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SERVICE AND MAINTENANCE PROBLEMS OF AGRICULTURAL MACHINERY IN DEVELOPING COUNTRIES[1]

by

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FOREWORD

Agriculture and its problems have always received the most careful attention by FIAT. Perhaps, this fact is known, but the point deserves further consideration. One among the first to start large scale manufacturing of tractors, now FIAT production accounts for almost 1/10th of the world demand, excluding the Eastern countries. Also, FIAT has acquired a considerable experience in the agricultural conditions of the DCs through export operations as well as industrial joint-ventures and cooperation in tractor manufacturing, farm mechanization projects, and important land reclamations and civil engineering work.

It is because of these highly diversified activities preliminary to agricultural production and, particularly, for its availability in examining, planning and bringing to practical solutions the questions and problems of the DCs in the specialized sector of tractor Service, that FIAT has built up a diversified experience in the field.

Organization, based upon measurements and technical resources, is the supporting structure of the modernization plans. And we can see everywhere, with no exception, that the sector of agriculture lags well behind all others in the mechanization process.

The fact that, still recently, this technological gap has reached its highest point right in the industrialized economic systems, proves that the penetration of farm mechanization in the DCs, in the way it is proposed by the major problems of those societies, is a really difficult operation. This is true even when, as it often happens, at an early stage the operation is limited to tractors for farming and trucks for the transportation of the agricultural products to commercial outlets.

The resistance that agriculture opposes to the "penetration by the machine" is only a facet of the problem examined in this meeting. Certainly, we should not conceal from the DCs the fact that their retard in agricultural mechanization is not the most important sign of the difficulty of mechanizing the agricultural production. We can see these signs in Europe, and particularly in the OEEC countries, where farm mechanization, even before being brought to completion, has aroused some problems which are even more seriours than the ones solved. So, it is now essential to devise agricultural patterns suitable to the new production systems which, for the most part, are a consequence of mechanization.

These two difficult aspects of farm mechanization, which are predominantly of a "social" character, are at the origins of the problems we are going to examine which are mostly of a "technical" character.

Let it be clear that considering them does not imply putting under discussion the usefulness of farm mechanization in the DCs. The usefulness of it, though with the necessary differences, due to varying local conditions, is now universally recognised and has become part of an increasingly growing number of economic schemes drafted by many nations, or, at least, of regional land reclamation projects.

The current opinion is that a qualitative appraisal of the development of a DC mostly depends upon the proportion of the overall value of progress which is determined by the choices and achievements made in that country.

Once this line of thought is accepted, we must also recognize that, within these systems, the modernization of agriculture, a field in which most choices and achievements are carried out, represents the most significant index of progress.

Considering that, even in the less industrialized areas, the progress of agriculture in the 70's seems to depend upon a certain degree of mechanization, the time has come to improve our knowledge of conditions which favour this take-off.

Among these conditions, the reliability of service for the machines and equipment is of fundamental importance.

This reliability is the result of an operation which, in many of the cases considered, is to be appraised -under its financial and economic aspects- as well as a cultural investment.

THE MAIN PROBLEMS

FRAMEWORK OF THE PROBLEMS CONSIDERED

common motivations in the less industrialized countries

The farm mechanization process in the DCs differs substantially from the one of the most industrialized countries. While in the latter only at the end of the mechanization process the farm tractor has drawn to the country the earthmoving machines for creating the necessary structural conditions suitable to large scale power farming, in the DCs, usually, the earthmoving machine is the starting tool which is required to establish the conditions for the gradual development of farm mechanization.

In fact, while in Europe, up to recent times, mechanized farming consisted mainly in using the farm tractor and its implements, in the developing countries, the introduction of mechanized farming requires, at the starting stage, a more inclusive supply of machines and equipment, i.e., earthmoving machines, logistic vehicles (off-the-road vehicles for technicians and trucks for the transportation of the increased farm produce to the commercial outlets).

Therefore, in the DCs, the problems involved in setting up a satisfactory service organization are often complex because of several reasons, three being the major ones.

- The machines that the service organization is called to maintain efficient are more comprehensive because, apart from the actual cultivation of land, it must be considered the reclamation of land itself (construction and improvement of roads, irrigation projects, terracing) and transportation.

- Usually, the changes which are brought to the rural areas by the introduction of this set up, are of radical nature.
  The employment of operators and of maintenance and service personnel calls for vocational training and specialization courses. When the service organization is starting out, the local resources in terms of maintenance and repair equipment and facilities are generally scarce.
  Sometimes, the scheme must be started from scratch, other times a great deal of persevering and hard work is required to coordinate the existing resources.

