements and attachments. The widespread use of tractors as road haulage vehicles, inevitably mitigates against their optimum utilization on the land. In addition to this, poor maintenance facilities and spare parts supply, ensure that between one third and one quarter of all the tractors in the country, are inoperative or under repair at any one time. For all these reasons, only a fraction of the total horse-power and tractor

hours, is available for utilization on the land.

The existing tractor population has been built up over the years through imports. At first, many different makes,types and models were allowed entry into the market. Although this open import policy, facilitated the purchase of the correct type and model of tractor, with the most suitable horse-power rating, to tackle a particular task, it caused severe problems in the field of maintenance and after sales service.

In the interest of standardization and in an attempt to obtain better value for the large amounts of scarce foreign exchange, that were allocated each year for the import of tractors, the government decided to restrict the number of makes and models. Currently, the approved list consists of the following makes; Massey Ferguson, Fiat, Belarus and IMT. These are also the makes whose local assembly has been authorized.

Another facet of this policy, is the fact that all types and models of tractors approved for import into Pakistan, have to fall within the 45 to 60 horse-power range. A concession to this rule has recently been made, allowing the import of smaller tractors. A far better case could be made however, for the liberalization of the import of larger, higher horse-power tractors, bearing in mind the topography, soil conditions and climate of large areas of the country.

The above mentioned import regulations, governing the entry of tractors apply however, only to those machines which require official foreign exchange allocations. Private imports, financed by overseas Pakistani workers, sent in the form of gifts to their families, are free of all restrictions as to make, type, model or horse-power rating. The other major factor working against the creation of a more standardized tractor population, are bilateral technical assistance loans and barter agreements.

Under these schemes, large numbers of tractors and other equipment are brought into the country, consisting of the most diverse makes, types, models and horse-power ratings. By allowing the entry of this diverse equipment under these schemes, the declared government policy aim to achieve a standerdized tractor park, is steadily undermined. These exemptions to government policy guidelines, are frequent and widespread enough in their occurance, to render them ineffective.

This flouting of policy decisions, often has a negative effect on priority projects in both the private and public sector. With the approval of local tractor assembly, the continued import of tractors under barter arrangements or bilateral aid schemes, could damage the economic viability of local assemblers and their ability to persue a realistic parts deletion programme.

The establishment of local assembly makes it imperative, that the limited demand for tractors is as far as possible supplied entirely by these plants. This implies that all alternative sources must be severely limited, to give local assemblers a reasonable chance of profitable operation. The demand for tractors is thus a key factor which will determine the eventual success or failure of local component manufacture and final assembly.

Taking into account the state of agriculture in the country, its likely development in the future and past trends in the growth of the tractor population, demand for new tractor sales is estimated to be as follows:

ESTIMATED GROWTH IN TRACTOR POPULATION

YEAR	POPULATION AT START OF YEAR	DEPRECIATION	IMPORTS	POPULATION AT END OF YEAR
1975	35,714	3,500	9,472	41,700
1976	41,700	4,200	15,058	52,600
1977	52,600	5,300	11,272	58,600
1978	58,600	5,800	15,178	68,000
1979	68,000	7,000	20,000	81,000
1980	81,000	8,000	25,000	98,000
1981	98,000	10,000	23,000	111,000
1982	111,000	11,000	30,000	130,000

Based on the above figures, it is estimated that the tractor population will continue to grow over the next ten years reaching some I90,000 units in I987, 230,000 units in I992 and approach market saturation at approximately 280,000 tractors by the year 2000. The above estimates assume no major change in the land tenure system over this period, which alone could affect the total demand for tractors significantly.

In the absence of any widespread consolidation of small farms, into larger more productive units, the mechanization of agriculture will continue to be viable for only a minority of larger land holders. In these circumstances, an annual demand for some 30,000 new tractors is quite a respectable volume. Despite growing labour shortages and the steady decline of the total number of bullocks, tractor farming shall remain largely the preserve of the more affluent sector of the farming community.

c) TRACTOR DRAWN IMPLEMENTS

Top quality agricultural implements are all imported. The market for this high priced equipment is rather limited however, since most farmers in Pakistan are very price concious. This phenomenon is as common among large, prosperous land owners, as it is among their poor neighbours. The plain truth is that few if any farmers are willing to pay a premium for quality. It is not surprising therefore, to find that no local manufacturer of tractor drawn implements, produces high quality goods.

