



GUIDELINE FOR 2WT BASED FARM MACHINERY HIRING SERVICES

Farm Mechanization and Conservation Agriculture for Sustainable Intensification

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1. Introduction

The technology of food and crop production has undergone increasingly rapid change in recent decades. In the industrialized countries, technology based on mechanical power and other advanced inputs has progressively made farming more capital-intensive. In the developing countries, however, this level of agricultural production technology has not been widely adopted and, where it has, results have been variable. Farms in the developing countries are normally small, often consist of fragmented plots and often have poor accessibility for mechanical equipment and the supply of other inputs. Most farmers do not have the capital nor the credit available, for the purchase of advanced power machinery. And where these investment constraints have been overcome, farmers are unable to use the advanced technology economically on the average small-farm unit.

Developing countries these days have a greater range of technological options when deciding upon the form and level of agricultural mechanization which is best suited to their development objectives and conditions. In the past, much of the mechanical-power technology introduced has not been technically or economically appropriate for individual ownership by small-scale farmers. Efforts were made to meet the needs and desires of these smaller farmers by scaling down the size of farm machinery. The most successful of these efforts has been the introduction of single-axle tractors or 2WTs (power tillers with matched implements and equipment for use especially in paddy production. Similar efforts to design equipment for upland and rain-fed farming situations is going on in an effort to replicate this experience.

The agricultural input-output value relationships in most countries of the world have reached a point where the cost of individual ownership and use of powered machinery and equipment on a single-farm unit has become prohibitive. For large-scale farmers it is increasingly difficult and for small scale farmers it is virtually impossible. The introduction of 2WTs and their accessories have provided a new set of mechanization options for smallholder farmers. Many of these farms are less than two hectares, consist of scattered fields or plots, and are relatively isolated from the infrastructure which has been built up in rural areas close to urban centres. The provision of mechanization hire services for 2WTs and their multifunctional use is one approach to make mechanization available to a larger proportion of farms and to help ensure that the capital investment in mechanization inputs is utilized as efficiently as possible. The case for hire services rests on the premise that it is a practical and realistic means of providing more technologically advanced systems of agricultural mechanization to farmers who:

- are constrained by limited farm size;
- have insufficient access to investment capital; and
- face seasonal fluctuations in labour and machinery requirements.

The problems which confront mechanization under small-farm conditions - particularly but not exclusively in the developing countries - constitute the specific background against which to assess experience to date. Even at the most technically sophisticated levels of commercial farming there is machinery and equipment available which offer returns to scale but which are economically unjustifiable for single-farm use. Since fixed costs per unit of work (mainly annual depreciation and interest) vary according to the amount of work done, whereas variable costs per unit (mainly fuel and wages) remain relatively constant, it follows that total operating costs to decrease with the number of hours worked. Hire services is an obvious way of increasing the annual utilization of machinery and equipment, provided that the potential reduction in costs per unit of work is not offset by high overhead costs of administration, failure to collect charges or, in many cases most important, by poor maintenance and idle running between farms.

Notwithstanding these potential advantages, there are noticeable challenges. The seasonal nature of agriculture whilst a major justification for machinery hiring services, the time of planting can be very critical and land preparation and tillage through hiring services can be difficult to achieve on an economic basis, especially where uni modal rainfall patterns exist. Labour and power requirements may be at a peak simultaneously on a large number of small farms and if acceptable levels of utilization (hours worked per annum) are to be achieved, not all of them can be cultivated at the optimal time. The difficulties are exacerbated where the majority of small farms in question are all growing a similar range of field crops and similar varieties. Where ecological and economic circumstances allow for more diversification in cropping patterns, this problem is less severe. Hire services also offer (indeed require) more highly skilled work. However, greater technical skill are needed, for example in adjusting equipment to a variety of conditions and in carrying out routine maintenance in the field, transporting equipment, fuel, etc. The provision of adequate training and incentives for operators is therefore of vital importance.

As a concept, the provision of hire services provides a practical opportunity to bring improved agricultural technology to a large number of small-scale farmers on a sound economic basis. Of particular concern in this guideline is how 2WT based technologies can best be made available to small-scale farmers. Many important lessons have been learned from the successes and failures of farm mechanization hire services over the past few decades for all types and ranges of farm machinery. This guideline aims at accumulating some of this information whilst providing lessons that could be applicable to 2WT service providers.

