INFORMATION NEED FOR AN IMPROVED MECHANIZED AGRICULTURE FOR AGRICULTURAL DEVELOPMENT IN NIGERIA

By

Zungum, A; Babasanya,B; Sabo, D.M.and Patrick.
Federal College of Forestry Mechanization, Afaka, Kaduna

ABSTRACT

Mechanized farming if practiced under farmable atmosphere with political will-power from government, regular financial backing and understanding of the working principle of mechanic based on its relationship will soil leads to greater output. The study found that associated factors of soil, government intervention through urban development that mobilize people from the rural area thereby making vast land area available for mechanized farming is a *sine quo non* for an enhanced agricultural productivity.

IINTRODUCTION

Man as a power unit is very inefficient and ineffective. He is limited to about 0.1hp continuous output and is therefore worth almost nothing as a primary source of power (Berger *et al.,* 1963). For the farmer to receive an adequate return for his labour, he must be an efficient producer. This efficiency can only be achieved if there is proper use of materials and effective utilization of power through mechanization. The agricultural engineer has a major responsibility in solving engineering problems in agriculture by mechanization.

The application of machine to agricultural production has been one of the outstanding in American Agriculture during the century. The results are to be seen in many aspects of American life. The burden and drudgery of farm work has been reduced. Mechanization has been aided by, and in some cases made feasible only because of the contributions of plant scientists and others in the biological sciences. Pant breeders have produce varieties better suited to mechanical harvesting. Examples are dwarf varieties of grain sorghum having uniform growth, storm proof cotton, hybrid corn varieties with less tendency to lodge, and tomatoes that all ripe over a short period of time and can withstand the rough treatment from a mechanical harvester. Cultural practices for some crops have been changed to modify growth habits and obtain plants better suited to mechanical harvesting such as hay balers, hay cumbers, cotton pickers, tomatoes harvesters and the like. The importance of mechanization is limit less.

The purpose of this paper is to produce requisite information to guide the practitioners of mechanized agriculture and the intending ones on the pitfalls to avoid and technical guides to follow. As a result the study describes Agricultural Mechanization and its influence on agricultural development, cost implication of the use of machine, measuring and evaluation of performance of machine and some soil related terminologies (minimum tillage, etc) and finally it proceeds to discuss the relationship that exist between government and agricultural mechanization in Nigeria.

Literature Review

Agricultural mechanization may be defined as the application of engineering principles and technology in agriculture production, storage and applications are not limited within the boundaries of the farm unit, (Anthony Ezedinma and Odiapa, 1986). Anthonio submitted that agricultural mechanization is an implement made up of two more parts which work together for a common purpose. The farm equipment can be a simple mechanical device e.g. the horse-drawn plough or a more complex device e.g. the shelter. Farm equipment differs from a farm tool in that it requires less effort from the farmer for operation than does the farm tool. Some examples of farm equipment are ploughs, harrows, tillers (which are tractor or horse-drawn) some sprayers, shelters scales, irrigating devices. There is some implement used agricultural mechanization which includes: primary, secondary, tertiary and quaternary implements. These implement are made in different forms for use on different types of soil and the crop planted will dictate the form of implements to be used.

Peter (1970) made it clear that agricultural mechanization is a broad subject which includes the application of all forms of power to agricultural operation of all types, so that the farmer is less and less dependent on his own physical labour and that of those helping him. He explained that mechanization enables the existing farming population to cultivate more land, but unless regeneration by quicker means that natural re-growth is introduced; more cultivation may increase pressure on the land and reduce resting periods. The smaller types of tractor and cultivator found suitable for use in temperate regions are often too light for tropical use and not design for heavy and rough condition of the tropics.

According to Bates (1957) mechanization is directed towards making the fullest possible economic use of the land which has been prepared for cropping, she also added that machinery can make possible some jobs which the grower could not otherwise undertake, such as early ploughing in dry weather and green manure on a field seals. It also reduces bad agricultural practices such as burning of vegetative cover of new land. The effect of mechanization or its consequences on agricultural according to Harris is shown n the number of man-hours required to grow and harvest an acre of wheat yielding 20 bushels. In 1830, when the grain, was sown by hand and harvested by hand with a cradle, 55.7 man-hours were required. In 1896 with the use of horse-drawn drill and binders, 8.8 man-hours were required, while in 1930 with the tractor-drawn drill and combine harvester only 3.3 man-hours were necessary. Webster and Wilson (1980) stated that mechanization and the use of herbicides can save labour and increase production per man and this may be of primary importance where labour is short or opportunities for employment other than in framing available. For example Japan where shortage of labour in rural district has resulted from a large movement of people to industries in the town, mechanization has been wide spread and highly developed. But it did not do so until yield has been raised by introducing other inputs, such as, improved varieties, fertilizers, pest and diseases control. In Nigeria farming is still widely carried out by human labour using mainly traditional tools. Labour components constitute the highest factor in production cost. Studies carried out on Nigerian Agricultural production revealed that, for

example that labour accounts 72% of the cost of maize production and 60% of total cost of sorghum production. Commercial manufacturing organization are of course, concerned primary with the development and improvement of farm machinery, the ultimate goal being to obtain a product that is useful and acceptable to the farmer and that can be manufactured and sold at a profit. To this end, the farm machinery industry is doing an increasing amount of research, the result of which can be applied to some particular class or group of machines. Public service agencies such as state agricultural experiment station and the United States Department of Agriculture (USDA) may undertake any of the types of problem listed above, but their major emphasis and responsibilities are in research activities.