The other main characteristic of the demand for tractor drawn implements, is the narrow range commonly in use. The most widely used machine is the cultivator. Eleven and thirteen tine cultivators are bought with practically every tractor. These secondary tillage implements designed primarily for seedbed preparation, are widely misused as primary tillers. In this capacity their performance is inefficient, since they are only capable of very shallow tillage. They are also prone to premature breakage, especially in hard soils such as sun-baked clays.

Apart from these locally produced cultivators, smaller numbers of Mould Board ploughs, disc ploughs and off-set disc harrows are also used. In irrigated areas, land levelling blades are beginning to achieve widespread application. Less common is the use of [illegible]

ditchers, rotavators, chisel ploughs and sub-soilers.

With few notable exceptions, the use of agricultural equipment other than for primary or secondary tillage, is still very unusual. Among the exceptions are rice, wheat and maize threshers. Thousends of these machines are already in use, powered by electric motors, stationary engines or coupled to the tractor power-takeoff. The only other widely used piece of equipment are tractor trailers and farm waggons. These are used on and off the farm, accounting for the bulk of a tractors total working time in many instances.

Cane crushers, seed drills, reapers, fertilizer distributors, sprayers and rice planters are beginning to be used by some of the more progressive farmers. Relatively few self-propelled combine harvesters are operated by some of the largest landowners, but the demand for tractor drawn combines is on the increase. In irrigated areas, tube-wells, pumps and stationary portable pumping engines are common.

Although there exists a large latent demand for all the above mentioned implements and equipment, machinery in common use to-date consists of cultivators, land levelling blades, threshers, trailers and tube-well equipment. The utilization of all other implements however, has so far only attained marginal acceptance and is still at an introductory stage.

Annual demand for tractor drawn implements can be summerised as follows:

TYPE OF IMPLEMENT	ANNUAL DEMAND
Cultivators	37,000
Mold Board Ploughs	4,000
Disc Ploughs	4,500
Disc Harrows	3,500
Levelling Blades	I6,000
Rotavators	I,000
Grain Drills	2,000
Threshers	I0,000
Trailers	22,000

The above estimates refer to I982, but similar sales volumes are expected for each year up to I987. From that year onwards the number of thresher sales will begin to decline as market saturation for this machine will have been reached. In any case, by this time combine harvesters are expected to start replacing threshers on many of the larger farms. It is also hoped that the sales of primary tillage implements will rise substantially, thereby reducing the sales of cultivators to some extent.

IV. THE SIZE AND STRUCTURE OF THE AGRICULTURAL MACHINERY INDUSTRY

4.I AGRICULTURAL MACHINERY SUPPLIERS

The industry can be conveniently split into three distinct sectors; the makers of animal drawn implements, the tractor drawn implement manufacturers and the tractor assemblers. With some 45 thousend villages in the country, there are tens of thousends of village blacksmiths who supply the local farmers with hand tools and simple animal drawn equipment.

The tractor drawn implements are supplied by some 400 mainly small scale manufacturing establishments. The majority of them have fewer than ten employees, with perhaps a dozen medium sized companies employing up to 40 or 50 people. There is one larger manufacturer in Lahore, whose output in terms of volume and quality is in a class of its own.

The third sector of the industry consists of four tractor assembly plants. Two of these are in the public sector while the other two are privatly owned companies. One of the public and one private company are already assembling tractors from imported C.K.D. sets. The other two companies are in the process of finalizing the construction and commissioning of their respective assembly plants.

4.2 ANIMAL DRAWN IMPLEMENTS

There are many thousends of village blacksmiths who supply all the hand tools and animal drawn equipment, which the majority of small traditional farmers normally require. These simple tools are constructed from any readily available material and sold at prices, which the average small farmer can afford. These implements are also of very simple design, being most often direct copies of traditional equipment that has been in common use for many centuries throughout the area.