2. Organizational forms

Organizational forms of multi-farm use systems are many and varied. In a broad sense the forms divide into public and private sector categories but given the dismal record of public sector run tractorization schemes over the last five decades, private sector ventures have been seen to be the only way to proceed. Hiring schemes in the private sector can be conveniently divided into systems of individual ownership and systems of group ownership of machinery. In both forms of private led system, sound business management principles are crucial and they tend to be more evident than in the public sector systems. As a result, private sector led service provision is likely to be more financially viable whilst providing higher quality services than the farmer would receive from public sector systems.

2.1. Individual ownership

Informal sharing. Informal sharing among neighbours is a common occurrence among small groups of farmers who are well acquainted with one another. The principal motive of neighbourly assistance is based upon reciprocity in time of need, although in many communities social obligations often play a role.

Farmer contractors: Farmer contracting is probably the most common system of multi-farm use of machinery in the developing countries. The most widespread arrangement is where farmers use the surplus capacity of a tractor and associated equipment required for their own farming operations to cultivate or harvest the crops of neighbouring farmers at an agreed rate. Normally, this work is done when the farmer contractor has completed his own operations. The amount of work that the farmer contractor can undertake is generally restricted by the requirements of his own farming operations but as long as he gives timely and satisfactory service to his customers, without neglecting his own farming activities, it has potential to be an effective and efficient system.

Commercial contractors: Full-time commercial contractors are the main providers of contract services in most developed countries. In developing countries, large commercial contractors, whether individual or corporate, are still relatively rare. Where mechanical skills are not widely diffused, farmers who have learned how to undertake routine maintenance work or have the services of a trained mechanic to support their contracting operations may be in a better position to provide a reliable service than individual small farmers who have little or no experience of machinery maintenance. The full-time contractor differs from the farmer contractor in that his services are not constrained by the need to carry out his own farming operations first. Amongst other things, he may be able to develop a more comprehensive service which could involve the purchase of additional equipment such as trailers for transport and machinery for shelling/ milling

Mechanization hubs: Perhaps the most highly developed example of multi farm use of machinery based on individual ownership of equipment is the mechanization hub that provides a range of services as a one-stop-shop. The hub consists of a formal arrangement for pooling machinery with surplus capacity. There are very few mechanization hubs operating in Africa but the concept is catching on and is currently being developed by KENDAT in Kenya. Membership includes both farmers and contractors and the concept aims at developing an economic and cost efficient way to make full use of available machinery. Significant economies are expected to be achieved in the capital investment per hectare in machinery amongst the members, who may number from several hundred to a thousand or more. The basic principle is an extension of the informal sharing of equipment by small groups of farmers personally known to one another, to that of an organization employing a full-time manager with an office. Charges are expected to be fixed in advance by an executive committee. While the basic idea is simple, the potential exists for the hub to become progressively more sophisticated and efficient, relying primarily on a highly developed communication system and high levels of managerial skill. The existence of well-developed private sector repair and maintenance facilities for use by individual farmers also means that the hub is not obliged to complicate their activities by having to provide such services for their members. It is precisely these infrastructural assets which are lacking in many developing countries. The machinery and equipment would be made available for hire or renting with or without the operator depending on the level of sophistication in use. Other financial forms such as leasing can also be applied for an extended period up to the working life of the machine.

Corporations and partnerships: Other categories of group activity in the multi-farm use of machinery are corporations and partnerships (or associations) which are fairly common in developed countries, some of which have created legislation or regulations to facilitate their establishment and operation. Such arrangements can, however, be quite informal with a few partners who are close neighbours or relatives sharing the ownership and use of one or two specific items of equipment which can be easily moved between farms. Where the individual members are legal partners and therefore jointly liable for the debts, investment costs and work charges may be strictly shared according to the size of members' farms and their relative use of the corporation's assets.

2.2. Group ownership

Cooperatives: Cooperatives as a legal entity on a voluntary basis have historically been well established in agriculture in many parts of the world. In some countries machinery services are provided by multi-purpose cooperatives in conjunction with other inputs and services. In others, machinery services may be the only facility provided and the cooperative is established solely for that purpose. During the past five decades governments in many developing countries have taken it upon themselves to establish agricultural cooperatives. Due to the fact that this has been a government initiative the concept of voluntary membership and mutual interest of members has often been lost. In addition, government tends to invest substantial capital into the cooperative as the situation in Ethiopia will testify. It is also

common to find that these cooperatives are seen by the government as official instruments of development and are often used to administer government programmes, collect data and/or taxes and fees, channel subsidies to farmers and so on. As a result, many cooperatives cannot function as an economic system for mutual benefit of the small-scale farmers they were meant to serve. There is little difference between these types of cooperatives and government led enterprises. The record for the provision of farm machinery by cooperatives set up by government has generally not been successful, particularly in comparison to marketing and input supply cooperatives. In general, where farm machinery services have been grafted onto an existing multipurpose cooperative it is not unusual to find that the machinery service proves extremely difficult to manage. Staff motivation is often low and optimum levels of operational efficiency are rarely achieved.