- The incidence of an agricultural-rural mechanization scheme, under the conditions considered, is often dramatized by the limited financial resources and technical know-how. Consequently, when the time comes to bring the service scheme to a practical solution, the planners face bureaucratic difficulties which stem from considerations involving the entire program.

In fact, the service organization scheme is only a part of a more comprehensive agricultural plan and as such it is subject to controls by several public bodies.

Opposite this hold-back action, deriving from the general problems involved, there is usually a compensating and stimulating factor. It is now universally recognized -both in the DCs and in the industrialized countries aiding their agriculture- that the functions of service have positive effects on the public programs of modernization of less advanced areas, both as to the social context and in building the infrastructures and giving a new order to the territory.

This being the common platform on which the local technical problems of the DCs take place, such problems are to be brought to practical solutions by the international corporations with the cooperation of government planners and sometimes of international agencies responsible for bringing economic aid and technical advice to the less advanced agricultural areas.

An analysis of problems and technical solutions which appear in the projects for large scale,

indipendent service organizations, normally leads the public authority that has made the request to appraise the cost of the service set up under two points of view, and precisely, as the cost of an economic factor (direct function of service) and as the cost of a structural factor (indirect function of service).

The hope is that the growing presence of these two potential values within the framework of the farm mechanization scheme will draw a greater attention on the part of the international agencies responsible for financing the development of agricultural areas of the DCs.

COMMON OBJECTIVES OF THE PROBLEMS CONSIDERED

Two main objectives: proper use of machines and diversified skills.

== Service as an economic factor

Two cost proportions must be considered :

i) incidence upon the mechanized farm operation costs;

ii) incidence upon the overall cost of the farm mechanization project.

i) Incidence upon the mechanized farm operation costs

This is the more immediate appraisal, though not necessarily the more significant one, particularly where the service is part of a long range public scheme intended to get over a traditional type of social and economic order. Let us now consider the operating cost for a new farm tractor under the favorable conditions existing in the industrialized countries. Assuming a standard operation of 10 thousand working hours, the cost of operation will amount to 2,5 times the initial cost of the tractor, approximately. This operating cost of the tractor includes the following items : 1/2 for depreciation and capital interests; 1/4 for repairs; 1/4 for maintenance (fuel, lubricants, etc.).

There is no reason why the same cost scheme should not apply to DCs, provided that Service is run efficiently except for some particular conditions, for instance : price-setting policies for fuels and lubricants; centralized maintenance operation to make up for lack of skill on the part of the tractor driving crews; tractors scattered over a wide territory and, consequently, higher transportation costs for fuels and lubricants; difficulty in getting skilled personnel.

Therefore, under normal operating conditions, the service set up accounts for a share (repairs and maintenance) of the mechanized farm operation cost, for the tractor, amounting to about 1/2 of the total operating cost. It can be readily seen that under abnormal operating conditions (service set up badly organized or too small a number of tractors) the proportion of the cost absorbed by service is greater and, under extreme cases, may reach yearly values approaching half the expenditure made to acquire the tractor.

This explain why, even now, it is not uncommon to find, in some of the DCs, unfavorable service conditions, so that tractors are scrapped before undergoing their major overhaul. These are the cases in which the mechanization of the land was started improperly, with no consideration given to the necessity of acquiring, within a reasonable period of time, a tractor fleet of a size corresponding to the threshold dimension for an efficient service organization.

ii) Incidence on the overall cost of the farm mechanization program

Let us continue to consider the typical case of the wheeled farm tractor. In fact, this is the type of unit which stands out as the basic machine of the power farming equipment. Also, it absorbes the highest

share of service costs excluding the particular case of the crawler tractor as it works many more hours per year than any other single machine.

Further on, more details will be given regarding the organization cost of service operating under standard condition. Now let us consider the setting up of an autonomous service organization largely extended over a country which can be assumed as "the basic module" of any well conceived farm mechanization plan. This fleet -to be achieved during a certain number of years- can be indicated as follows : 1000 tractors with implements, a small proportion employed in earth-moving job applications, plus 500 lorries and off-the-road vehicles; the whole fleet scattered over a number of separate localities requires:

- a considerable expenditure in relation to the capital invested to acquire the farm machines

- an even bigger expenditure in relation to the annual cost of depreciation + capital interests.

Therefore, under these particular conditions:

<u>capital investment expenditure</u> may approach the shipment price of machinery

operation cost may approach the shipment price of machinery but with a limited currency outlay. In fact, 4/5ths of the cost are absorbed by the wages paid to the service personnel while attending basic vocational training or specialization courses during the early phase of operation.