The development or improvement of a machine, where undertaken by a public-service agency, often involves either a special problem of a localized nature (geographically) or one that is likely to require a great deal of development work and close coordination with research workers in other agricultural fields (such as plant breeders, botanist, entomologist etc).

Agricultural Mechanization and its Influence on Agricultural Development

In order to achieve the objectives of Agricultural mechanization, preliminary definition of agricultural mechanization in each country is required, which takes into consideration its socio-economic conditions, the development targets to be achieved and the optimal mechanization level (hand, tool, animal operated). To be used in order to ensure a certain labour productivity (man-hour per hectare) that will be able to face the timeliness requirement and to reduce production costs. What is meant there is that a country going on a mechanization journey should identify where it stands, where it is going and then decide how to get there. To best understand the influence of mechanization on agriculture, it is pertinent to take a look at a country like the United States with highly developed agriculture. Since 1950 mechanization and technology have modernized the operations of American farming dramatically. Today, the nation can point to such striking facts as these. A single hour of farm work produces more than twelve times as much as it did in 1940, when a single farm worker could provide for about ten people.

Though the farm population has dwindled now to about 6-9 million from more than 30 million in 1935, largely as a result of the general urbanization of American society, the Agricultural industry has been expanding. Four of every ten positions in private employment are related to agriculture in one way or another. From the analysis above mechanization is the only solution to this problem of low-production with high labour input. Attempts to mechanize only imply full tractorization. However, tractorization is just only one aspect and level of mechanization.

Machine Use and its Associated Cost Implication

The total of performing a field operation includes charges for the implement, tractor power utilized and labour implement and tractor costs are divided into two categories – Fixed costs and variables or operating cost. Fixed costs per hour are inversely proportional to the amount of use and include repairs and maintenance,

fuel and lubricants, and servicing. Depreciation as fixed cost of the machine life is determined by obsolescence or if the machine is arbitrary fully depreciated before it wears out (as for tax purposes). But if based on the operating time required for the machine to wear out, depreciation becomes a variable cost.

(a) Depreciation of machine

Depreciation is the reduction I value of a machine with the passage of time. In the usual situation, with field machines being operated only a few days per year, obsolescence is the most important factor affecting depreciation. A machine may become obsolete because of the development of improved models, changes. To best understand the crucial role of the government in advancing agricultural mechanization, it will be good to take a look again at United States. A quick look at the past show that the agricultural development in the United States only took a new turn in the second half of the 19 century and this was due to the progressive attitude of the government. But when it comes to Nigeria, one cannot say that there have not been some good far-reaching laws on production through mechanization. Instead, what one sees are well thought-out laws and decree, sometimes conflicting with each other, but not well or fully executed. We must say that one of the bones or a problem facing our mechanization programme is instability in government and ignorance on the part of policy makers. Laws are not given time to be fully executed and tested before another is enacted that either conflicts or cancels the former.

(b) Machine Life

A value for the useful of a machine is needed to estimate depreciation by any method except the one based on estimated market value. Estimates of either obsolescence life or wear out life are rather arbitrary. Usually there is no definite time at which a machine suddenly becomes difficult to repair. Rather, there is a gradual increase in repair cost until eventually it becomes uneconomical to continue making repairs. Cost of using this machines as we can have a lot of areas or processes to be considered for one to really come up with a reasonable conclusion about cost. Some of these areas are the interest for investment, taxes, insurance and shelter, repairs and maintenance, fuel, lubricants and miscellaneous supplies.

(c) Soil Abrasions

Abrasiveness is a dynamic properly of soils that has a cumulative effect rather than an immediate effect. When a large amount of soil slides over the surface of a tillage tool, abrasive wear may change the size, shape, or roughness of the tool enough to make it ineffective especially if soil pressure against the tools are high. Soil characteristics on condition that affect abrasiveness include the hardness, shape and size of the soil particles, the firmness with which the particle are held in the soil mass, and the soil moisture content.

(d) Minimum – Tillage System

Engineers, crop and soil scientist generally agreed that more tillage is being done than is necessary to assure maximum net income from crop production. In some cases, soil compaction from the tractor and implement in a sequence of secondary

tillage operation may virtually eliminate the effects of primary tillage operations. Continuous-width tillage operations are usually designed to produce a good seed even through the degree of soil pulverization and the firmness may be excessive for optimum root growth. In recent years there has been increasing interest in minimum – tillage system as a means of reducing row-crop production costs and improving soil conditions. Minimum tillage is a broad principle that can be applied in many ways.