Farmer groups: In some countries the establishment of farmer groups has been encouraged in order to provide access to machinery, particularly in areas where cooperatives have been unsuccessful. The usual arrangement is that a group of farmers in a single community pool their resources and purchase the required machinery, the title to which is vested in the group as a legal entity. The arrangement is rather more formal than the sharing system described earlier and as such may have advantages with respect to access to credit or supplies of fuel or other consumables but is smaller and less formal than a cooperative society. The groups use the machinery only amongst themselves with each farmer hiring and operating the machinery independently whilst taking responsibility for routine maintenance. In practice, however, this farmer-group system of machinery hiring has also been less successful. While it is easy to generate enthusiasm to form the group, and easy to provide support for the purchase of machinery, the problems of management, maintenance and repair are the same as for other systems of group ownership and these have not generally been overcome.

Service provider associations: During the promotion of multi-farm use of agricultural machinery and mechanization, organizations or associations of contractors and farmers can play a prominent part. At an early stage where these associations are lacking, the project together with public sector extension services have a role to play in supporting their establishment. A service provider/ contractor association fulfills a function as a forum to exchange ideas and experience, cooperate with farmers' organizations and with policy makers. Whether an organization should include contractors only or both contractors and farmers depends mainly on which type of contractor is concerned. At first, full time contractors will probably prefer their own organization, while farmers and farmer contractors may prefer theirs. The first step may well be an organization of full-time contractors.

Contractor's organizations can act as a useful instrument in the hands of extension services. Their members can be invited to meetings to exchange ideas and experience. Subjects of common interest could include: training of 2WT operators; provision of servicing facilities; supplying fuel, oil and spare parts; use of private machinery to extend the working season; introduction of new machines/equipment; service rates costing.

3. Organization and management

As stated earlier, the organizational requirements for the more simple systems of machinery multi-farm use are minimal. Informal sharing, small-scale farmer contractors, and small groups are informal systems organized around the needs and views of the individual owners of the machinery. As the size and scope of the hiring system increases, however, there is likely to be a need to consider an appropriate organizational structure.

The organizational structure of the machinery hire business will vary according to the size, scope and formality of its operations. Examples of more formal systems are the machinery rings found in developed countries and more specifically, KENDAT's mechanization hub. The overall structure should basically provide for three main functions:

- overall management and financial control;
- field operations; and
- machinery maintenance and repair.

The more formal structure could include a management section, a field operations section and a machinery maintenance section. The management section of the structure should be the focal point for planning, administration, finance, coordination and monitoring. The field operations section should be responsible for organizing and scheduling field operations and controlling the timing, quality of work and cost efficiency of their execution. The machinery maintenance and repair section could operate stationary and/or mobile workshops and would have overall responsibility for ensuring that machinery is in full operating condition when it is needed for field work. This section might also operate stores for spares, fuel and other operating supplies. In a large-scale system there may be an additional requirement for a training section as is proposed in the KENDAT mechanization hub. The overriding objective of the structure should be to provide a framework which will ensure that effective and efficient services are carried out. The field operations section would, therefore, be the focal point and all other sections are complementary.

3.1. Staff requirements

The key to success for any machinery hiring business is competent people to carry out all the functions for services provided. In the less formal business enterprises the requirement for organizing to meet staff needs will obviously be less than for more formal businesses. Nonetheless the capability of each person in the operation of the system will be critical and needs to be carefully planned for in the organizational phase of establishing the system.

In selecting staff members for any system it should be realized that the main purpose of the operation is the performance of the fieldwork and that the quality of this work should always be kept at a high level to ensure a long-term business operation. The responsibility for meeting this objective is in the hands of the manager. Consequently, his or her knowledge, experience and ability are of decisive importance in the success or failure of the enterprise. As a prime requirement, they must have a sound knowledge of, and experience in business management. The manager should be a good organizer and possess the relevant knowledge for the operation, management and repair of farm machinery together with a good knowledge of agriculture.

Similar qualifications will be required in the case of the manager of the field operations who will have to organize the field work, and instruct supervisors and operators on how the different jobs should be performed. Therefore, a special requisite is good knowledge and experience of farm machinery operations.

In order that the field operations section can carry out its duty efficiently it should be supported not only by field supervisors and operators but also by mechanics and storekeepers based in the main workshop and stores. This structure, however, is only likely to exist amongst the larger more corporate machinery hire service enterprises. For smaller scale businesses it will require collaboration and partnership with other supporting businesses. A so called 'service manager' will need to know how to carry out all the maintenance and repairs of the machinery owned by the service. In addition, the service manager will also have to teach his mechanics the maintenance and repair of the more

intricate machinery. Therefore, it is necessary to ensure that he has good technical training and experience.