The big difference of cost for service organization under the two extreme conditions considered -that of an organization comparable to those operating in industrialized countries and that of an independent organization started anew on a sizable national scale- gives the measure of the importance which is to be attributed to the service set up scheme. In fact the difference in cost is in the proportion of 1 to 10.

Thus, it can be clearly seen the convenience for the DCs to secure international cooperation in order to avoid the easier, but more costly solution of an independent service set up. Whenever possible, and under all points of view, it is preferable to adopt the solution -though certainly more painstaking- of exploiting the resources already existing in the country, though highly dispersed, integrating and coordinating them within the agricultural scheme.

-- Service as a structural factor

In this case, instead of examining cost proportions as in the previous alternative, we shall

compare the relationnship existing between the direct technical effects of service and indirect ones :

i) skill diversification
ii) building the infrastructures.

i) Skill diversification

The operation of an effective agricultural service organization involves the employment of workers, technicians and executives with highly specialized skills in economic sectors which the DCs have every interest to strergthen. The manpower employed by an effective service organization -and precisely, caring for the basic fleet of machines including 1000 tractors with implements, etc.- depending upon the organizational solution adopted, may vary from 200 to over 500 persons, excluding tractor drivers. Thus, manpower skills, highly valuable for a weak economy are created since the early stage of operation.

The attention that this function of service deserves on the part of the planners is motivated not only by the size of manpower skills it creates, but even more by the effectiveness with which the service set up spreads the know-how over the interior of the country and over areas which are remote from the main lines of traffic.

In particular, if cooperation by international corporation is expected for transferring the necessary know-how, this side contribution promoted by the service organization is certainly important during the phase of economic take-off; it represents a direct contribution to a cultural investment in the educational field.

ii) Building the infrastructures on the territory considered

The value of this other side function of service is similar to that of skill diversification. This asset combined with gradual increment of farm machinery may well create the starting platform for new private enterprise in various collateral field such as services, craft, small industrial concerns, all of them spreading over peripheral localities and therefore particularly interesting.

In conclusion, it should be mentioned the contribution which the planning of a specialized organization for service, meeting the minimum size requirements considered, can secure -through international cooperation- to the land reclamation projects, to the modernization of small shops and transportation facilities and to the creation, in remote areas, of a sort of a pre-industrialization stage.

DIFFERENT SOLUTIONS

ways of introducing agricultural machinery and equipment and relevant service costs

Often, in the DCs, two different patterns of agriculture co-exist : a self-contained type consisting of large plantations, often provided with a considerable supply of mechanized equipment; another one, which is of basic importance for the social structure of the country, having the traditional type of organization and, consequently, with pratically no mechanized equipment. Between the two, in recent times, and growing at a progressive rates, a third kind of agricultural structure is born created through regional agricultural programs or through more important land reform projects.

During the later years, the agricultural sector, within the economic development schemes of the DCs, has become more and more important,and, of course, farm mechanization plans have followed along the same line. However there still exist some areas , with a predominantly rural type of life -particularly in Asia and Africa- where farm mechanization has been ruled out as a possible mean of promoting progress.

Under these conditions, the introduction of tractors and equipment in the DCs follows different schemes, at one end of which is the manufacturing industry and, on the other : a privately owned dealership, or a public agency, or the government as a direct importer or as a partner in a manufacturing joint venture.

To these considerably different conditions of the ways and means of supply and distribution of farm tractor equipment (sometimes a manufacturer is present in the same country through two or more of these schemes), correspond different management policies and development outlooks for the service organization.

The experience of the last decade, when the major preoccupations in the DCs were mainly focused on industrial development, has often been unfavourable to the more important operations, those included within the framework of general schemes, and negotiated by government agencies under conditions which, as already pointed out, were particularly difficult.

Going through the experience acquired by FIAT, one notices that in the sphere of initiatives negotiated by public agencies it still happens frequently that, initially, requests are made for costly independent service organizations, to fall then back on minimum size solutions which are inadequate to secure acceptable maintenance standard for the machines and the equipment . The main reason for the slow penetration of farm mechanization, at least in the DCs having an extensive agricultural base, is the inherent weakness of agricultural planning; the second reason is the inadequacy of service, resulting in job applications and operation of the machinery which still frequently leads to stagnation or regression of mechanization. Progress has been greater where governments

have encouraged the private enterprise, reduced the red tape, stimulated competition and used individual initiative to advantage.

To proportionate even roughly the basic elements of a tractor service (i.e. manpower, area, spare parts service, logistic vehicles) we enclose the charts which have been taken from the technical manuals used for the specialization courses held by FIAT in Turin.