It is also a fact that, irrespective of the pace of agricultural mechanization or the extent of its development, the majority of small farmers will have to continue to use, animal drawn equipment for the foreseeable future. Even many medium sized farmers are faced with the same predicament. Despite their higher incomes and consequent greater ability to afford mechanization, the funds at their disposal are still limited and generally prove to be insufficient for the purchase of a tractor with a full set of implements. The majority of these farmers will therefore, use tractors for the most arduous tasks, such as pan breaking, ploughing etc., leaving all other operations to bullock drawn equipment.

Despite the low price, or perhaps in many cases because of it, the traditional equipment in common use at present, is far from

being perfect. In many instances however, design deficiencies make these implements inefficient, often cumbersome in operation and apt to break easily. In these circumstances, the introduction of better designed and sturdier equipment, would undoubtedly prove to be of substantial benefit to small-holders.

Fortunately, many different types, models and designs of "improved" animal drawn implements are already, widely used in many countries. It should be possible therefore, to select a range of these improved machines for eventual use in Pakistan. Limited numbers of such implements could be imported and field tested, in the first instance, after which machines that give positive test results, could be considered for local manufacture.

Whatever equipment is finally selected for local production, each of the "improved" implements would have to be superior to the traditional machines in terms of, depth, width and speed of tillage as well as operational manouvreability. Being manufactured on an industrial basis rather than made up by artisan blacksmiths, the improved implements should be of more uniform quality, being made from better materials and should therefore, have a longer working life.

Some examples of the type of improved implements, which could be considered for eventual local manufacture, are as follows:

a) Mouldboard plough - single furrow 8" or IO" weighing approximately 38 Kg; with forged beam and frog, hot formed heat treated mouldboard share and landside plus cast wheel and mild steel frame.

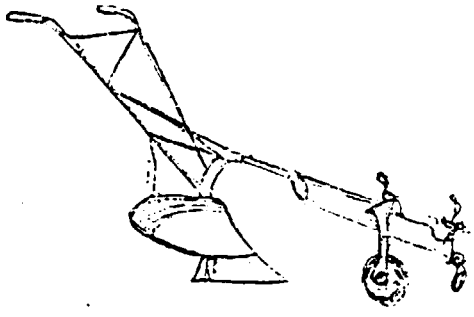
b) Spike tooth harrow - triangle or diamond type; consists of forged teeth and mild steel frame, average weight 2I Kg per section.

c) Row crop planters - single row, horizontal plate type with fertilizer attachment - for maize, cotton beans etc., weight 50 Kg; with mild steel frame, forged openers, cast bearings gears and seed metering parts.

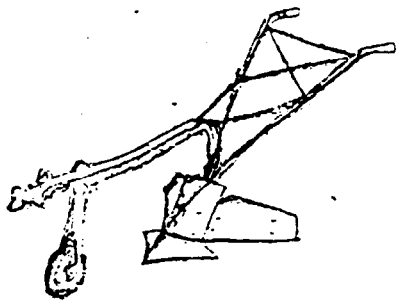
d) Inter row cultivator - single row, weighing 44 Kg; 5 tines with reversible points, 2 hilling blades - swept. The tines are forged, ground working parts,hot-formed heat treated high carbon steel.

Implements of the above type are manufactured by Massey Ferguson Limited in Africa, where these improved designs are widely used.

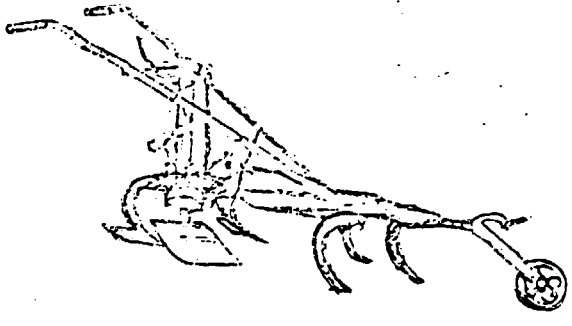
The following diagrams illustrate the basic simplicity of this equipment and its parts. All the implements mentioned with the exception of the harrows, consist of a common mild steel frame on which the various attachments are mounted. The equipment is easy to assemble from to a large extent common parts, thereby keeping production costs to a minimum. This allows selling prices to be kept low enough to be within the purchasing capacity of even small-holders, carrying on subsistance type agriculture.