Supervisors, foremen, operators and mechanics will have to be trained for their particular jobs, and in the initial stages this training may have to be provided entirely by the hire service. This is the purpose of the training section, the head of which should possess good knowledge and experience of both farm machinery and agriculture. The project manager and the managers of field operations and the base workshop should be available to contribute to the training, and in the early stages may have to undertake a considerable part of it. The staff who occupy the managerial posts of the hire service should be considered as permanent and may need to be employed on a contract basis. Other key personnel such as supervisors, mechanics, operators and storekeepers may also need to be employed on an annual basis. This is necessary to secure good staff and stability in the organization. It is important to consider carefully exactly how many people in this category are actually required. Experience from developed countries suggest that employment of extra operators on a seasonal basis is likely to be difficult and therefore it is important that operators and other staff employed on an annual basis should be prepared to undertake other jobs when they are not busy with seasonal work.

3.2. Repair and maintenance workshops and stores

Careful thought needs to be given to the role and scope of the workshop that is attached to hire service hub and to the servicing facilities available from the dealers and manufacturers. The establishment and running of a full-scale workshop capable of dealing with all major repairs and engine reconditioning is a costly undertaking which would have to be added to the overhead charges of the hire services provided by the hub. Wherever possible, therefore, the service should utilize existing facilities for major repairs provided by dealers. The workshop could then be established and run at a much reduced cost by confining itself to general maintenance and the fitting and reconditioning of spare parts. However, it may be necessary to set up a full-scale workshop where the hire service is operating at a considerable distance from a dealer's service centre, or where no such centres exist.

In addition to the workshop, a stores section may also be required to deal with the ordering and distribution of all incoming and outgoing machinery, general supplies, spare parts, fuels and lubricants. It may take some time for the hub to reach this level of sophistication but this is likely to be invaluable. The service manager would have to keep a careful check on the fuel consumption whilst ensuring that stocks are replenished at regular intervals, particularly in the case of fast-moving spare parts.

Sometimes a hire service may have to be divided into several field units in order to serve different areas and as a means to cut down transport and travelling costs. As the business expands, some consideration could be given to setting up a mobile workshop attached to the base workshop that could provide support on request, to service different work areas in turn. Another course suitable in some cases would be to arrange the machines into groups according to the demands of work in different areas. The operators of such a group can be fed and housed on the spot and remain in the area until all the work required has been performed.

3.3. Machinery selection

As the 2WT based farm machinery in use are made by a variety of manufacturers, several similar machines may be equally suitable for a certain job while in other cases just the slightest difference may be of great importance. Considerable thought needs to be given to the selection of machinery for the hire service enterprise. As a general rule it is advisable to standardize as much as possible, and the fewer different makes of machines there are, consistent with the work to be done, the better. It

simplifies the attachment of various implements to the tractors, the purchase and storage of spare parts, the maintenance and repair of the equipment and the training of operators and mechanics. The main point is that machinery must be suitable for the work it has to do.

In the initial stages of a hire service it is most likely that the basic operations such as planting, ripping and ridging, will be required by farmers. In fact, in areas where there is an abundance of labour only partial mechanization may be necessary and the greatest benefit is likely to be derived from lowering the costs of operations and ensuring more timely field operations. Farmers using hand tools and animal-draught equipment are often unable to complete cultivation by the optimum planting time, particularly if the land is dry and hard. Under such conditions the tractor hire service may provide the means to an increase in yields. On the other hand, this confines the work of the hire service to a short period of the year during which it can rarely hope to obtain sufficient work and income to cover its costs. Invariably therefore, a hire service is faced with the necessity of diversifying its work over as much of the year as possible, once it has established itself with the basic operations, and its potential has been appreciated by the farmers.