During the last few years, in conjunction with the greater interest for the weak agricultural systems shown by the Western countries and the United Nations, the outlook for an extensive use of farm tractors in the DCs, appears to be gradually consolidated in Asia. Now, signs seem to justifie a certain optimism. At this stage the DCs should formulate more realistically their requests of international cooperation for the setting up or the improvement of agricultural services.

These charts put in evidence the attention paid to this kind of information in programming the courses for the technical personnel. The impression of uniformity of the organizational solutions and of the costs that may be deduced from the diagrams is misleading. In fact, when drafting the final project, due account must be taken of the resources -frequently already existing- in the country and not yet full exploited.

In Italy, for example, over 8/10ths of the tractor repair and overhauling work is carried out by small workshops generally hiring much less than 20 workers (limit for a handicraft activity). The great majority of these shops handles both motorcar and tractor jobs.

As to the setting up and operating costs involved for the service organization, the factor that mainly causes the large differencies in value is the way the equipment is introduced into the country: this may vary from the strengthening of the service facilities available by a pre-existing local dealer to the setting up of a new organization managed by some public agency.

Within the wide range of intermediate solutions and local conditions, the problems, that the service organization is called to face, fall under two basic operating conditions, with different cost levels :

i) countries with a relatively important market of vehicles and machines (in this case, the availability of other mechanical resources makes the organization of service easier);

ii) countries with a still limited market of vehicles and machines (in this case manpower is difficult to find and the necessity to run a practically independent organization will increase the costs of the operation).

Under the ii) condition -still limited market- the setting up or the improvement of a service organization, at an acceptable standard, is practically always an emergency operation, in which case external financial support is needed; the financial support granted by the manufactures on a goodwill basis becomes less and less sufficient.

It should be held in mind that, when setting up a new independent service organization on a basic structure of 1000 tractors, the relevant expenditure -which may reach the same value of the capital outlay for acquiring the machinery and equipment- has clearly not to be considered as a normal investment. Every successive increase of the service for a fleet of two or more basic modules (2000 tractors, etc.)will require a small fraction of the initial capital outlay only.

So, public financing is necessary, and we have shown why. For a number of reasons not related to the farm mechanization scheme, this support is justified and desirable. One disadvantage is that, in the DCs, public aid is often delayed and sometimes it happens that bureaucratic bodies which are usually characterized by scarce know-how and high costs take over the distribution and service operation of the machines.

Summarizing, in a plan for agricultural mechanization , the expenditure required to secure an adequate service for the first lot of one thousand tractors, etc., may vary from 1/10th of the capital investment for machinery (this in case of local distributor already running a sound business) to a maximum expense oorresponding to the full capital investment allocated for the machines.

The cost of alternative solutions, in case of intervention of a public agency operating within the framework of a national development plan, justifies preliminary assessing, in looo, of existing resources and requirements and a careful study of the problems involved in strict cooperation with experts; this cooperation should be extended through the starting phase of service operation.

The choice of the appropriate solution should be favoured by the availability of multilateral aids specific for these preliminary tasks.
These aids should be proportioned to the indirect as well as direct benefits, apported by this modern tool of progress in the phase of economic take-off.

FINAL CONSIDERATIONS

The measure of the danger of the agricultural situation in the DCs is given by a recent statement issued by World Bank according to which "the date forecast for the beginning of local famines is the period 1975/80". In recent years, the countries of the Western world have been transferring to the agricultural sector increasing portions of the bilateral and multilateral aid to the DCs; Italy is among the 5 countries which supply about 9/10ths of the OECD's aid to the nations with a weak agriculture.

The 1968 survey made by the Development Aid Committee of the OECD has found that in the period 1962/66 the member countries have granted 3.3 thousand million dollars to weak agricultures, equal to 12 percent of the bilateral aid to the DCs.

The farm mechanization equipment fund plays a minor role in the financial aid program and, precisely, it accounts for 1/4th of the share (20 percent) allocated for supplying technical equipment.

As to the overall aid scheme -financial aid, technical assistance and equipment- agricultural machinery, starting from the late 60's, shows a 5 percent bigger share; during the 70's the rate of growth of the number of countries which will fall under the conditions justifying a farm mechanization scheme will certainly be accelerated.

Specially in those systems which are just starting to mechanize their agriculture, the problems of a service organization for agricultural machinery and equipment are a starting point for a subsequent diversification of the previous traditional rural structures.

It is therefore irrational, and consequently uneconomical, to challenge separatly the problems of an organization which ought to operate consistently in conjunction with an agricultural scheme, and, more generally, with the national economic plan.