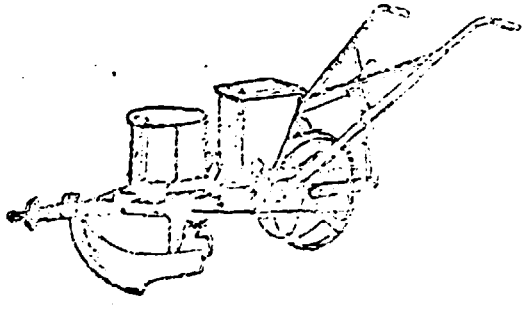
Mouldboard Plough



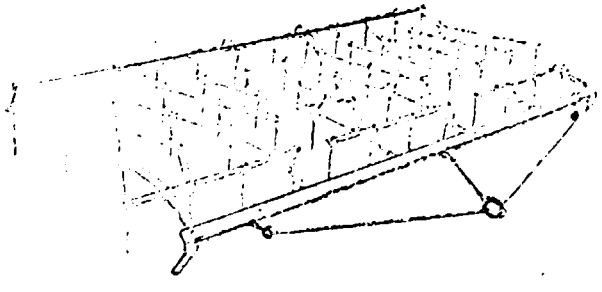
Ridger



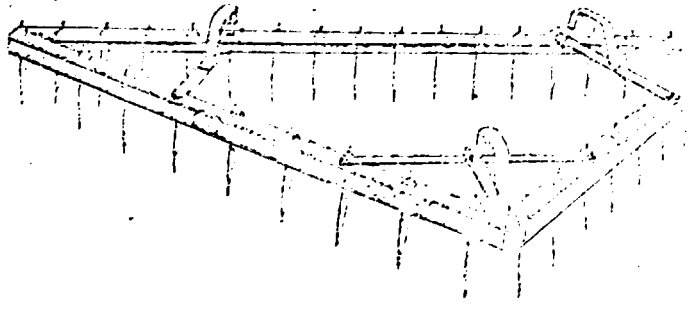
Inter Row Cultivator



Single Row Planter

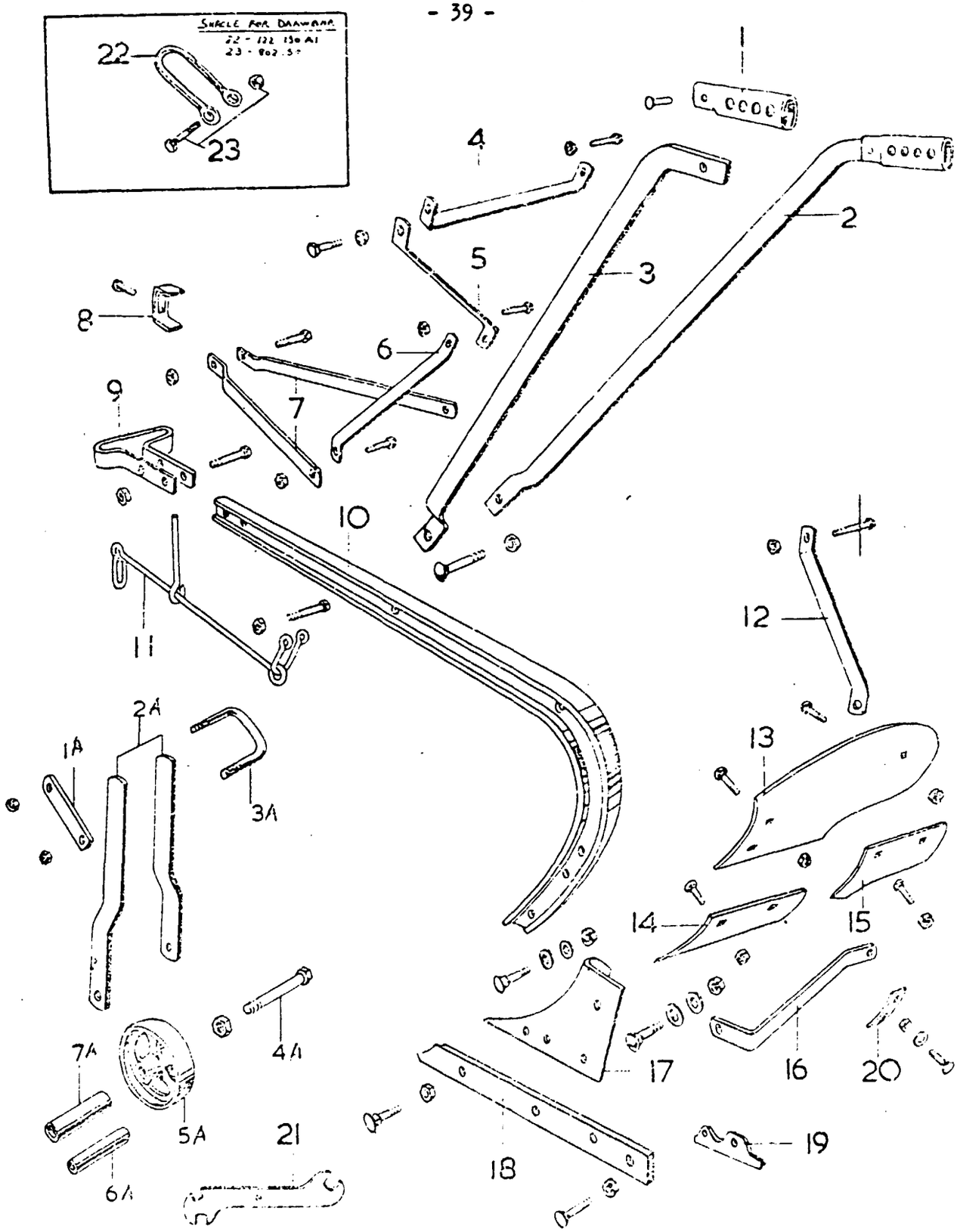


Seed [illegible] Harrow



[illegible] Tooth Cultivator

Fig. [illegible] Power Take-off



MOULD BOARD PLOUGH COMPONENTS

4.3 TRACTORS

Up to very recently, the total annual demand for tractors was met by imports. The slow but steady growth in the demand for all types of tractors, together with the unabated inflationary rise in their unit prices, has exerted increasing pressure on the limited availability of foreign exchange. Mounting pressure on scarce and valuable resources, led to the decision to encourage the local assembly of wheeled agricultural tractors.

To-date, four companies have been authorized to assemble a total of some fourty thousend tractors per annum. Of these, two of the companies are in the public sector, while the other two are private. The companies concerned are; Millat Tractors Ltd., Fecto Pakistan Ltd., Associated Agencies Ltd. and Pakistan Tractor Corporation.

a) MILLAT TRACTORS LTD. - This is a public company situated in Lahore. It assembles Massey Ferguson tractors from C.K.D. packs in a new well equipped factory. Its current output consists of two models; the MF 135 and MF 240. The company has been allowed to produce up to 10,000 units per annum, although the factory capacity is in excess of this figure. At present, output is limited to some 6,000 units per annum and contains a 30% local content. The eventual target for local content is 85%, once the local parts suppliers have reached a sufficiently high standard

of quality and continuity of supply. The programme includes the progressive deletion of imported diesel engines with increasing substitution by locally manufactured parts. At present the plant has no machining facilities, but plans for the construction of a production shop for the machining of engine components are already well advanced. The company also imports a range of agricultural implements among which, tractor drawn combine harvesters are the latest and most sophisticated machines to be introduced. For this purpose Millat Tractors Ltd., conduct a training scheme to acquaint farmers with new types of equipment and to instruct them in its proper use.

b) PAKISTAN TRACTOR CORPORATION

This is a state owned company located in Karachi,which assembles Fiat Tractors from C.K.D. packs in the old Mack Truck plant. This is a temporary arrangement as assembly is due to be moved to a new plant, that is currently under construction at Multan. Current production is of the order of some 30 tractors per day, that is approximately 7,500 units per annum. The company has however, an eventual target output of 10,000 tractors per annum. At present, only some 11% of the totol value of these tractors are made up of locally manufactured parts. Further deletion is planned, as soon as reliable local supplies can be guaranteed.