The choice of machinery will clearly depend on the conditions under which it will have to work and it may also be necessary to use more than one kind of tractor. This is an observation based on the experience of the machinery hub in Laikipia, Kenya, where a combination of 4WTs and 2WTs was seen to be optimum. There is a good deal of controversy as to the best kind of tractors to be used for a hire service, but there are certain guidelines to correct choice. The 4WT is more expensive than the 2WT to buy and maintain but can easily be moved from one work area to another under its own power. Its work capacity is also higher than the 2WT. However, it may not be possible for a hire service of the kind to find sufficiently large aggregated areas and big fields to justify the use of these very powerful tractors and it may have to rely on the smaller, medium-powered tractors in the 20-40 hp range

2WTs are usually in the 10-18 hp range. They are cheaper to buy than a medium-powered, four-wheeled tractor but more expensive for the available horsepower. They are very maneuverable but their work capacity for cultivation is low, not much higher, if at all, than good animal-draught equipment. On the other hand, the same machine can be used for a variety of work that animals could not do successfully, such as transportation using a trailer, crop cutting, shelling, milling and pumping of water for irrigation. There are also cases where, for example, farms are very small and fragmented and the fields too small for a four-wheeled tractor to operate in. In such cases there may be no alternative except the single-axle tractor. However, many more of these two-wheeled units would be required for a given work-load than four-wheeled tractors and this would increase the investment necessary and also the number of operators required. The working life of these machines is often much less than the four-wheeled types and the need for proper service and maintenance is equally if not more important.

While planning requirements and selecting machinery for a hire service it should be remembered that certain basic equipment is required for transportation, depending on the kind of work and the conditions under which the machinery of the hire service is to be used. The efficiency of the transportation system will in turn depend on:

- the kind of equipment used;
- the distances and the frequency with which equipment has to be taken from one work area to another; and
- the speed of travel, which in turn is dependent on the existence and condition of roads.

If a group of 4WTs and 2WTs are to work together at a considerable distance from their base workshop, they may be equipped with a trailer fitted up as a mobile field workshop to take care of maintenance and all but major repairs on the work site. With groups of units working at the same site

one or two larger trailers may be used to transport all the equipment and supplies for the group. Alternatively a self-propelled, mobile workshop could be provided to service more than one group of units in the field.

3.4. Management

The long-term viability of any business enterprise depends on income exceeding the costs of doing business in the first instance, and on providing goods and/or services in a manner which will ensure a continuous flow of customers or clients in the second. The task of management is to ensure that both of these key requirements are met, and this is just as true for a machinery hiring services as for any other business. The manager of the hire service must first, therefore, have a sound knowledge of business management. He must understand record keeping and accounting, personnel management, government rules and regulations, procurement and marketing to name only a few of the wide range of skills required. The manager must also have a sound knowledge of the selection, operation, maintenance and repair of farm machinery and a thorough exposure to agriculture and farmers.

The manager's task starts with the establishment of what services are to be provided. This is determined primarily by farmer demand in the area to be served. The financial strength, access to machinery and operating inputs, availability of labour and staff, and government rules and regulations will also influence the type and scope of services offered. Once it has been established what services are to be offered, the manager should proceed to organize business activities so as to ensure a profitable operation. Systems must be established for records and accounting. Supply channels for machinery and operational inputs must be identified. Personnel policy and administrative procedures must be worked out.

Facilities such as workshops, storage buildings, fuel dumps, machinery parking, and offices must be designed and built. The provision of seasonal farm machinery services for farmers is not an easy task. Most of the work required is for short periods only during the year and farmer/customers all want their work done at the optimum time. Breakdown of machinery, unfavourable weather or other hazards will inevitably upset the most carefully made plans and schedules, and farmers will understandably be upset and complain. Therefore, it is important that sound public relations with farmers are established and maintained to ensure their loyalty to the hire service in bad as well as good times.

3.5. Service provision

3.5.1. Scheduling of services

A system for scheduling field operations must be established which meets the needs of the farmers and, at the same time, ensures that machinery and operators are employed as continuously as possible and that unnecessary travelling is avoided. Farmers must be interviewed and their applications for field work must be collected and analysed in order to formulate a field schedule and operating plan.

It is advisable for the hire service and the farmer to sign written agreements on the work to be carried out. This has been found in practice to be necessary to avoid misunderstandings, and to ensure that capital invested in machinery and the employment of operators is not wasted on verbally estimated work schedules which, when the time comes for the work to be done, no longer appear to exist, or are much less than the verbal estimates. Even when a hire service has continued for some years, it has been found necessary to retain a system of written agreements to reduce the possibility of disputes and dishonesty. See the example in the Annex.

When all applications are in, the hire service managers should prepare a plan of operations to meet the needs of the farmers and at the same time ensure that the machinery and operators are employed as continuously as possible and that unnecessary travel is avoided.

3.5.2.Payment for services:

In many countries payment in kind by a share of the crop is practiced, but mainly by local farmers providing contracting services to neighbours. Payment in kind by a share of the crop means that the contractor stands an equal chance of making a good profit if the farmer has a good harvest, or making a loss if the harvest is poor. Obviously, this method of payment is justified when the work carried out by the contractor can influence the yield of the crop, as in the case of harvesting under difficult seasonal conditions. In general however, contract work does not have such a great bearing on productivity increases. Often payment in kind seems to be applied because it may be attractive to the farmers, and if they are short of cash it may be the only way they can make payment. There is evidence to suggest that some contractors take advantage of these conditions by charging rates in kind which, calculated as money, are much higher than they should be.