The indications suggested by the previous findings may be summarized in two points :

i) Any plan to mechanize the agriculture of the DCs should be in accordance with the national economic program or, in absence of this, with the agricultural program. The problems concerning agricultural mechanization should be considered all at one time in order to make sure that they comply first of all with the agricultural program.

   The setting up of an effective service organization remains a difficult job until a continuity of the mechanization is secured.

ii) Aids to the weak agricultures require more technical

assistance than in the past (the diversification arising from the variety of problems subsequent to the modernization of agriculture is one main reason).
Therefore, both the bilateral and multilateral contributions should be increased and particular attention should be paid to the requirements of the planners assessing the starting positions and formulating plans of technical alternatives.
The aid to agriculture should go first of all to agricultural planning.

From these two points it follows that the aid-granting countries should start taking systematic committments to form in the DCs specialized technicians in :

i) farm mechanization planning
ii) management of farm machinery fleets (of cooperatives or of public agencies)
iii) service of agricultural machinery.

A United Nations body in Turin, Italy, the International Center of Advanced and Vocational Training of International Labour Organization -ILO- has programmed specific courses for these specializations, but up to the present time it has had no occasion for holding these courses.

The two remarks above, clearly of committing nature, have been proposed considering the even more binding comment released in the course of a UNESCO meeting in Rome in which it was found that: "..... illiteracy is increasing with investment in developing countries", it was proposed that "....costs of literacy training should be part of overall project financing, and that international banks and financial institutions should consider a requirement that all development projects in DCs have a budget for literacy training, including programs to operate prior to projects being launched. Tax incentives for firms that engage in literacy programs were also recommended."

Concluding, the problems here considered will find in future more satisfactory solutions to the degree in which private enterprises of industrial countries, together with bilateral and multilateral contributions, will find favourable grounds to start operations with the responsible executives of the DCs on a sound economic basis acceptable to any international financing agency.