The principal application if a minimum-tillage system has been in corn although zero tillage has been used successfully in cotton and a number of other row crops. Minimum-tillage corn is often planted through big or small grain residue. Experience has indicated that minimum tillage, under suitable condition and with some row crops, is a practical way to conserve resources and reduces production costs, usually without reducing yields.

(e) Measuring and Evaluating Performance

As indicated in the preceding section, tool forces and changes in soil condition are the two basic aspects of tillage-tool performance. The root should accomplish the necessary soil manipulation with a minimum of energy input, and the final soil conditions. The force systems acting on tillage tools can be represented mathematically and the forces can be measured. But quantitative assessment of performance is difficult because no method has been developed for adequately describing soil condition that may be of interest depending upon the function or purpose of a specific tillage, are:

(a) The degree of soil breakup
(b) Segregation of clod sizes in relation to depth and
(c) Uniformity of mixing throughout the tilled depth.

Soil breakup may be measured by sieving a soil sample that represents the entire tilled dept. Often the objectives of tillage are to mix the soil to obtain uniform distribution of clods for moisture. Evaluation of performance involves comparing the actual final soil condition with the desired condition. The desired condition is determined entirely by the intended use of the tilled soil.

(f) Stubble – Mulch Tillage

The main objectives of stubble mulch tillage are to reduce wind and water erosion and to conserve water by reducing run off. This practice is widely accepted in the Great plants and other arid or semi-arid regions, stubble-mulch involve cutting the roots of weeds and other plants and leaving the crop residue on the surface or mixed into the top few centimeters of soil. The proper disposition of the residue depends upon the amount present and the subsequent operation involved. The large amount of residue on the surface protects the soil but introduce problem in planting.

Determining Economic Feasibility of Harvest Mechanization

The primary objective of harvest mechanization is to reduce labour requirement and to increase the net income to the grower through reduced costs. Although cost reduction is not always essential, a mechanized system is not likely to be

adopted if the net income would be reduced appreciably. Growers tend to use hand labour as long as it is available, adopting mechanization as a last resort.

Mechanical harvesting often cause reduction in harvested crop per hectare in comparison with hand harvesting especially in non selective of crops that do not mature uniformly or in harvesting easily damaged crops. The reduced value may be a result of reduced potential yield, actual field losses, or reduction in quality.

Agricultural Mechanization and the Government

Government has a very crucial and important role to play in the agricultural mechanization development as well as the success of any country. The government has so participated fully not by going into indirect production, but by creating the necessary environment and conditions for successful and fruitful mechanization through appropriate legislations and decree (in the case of military government) this may be of primary importance where labour is short for opportunities for employment other than in farming available. For example in Japan, where shortage of labour in rural districts has resulted from a large movement of people to industries in the towns, mechanization has become widespread and highly developed, but it do so until yield have been raised by introducing other inputs such as improved varieties, fertilizers, pest and disease control.

Conclusion and Recommendation

The analysis revealed that gross labour lost often trail use of crude implement. Conversely, the advent of mechanized farming not only increases large area cultivation, it enhances higher productivity and opportunity of economies of scale. The study further shows that the understanding of the life expectancy of machine helps to minimize rough handling and commitment to safety precaution rules. The economic adaptation of a certain types of machines to small farms is a problem that needs more attention before our agriculture can become completely mechanized. On many farms the area planted to a particular crop is too small to justify the ownership of expensive equipment such as hay balers, hay cubers, cotton pickers, tomato harvester and the like.

The effect of this equipment on the soil is also a matter which must be given due attention, the frequent use of this machine also has a devastating effect on the soil and the equipment or on the crop itself.

Cultural practices may need to be changed, or new crop varieties developed to make mechanization of a particular operation feasible or increase the effectiveness of a machine processing equipment and standard may need to be revised to accommodate mechanically harvested crops.

An enabling environment through the promulgation of law backing or favouring Urban housing development and employment generation that would attract the rural people to the urban areas thereby make land available for mechanization.

Revisiting the 1978 land decrees, this places land ownership under government and deemphasize individual ownership. Under this practice land fragmentation is discouraged thereby allow for vast expanse of land to be mechanized for agricultural purposes.

The structure of soil of a particular area and its peculiarity should determine the type of machine to be used to work on it. With this understanding tropic-friendly machine should be strictly used for tropical soil as does temperature-friendly machine. This will prolong the useful life of machine.

References

Anthony, Y., F.O.C. Ozedinma, Ochapa, C.O. (1986): Introduction to tropical Agriculture

Bager *et al* (1963): Tractors and their power units.

Bates W.N. (1957). Mechanization of Tropical Crops

Peter, M.A. (1970). The West African Soils.

Start *et al* (1970). Agricultural Mechanization in developing countries.

Webster and Wilson (1980). Agriculture in the Tropics.