As a result of experience of the difficulties often encountered in the collection of payment after the work has been completed, hire services now normally demand cash in advance, to be paid at the time the agreement is signed by the farmer. Sometimes however, a part may be paid immediately after the work is completed. The disadvantage of payment in advance is that farmers lacking the cash have to be excluded from the service and if there are private contractors accepting payment in kind, these farmers may be obliged to rely on them and be charged a higher rate. Therefore, it may be useful to make the effort to develop a suitable credit system to enable farmers to pay for work done by the hire service and avoid paying excessively high charges in kind. Where credit is required, it is usually until the crop is sold. For the farmer-contractor carrying out work for a few neighbours only, it may be easy to provide this credit, but for the full-time contractor it is often difficult as he is likely to need the money to carry on his own business. In addition, he may not know all his customers very well, and thus runs the risk that some farmers given credit may not pay at the right time, and on occasion a few of them may not pay at all. Therefore, if a contractor gives credit to people he does not know well he should expect some form of guarantee.

3.5.3.Establishment of rates:

General requirements for the setting of rates are that they should i) cover the costs for the work carried out, ii) be easily applied, and iii) if possible provide an incentive to increased efficiency. The data necessary for calculating the payments should be accurate and easily obtainable. In the long run it is also desirable that the method of calculating the charge is easily understood by the farmers, and that all farmers are charged fairly in relation to the cost of performing the work. This cannot be achieved without some differentiation of the rates according to the factors influencing the costs.

3.5.4.Rate per unit of work versus hourly rate:

An important issues is whether contract work should be charged on the basis of the time taken to complete a given amount of work or on the basis of the number of units of work carried out (for example acres or hectatres). The use of units of work is advantageous to farmers because they pay for a given amount of work regardless of the time taken or the sizes of the machines used. The capacity of a machine, however, does not depend only on its size but also on such factors as the dimension and shape of the fields, the yield per hectare and many other conditions. Therefore, the cost of performing

the work may vary much from one farm to another. To a certain degree this problem can be met by a classification of the rates according to these factors, without making their application too complicated.

The rate can also be combined with a time factor to secure a minimum income, when the conditions are very bad. When planting on a rate based on hectares a minimum number of hectares may be stipulated each hour, and if this number is not covered due to unfavourable conditions, the charge would be equal to the minimum rate. Similarly, when shelling, and the value of this turns out to be obviously below average, the contractor may stipulate a minimum hourly rate.

In some cases, however, it may be difficult to collect the data necessary for calculating charges based on the units of work carried out. For instance, data giving details of the field area must be made available, and this means both staff and time have to be used in measuring irregular fields. Rates based on time are as a rule simple to apply. Timing by a normal watch is sufficiently accurate, but somebody reliable has to do the timing. Nowadays however, most tractors are equipped with hour meters coupled directly to the engine. The hour meter is designed to register the hours run by the tractor engine at a predetermined or average speed, and recorded hours will be slightly more than the actual time taken recorded by a chronometer, or less if the engine is run below the average speed. Classification of the rates on the basis of time according to the different working capacity of the machine is likely to be an easier task than having to classify them on the basis of units of work carried out under varying conditions. Time-based rates are not, however, well suited as an encouragement for contractors to carry out the work quickly. The farmer may face the risk of too low an output in a given time with the result of too high a cost per unit of work. This in turn could be met by a special clause in the agreement between the contractor and the farmer; a minimum output per hour can be stated and if this is not reached the charge can be limited to the equivalent amount

3.5.5. *The level of rates:*

The general requirement that the rate should cover costs is valid and it means that a rate set at the correct level should provide the service provider with an income sufficient to cover the cost of the work, including the risks involved, and in addition to secure a reasonable profit. Accordingly, for a commercial contractor the level of a rate based on the time spent in carrying out the work may be easily calculated by dividing the total yearly cost by the number of hours worked per year and by adding to the result a certain sum to cover the risk and to provide a profit. However, the data necessary for this calculation, namely the yearly costs and the number of hours the machines will be used, have to be determined in advance. The result is therefore uncertain and it should be checked and revised now and then in accordance with experience gained.