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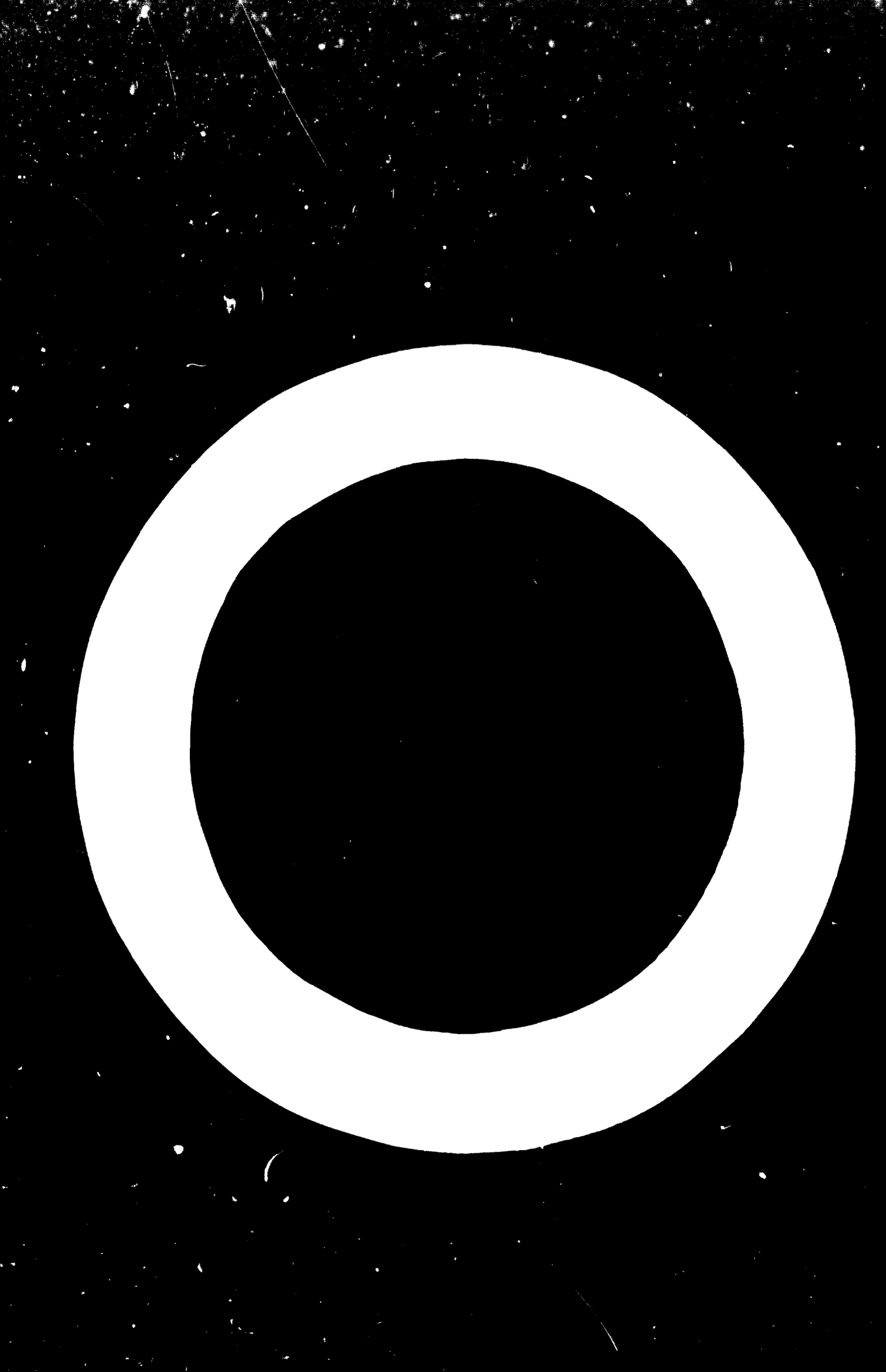
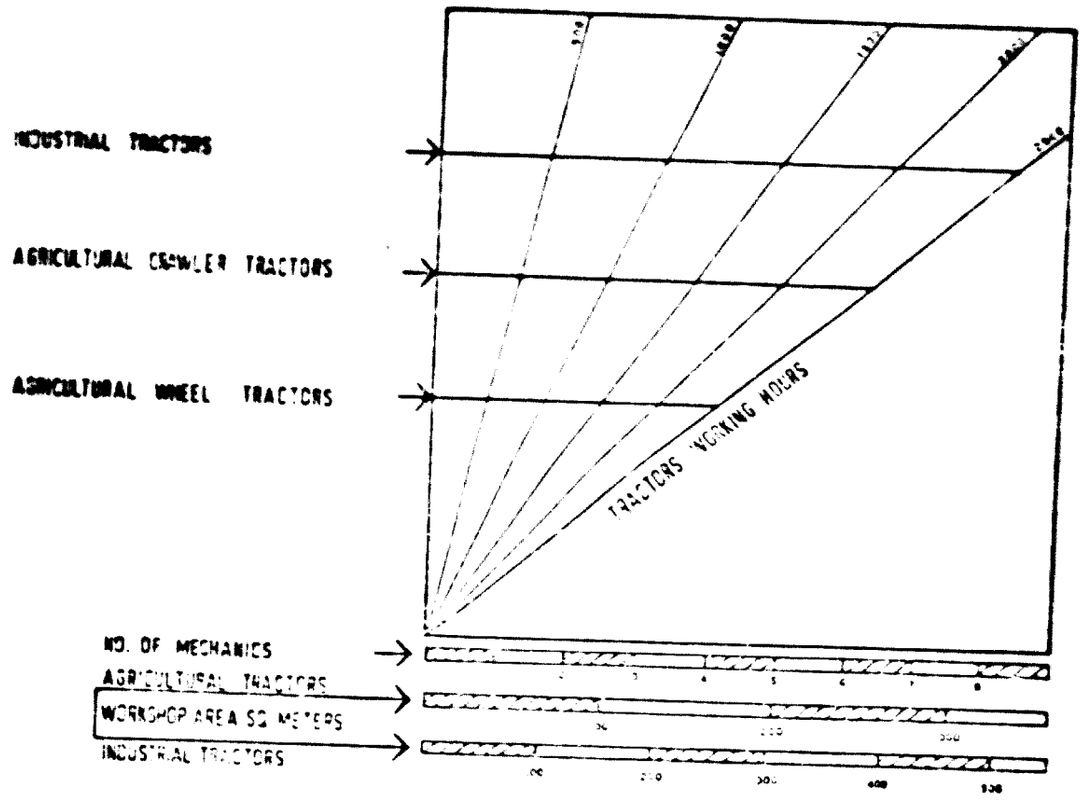
ANNEXE