c) ASSOCIATED INDUSTRIES LIMITED

This is a private company, which is assembling tractors from C.K.D. packs in collaboration with IMT of Yugoslavia. Their new assembly plant located in Lahore was inaugurated on the 20th of April I982. This plant has began to assemble IMT-540 tractors fitted with a 52.5 horse-power diesel engine. It is planned to achieve 27% local content within twelve months and eventual deletion of 85% of imported parts within 5 years. This is a very ambitious programme in view of the low levels of output envisaged, starting from 3,000 units in I982 and rising to some I0,000 tractors by I987. The initial target of 27% is quite feasible in view of the fact that the IMT-540 tractor is based on the Massey Ferguson MF-35 model. As such, it has a lot of common parts with the MF-I35 assembled by Millat Tractors Ltd., which is the updated version of the old MF-35. Associated Industries Ltd., can therefore take full advantage of the already existing deletion programme for the Massey Ferguson tractors, by using the same local already approved parts suppliers. The stepping up of the deletion plan to higher percentages of local content wiil however, be far more difficult, costly and time consuming. The achievement of 85% local content by I987 is therefore, most unlikely.

d) FECTO BELARUS TRACTORS LIMITED

This is another privately owned tractor assembly company based in Lahore. Its assembly plant is currently under construction and it is planned to start assembly by the end of 1982 or the beginning of 1983. At 60.5 horse-power the Belarus tractor is the heaviest unit to be assembled in Pakistan. It is planned to build up the assembly of this Russian designed tractor to some 10,000 units per annum. Starting with 100% C.K.D. parts assembly, progressive deletion of imported parts is envisaged once local supplies become available.

The annual production capacity of the four tractor assembly plants will be in excess of 40,000 units by the beginning of 1983. At the same time, annual sales of locally assembled tractors is likely to grow from some 20,000 units in 1982 to approximately 30,000 units in 1987. This demand gap implies a considerable degree of unused capacity, which will have a detrimental effect on the operating efficiency of the assembly plants and tend to raise the unit costs of production.

Pressure on costs and therefore on tractor selling prices will increase proportionally, with the increased use of locally produced parts. Local parts suppliers, forced to operate short production runs,

will be unable to produce increasingly more sophisticated components, at costs that can match the prices of equivalent imported parts. The relatively low volumes of components required for each tractor model, will ensure that local producers of such parts, remain permanently at a cost/price disadvantage compared with international mass producers. This will inevitably push up the price of locally assembled tractors, a tendency that will become more pronounced with the intensification of the local parts manufacturing programme.

A crucial factor affecting the establishment of a viable local components industry is product quality and reliability. This requires the aquisition of a considerable degree of technical know-how. Most of the existing parts manufacturers require considerable assistance with raw material selection, production processes, quality control and the strict adherance to specifications and tolerances. This requires a far more disciplined approach to manufacturing, which can best be achieved through a joint venture or technical co-operation agreement with a foreign component producer.

Even if local tractor assemblers can maintain reasonable prices and quality, their ability to increase their sales volume will be determined to a large extent, by their distribution network. In most cases the existing dealers are too few in numbers, cover only parts of the country and offer inadequate after sales service.

Unless these inadequacies can be overcome, their impact on the spread of farm mechanization will be negative. A more widespread and effective use of tractors in agriculture will be difficult to achieve in the absence of an efficient distributor/dealer network.

Taking into account the size and limited income of the majority of farms in Pakistan, it is surprising to find a tractor population of some 130,000 units. The sale of such a substantial number of units could not have occured without the existance of financial facilities and generous credit terms. Such loans furnished by the Agricultural Development Bank and similar institutions, have enabled many farmers to purchase tractors on deferred payment credit, which they would otherwise not have been able to afford.

4.4 TRACTOR DRAWN IMPLEMENTS

With some four hundred, mainly small scale manufacturers, producing this type of equipment in the country, there is a more than adequate supply in terms of volume. Considerable underutilised production capacity exists throughout the industry, which is being added to daily by newcommers to the industry.