In practice many factors will arise which will have to be taken into consideration. For example, it may be necessary, when there is a shortage of machines and labour, to reduce the demands for work during a peak season by setting a relatively high rate. Or, on the contrary, there may be a desire to encourage farmers to apply for more work during a slack period, in which case a lower rate would be set. Such a policy in the establishment of rates is justified by the fixed cost and not by the average cost. Once the machines are purchased, labourers employed and the business started, the contractor entails a fixed cost, independent of the hours worked or the amount of work carried out. Therefore, when the variable cost for items such as fuel, lubricants and repairs has been covered by the rates, any additional earnings contribute to the fixed cost, and during a period when the machines and labourers would otherwise be idle, it is sound policy to try to keep them occupied by encouraging farmers to apply for more work. Consequently, one cannot always calculate the profit gained from each job of work by reckoning that it is the difference between the rate charged and the average cost of the machine, or consider it as a loss when the rate does not cover the average cost. The difference

between the overall income and the overall expense of the business is the most important factor, not the profit made in each hour or on each piece of work carried out.

In some countries, competition is a very important factor regulating the rates. If rates are too high they may provide less profit than lower ones, due to insufficient employment of machines and labour. In this case there is little opportunity for an enterprise to gain unreasonable profits. In fact the profit made must as a general rule be the result of efficiency in the business. It is essential however, both for the contractors and for the farmers served, that the rates are fixed at a level which will allow the business to be continued and, if desirable, extended. In the beginning the rates are often set too low, and later, when it is found that expenses are much higher than expected, it may become difficult to increase the rates sufficiently.

Bearing in mind that high rates are a discouragement and low rates an incentive to farmers to use the machines, and the importance of having both the machines and personnel employed over a long period each year, it is certainly no easy task to determine the most profitable level at which to set the rates. What can be done is to calculate as accurately as possible the prospective average costs and then take into consideration the other factors influencing the level of the rates and the risks involved in the business. When the contract service has been in effect for some years, there will be information and data available to check the rates and, if necessary, to correct them.

3.6. Incentives for increased efficiency

In carrying out contract work there are many occasions when time and effort may be wasted because of lack of cooperation between the contractor and the farmers, and also among the staff of the contracting service. It is advised to try to address this problem in advance to ensure a reasonable degree of efficiency. Means available are standing orders regarding the performance of work and the provision of incentives which will encourage the persons concerned to cooperate and avoid interruptions as much as possible. Standing orders can for instance be applied in order to prevent machines being moved excessively long distances to serve small fields. The avoidance of unnecessary interruptions can be achieved by incentive payments. In the following discussion it is assumed that the employees accept normal regulations and instructions as to how and when they shall perform their duties and what they will be paid for them.

3.6.1. Incentive payments to staff members:

There are two general requirements to consider in establishing payments for staff/ operators of a hire service. Firstly, each person entitled to an additional payment should be able to increase this payment by his own efforts, or by cooperation with others. Secondly, it should be paid frequently enough to be felt as an incentive. In addition, the system adopted should not be too complicated and thus cause too much administrative work.

Incentive payments should be related to the results achieved by the hire service. Under these conditions therefore, an incentive related to the difference between income and expenses or the actual income or the amount of work carried out is preferable. It is also possible to employ two different incentives, one of which is related to the total results and the other to the results of the particular service provided. The efficiency and success of contract work depend to a large extent on the operators. The time needed for moving a machine from one farm to another should be kept to a minimum and all unnecessary delays avoided. In order to achieve this, the operators may be given a bonus calculated on the hours paid for by the customers or the amount of money earned by their machines. For instance, the operator can be required to fill out a daily record card giving information on his working hours and those of the machine for each customer (see Annex). Accordingly, an

incentive can be paid in relation to the hours paid for by the customers. Another possibility is to pay the operators for productive hours only.

Mechanics and other staff members also have a great influence on the efficiency of contract work. Close cooperation between all persons concerned is required, and to achieve this, an incentive payment to all staff based on the total results may be applied, in addition to the payment for operators. The advantage of including all staff members in an incentive, scheme is that they will be encouraged to keep an eye on each other's performance and thereby endeavour to increase general all-round efficiency.

3.6.2.Rates as incentives to farmers:

In contracting, the farmer's help in carrying out the work is invaluable, in order to save time, decrease costs and raise the quality of work performed. When the machines are moved to one village, it saves time and money if all the farmers in the area can arrange matters so that they all have the same kind of work carried out at the same time and before the machines are moved to another village or return to their base. In order to achieve this, all the farmers should be encouraged to apply for the work that requires to be done in good time. It may also be necessary to encourage them to grow the same kind of crops, or even the same variety, in order to enable tillage, sowing and harvesting to be carried out expeditiously.