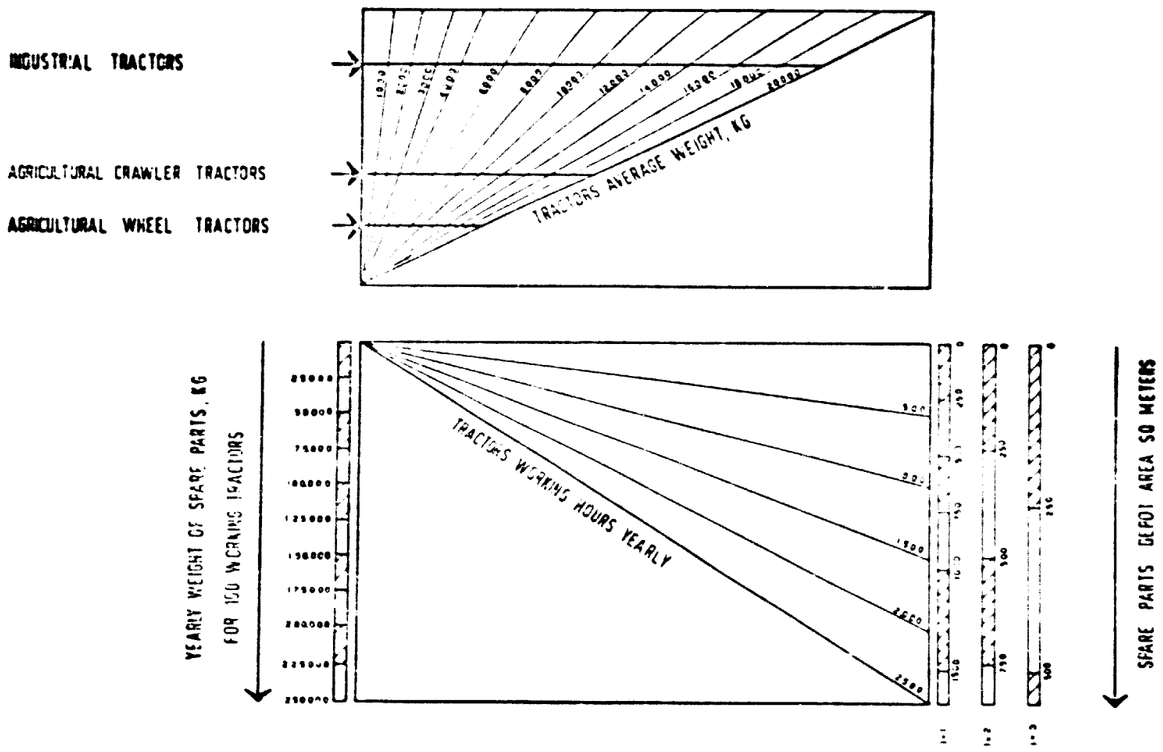
NOTE THE ABOVE DIAGRAM IS REFERRING TO 100 WORKING TRACTORS

Servizio Assistenza Tecnica

SPARE PARTS DEPOT DIAGRAM

UFFICIO ATTREZZATURE ED IMPIANTI

Annex
Page 2

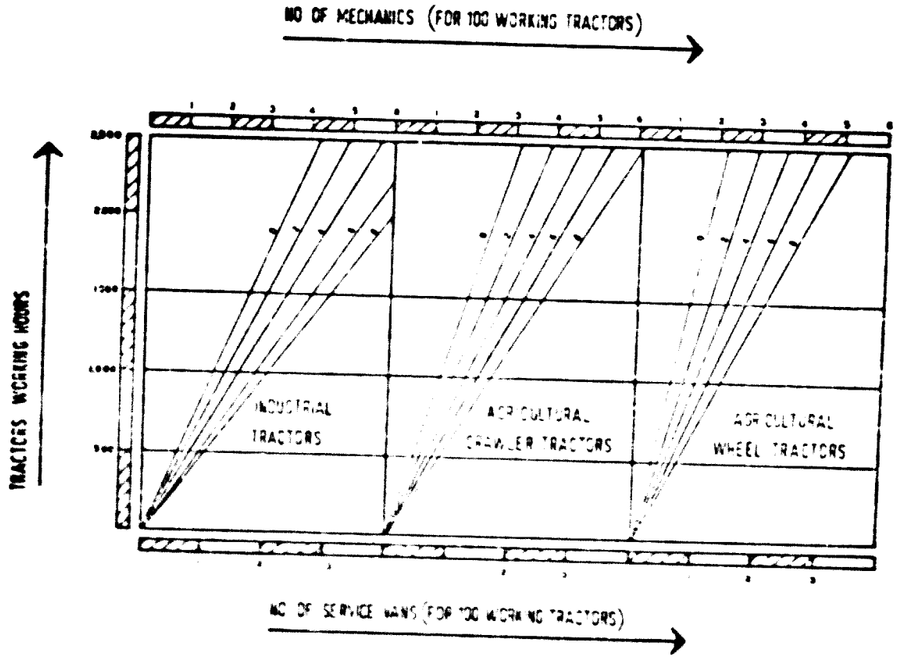


NOTE THE ABOVE DIAGRAM IS REFERRING TO 100 WORKING TRACTORS

Servizio Assistenza Tecnica