This glut in the number of tractor drawn implement producers, has been encouraged to develop by government tax concessions and other incentives. The vast majority of the companies, are small, poorly equiped,badly managed and produce poor quality equipment. Since the manufacture of simple implements requires relatively little in terms of capital investment, many of these small companies have been set up by people who have little knowledge of manufacturing or farming.

In these circumstances, most so called implement manufacturers can not be expected to produce good quality equipment, as they are merely poor copiers of imported machines. Lacking technical know-how and adequate manufacturing facilities, their products are generally badly made and liable to easy breakage. Unable to copy exactly due to the lack of certain components, they make do with whatever is available, thereby often changing and weakening critical parts of their products.

The lack of proper equipment and especially the general absence of power shears and bending presses, forces manufacturers to cut and bend material manually. This is done without any technical supervision by mainly illiterate, semiskilled workers, resulting in at best, very variable product quality. Furthermore, the standard of welding and even painting are generally of poor quality.

Even more serious for the durability in use of locally produced implements, is the lack of heat treatment facilities. This, together with the tendency to always use the cheapest and often inappropriate materials, makes the manufacture of good quality implements virtually impossible.

The local manufacturers preoccupation with the achievement of the lowest possible material costs, inevitably leads to the purchase and use of the cheapest mild steels available in the market, for the production of components which should be made from special steels. This tendency is further reinforced by the fact that the supply of special steels is limited, being 100% imported, as there is no reliable local source of this type of material.

Even the mild steel currently produced is of variable quality. This is largely due to the fact that the raw material used by local steel makers consists of scrap, originating mainly from ship-breaking. In the absence of proper scrap sorting, the composition of the finished

product, is inevitably variable and can therefore not be guaranteed to conform to specifications. The quality of locally produced mild steel at least, will improve once the Pakistan Steel rolling mill which is currently under construction, comes on stream. This new facility will however, have no effect on the local supply of special steels, as the production of these products is not envisaged within the scope of this project.

Apart from the lack of good quality locally produced mild steel, that is sheet and bars, good quality of castings and forgings are also in short supply. Forged beams to carry plough shares are a particular problem in this respect. Due to this problem implement manufacturers fabricate beams by welding and bolting, a practice which not only weakens the structure, but at the same time makes the plough heavier than it should be.

In these circumstances, it is realy not surprising that the impact of tractor drawn implements on the agriculture of Pakistan has so far been only moderate. Given the high cost of imported equipment and the poor quality of locally produced copies, the majority of farmers have been unwilling to invest their limited resources in this type of machinery. For these reasons, only a limited number of the most essential types of tractor drawn implements, have so far gained general acceptance and of these, only a few, are in widespread use.

For different reasons, cultivators, threshers and tractor trailers constitute the most widely used equipment of local manufacture. As their construction is relatively simpler than many other types of implements, many more companies have taken up their manufacture, thereby making them available throughout the country. This is important in view of the fact that most producers are very small and as such, tend to serve a very limited market in the immediate vicinity of manufacturing plants. Less commonly made implements, such as mould board ploughs, disc ploughs, disc harrows, planters, etc., are only available in certain parts of the country, thereby restricting their market penetration.

Scraper or levelling blades are the only other tractor mounted attachment, which has attained widespread use. In irrigated areas it is an essential toolin surface water flow management. Levelling blades, together with tube wells, form the essence of mechanized irrigation in Pakistan. Most tube wells are however, driven by old-fashioned slow-speed diesel engines, of heavy design and poor fuel economy. There is therefore, a need to have locally made small high speed diesel engines, for this widespread and important application.

Good quality tractor drawn implements could be produced in Pakistan, as the basic industrial infrastructure to support such an industry already exists. To do so however, will require a restructuring of the implement industry. The number of very small marginal producers would have to be

climinated, so that the remaining producers could be guaranteed a sufficiently large share of the market, to make investment in proper tooling worthwhile and profitable. The availability of special steels will also have to be improved, so that the appropriate raw materials can be utilized.

The overriding requirement however is the education of the farming community in the proper use of implements. Without this, no sustained progress in farm mechanization can take place. Farmers must be made aware of not only the operation and special uses of different implements, but also shown the advantages of buying good quality, instead of the cheapest equipment.