Other examples of ways in which farmers can facilitate contract work are the following:

- clearing the fields of stones, roots and tree stumps and levelling the surface;
- growing the same crop in one or more fields or field units arranged as closely together as possible;
- helping to provide access to the fields. In rice-growing areas where fields are enclosed by earth bunds the farmer should wherever possible level a small length of the bund, so that the tractor and implement can be easily driven in and out of the field;
- if the farmer has a draught animal he can mark out the field for planting in advance and for harvesting, where trailer-type machines are used by the contractor, the farmer can open up the field himself by hand- or by animal draught implements so that when the contractor's machine arrives it can start working at full capacity immediately.

Through cooperation of this kind the cost of contract work and the price charged to the farmer can be reduced, and the work can be carried out at the right time and with less argument. Moreover, attention to the needs of the machine operator- such as providing him with food and drink in the field- usually helps to get the job done more quickly.

In order to encourage farmers to assist in this way they should be allowed to benefit from their efforts and at least cover their costs. For instance, when the work is charged on the basis of hectares, and no distinction is made between the size and condition of the fields or of access to them, there is no incentive to the farmers to hasten the work. When on the other hand the work is charged on an hourly basis, the farmers have an excellent incentive because the more work performed each hour the cheaper is the unit cost.

A common objection to rates on an hourly basis is that they are unfavourable to farmers with small fields. However, if the policy is to increase the size of fields, a hire service would not wish to subsidize and thus perpetuate a system of small fields. There are other possibilities which can be tried. One is to classify the rates according to the size of the fields. In this way the farmers are induced to cooperate

in order to aggregate their small fields into larger ones. The benefits of this may be limited however, unless the shape of the fields and the access to them are also considered.

ANNEXES

Annex 1: EXAMPLE OF MACHINERY HIRE SERVICE WORK APPLICATION AND REPORT FORM

No. _____

Zone no. _____

Date _____

WORK APPLICATION SECTION

Received from Address

Home location District

the sum of as advance payment for the following

Type of work	Quantity Ha/ acres or hrs.	Location	Date required (approx.)	Rate	Estimated cost
				Total	

(Signature of persons receiving application)

Foreman's inspection report section					Date	
Estimate hrs.	1.	Acres/ ha.	1.	Machine requirem ents	1.	
	2.		2.		2.	
	3		3.		3.	
Comments (accessibility, soil type, topography etc.)						
Signature _____						
Work Report Section	1	2	3	1	2	3
Work done under work order no.						
Tractor no.		Operator		Date/ time start	Date/ time finish	
Total acres, ha. or hours for each type of work	1.		2.		3.	
Signature of supervisor						

Annex 2: AGREEMENT BETWEEN HIRE SERVICE OR CONTRACTOR AND FARMER

The undersigned, contractor and, farmer
 Have agreed to the following:

1. The contractor undertakes to carry out machinery operations himself during the period (date).....until (date)

Kind of operation	<i>The work is estimate to comprise at least</i>		
	Work hours	Area covered (ha.)	Rate
Ripping			
Shelling			
Milling			

2. The rates include expenses for tractor with implement, fuel and operator, or self-propelled machine. If more than one operator or any other labour is provided by the contractor, an additional charge will be made.

3. The farmer shall inform the contractor well in advance as to what kind and how much work he requires performed. After receiving this request the contractor agrees to complete the work by the following dates:

<i>Kind of operation</i>	<i>Estimated date for completion</i>
Ripping	
Shelling	

4. In the case that delays in the work are caused by lack of suitable preparation by the farmer (e.g. access to fields) the contractor will not be held responsible for lost time.

5. This agreement can be cancelled only if both the contractor and the farmer agree to it.

Date _____

Signature of contractor _____ Farmer’s signature _____

Annex 3: OPERATOR'S DAILY RECORD CARD

Type of work:	Card no. :
Name of customer:	
Name of operator:	
Implement and ref. no.:	Date:
Tractor and ref. no. :	Area covered:

Operator and machine working hours				Signature of customer
Machine time	Machine idle time	Operator time on other work	Operator total hrs.	
				Signature of operator

Annex 4: EXAMPLE OF INCENTIVE PAYMENTS AGREEMENT WITH TRACTOR OPERATORS

In addition to their fixed monthly salary, the operators receive a percentage of the gross income earned by the machine that they handle. The percentage is established as follows:

*Tractor drivers for ordinary farming operations such as planting, cultivating, shelling and threshing:
..... Percent of the gross income of the machines when the tractor driver/ operator is working
alone. Two tractor drivers or one driver and one assistant working together receive percent and
..... percent respectively of the gross income of the machine.*

The percentages are paid monthly and based on the final bills paid to the client.