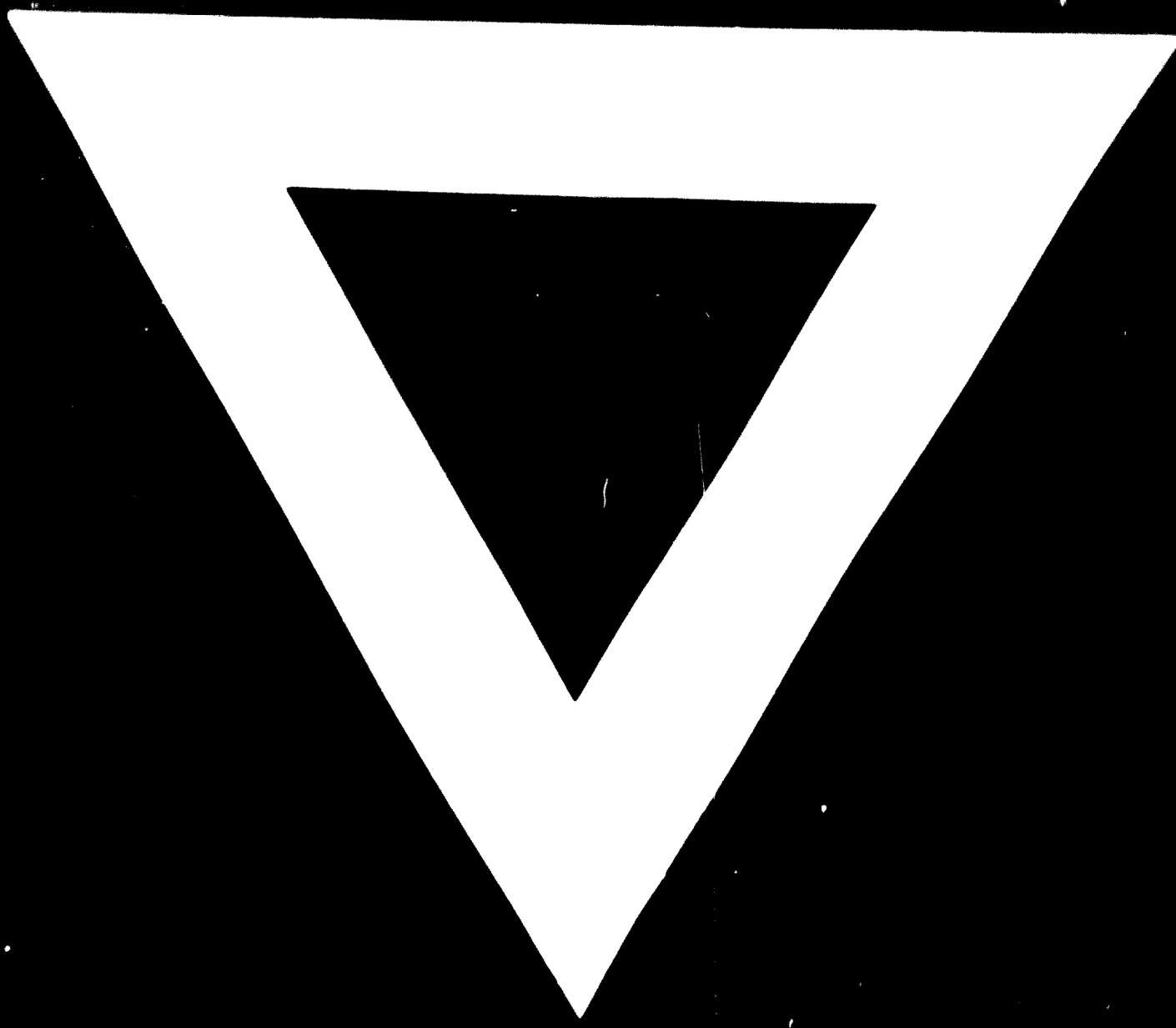
SERVICE VANS DIAGRAM

UFFICIO ATTREZZATURE ED IMPIANTI



NOTES
- 3 MECHANICS ARE NECESSARY EVERY 2 SERVICE VANS
- THE MECHANICS WORKING HOURS ON THE FIELD ARE 1/3 OF THE TOTAL WORKING HOURS
- EVERY 500 TRACTORS WORKING HOURS ONE INTERVENTION ON THE FIELD IS NECESSARY

Annex
Page 3



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