

Review

Improving small-farm productivity through appropriate machinery in Nigeria

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Abstract

Despite Nigeria's rich agricultural resource endowment, the agricultural sector has been growing at a very low rate. Less than 50% of the country's cultivable agricultural land is under cultivation. Most of this land is cultivated by the smallholder and traditional farmers who use rudimentary production techniques with low yields. The smallholder farmers face many problems including poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, land and environmental degradation, and inadequate research and extension services. A study of the use of Power Tillers in small farms was undertaken, 70 % increase in yield was recorded and problems facing small farms productivity were looked into.

Keywords: Machinery, productivity, small-farms and mechanization.

INTRODUCTION

In many parts of Africa, small farms remain at the center of agriculture and rural development. However, one of the main causes for the low agricultural productivity in most developing countries in the region is the lack of appropriate machineries that cater to and suit the requirements of small-scale farms. Due to this reason, many small farms are deemed as unproductive and inefficient.

Agriculture was and until the discovery of oil, the mainstay of the Nigeria economy. Agriculture provided employment for well over 60% of the population most of which were resident in the remote and rural areas of the country. Though the population engaged in farming was high, most of the farmers were subsistence or peasants, hardly producing enough to meet their individual family requirements and in rare cases only small surpluses to meet the need of the non-farming population and export. With this level of production, the country was still an exporter of some cash crops such as cocoa (*Theobroma cacao*), groundnut, (*Arachis hypogaea*) and oil palm products (*Elaeis guineensis*) while the country was also self-sufficient in staple food crops such as yam, (*Dioscorea spp*), cowpea, (*Vigna unguiculata*), maize, (*Zea mays*) and rice, (*Oryza sativa*). (Balogun, 2001; Moorhead, 2005; Anon, 2005).

The migration of youth to urban areas for employment while farming by old and less productive population resulted into declined production. With an ever increasing population, it became increasingly difficult to feed the teeming masses and the country resorted to importing food to supplement the one grown at home. It was considered necessary to reverse the trend and the three approaches adopted were the use of improved and high yielding varieties of crops, use of agro-chemicals and expansion of area under cultivation. (Anon, 2005). If the manual labor, which hitherto provided farm power, had dwindled at a time when the farmland had to be expanded, the only option was to increase the productivity of the reduced population on the farm. This required the introduction of methods with power output much more than could be provided manually. Animal traction was introduced to perform such tasks as ploughing and harvesting of crops especially groundnut. This was an improvement over the direct use of human labour but was restricted to environment that supported the survival of the draught animals. The desirability for efficient power sources that could be used under varied climatic and soil conditions motivated the introduction of farm power and machinery into the Nigerian agricultural system.

Farm power may be described as any source of energy that makes power available for farming operations. This includes animal power, wind power, hydro power, electric power, solar power and internal combustion engine, while

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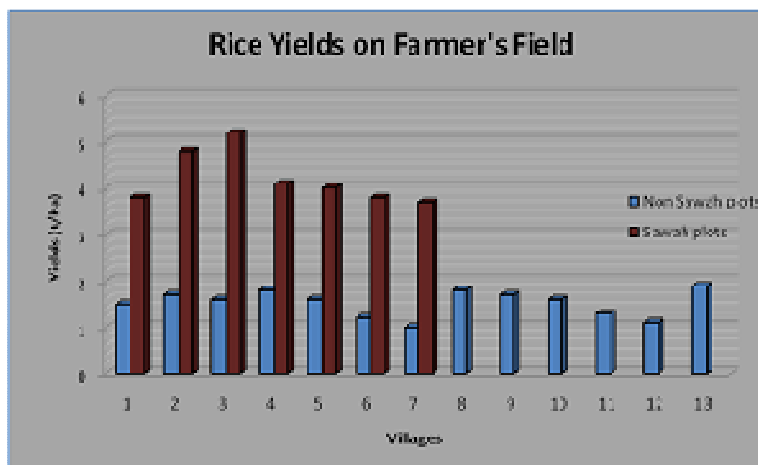


Figure 1. Yield comparison between sawah and non-Sawah plots on farmer's field.

farm machinery is a collection of machines for farm operations and include all types of implements and devices for applying power on the farm such as plough, harrows, seeder/seed drills and planters, cultivators, harvesters, haying machines and tractors. (Aduayi and Ekong, 1981).

The tractor is the most important machinery because it is the prime mover for all the implements. It is the most used and most prone to wear and tear. It is also the most expensive item of all farm machinery. Ellis and Wainwright (1994), put the cost of machinery used in developing countries including Nigeria, at about 30% of the total investment in agriculture while Igbeka (1986), stated that the cost of operating machinery is the largest single farm expenditure. As a result of the high cost of tractors and implements, equipment ownership was mainly by government through the ministries of agriculture and lately by departments and parastatals whose mandate involved substantial land clearing and development. It is therefore the opinion of many that due to the economic level of majority of farmers in developing countries like Nigeria, in transforming from the presently predominant hand- tool technology to a full blown large scale engine power technology, there has to be an appropriate intermediate technology. In the past this has been viewed as the animal draft technology. However, the introduction of two-wheel tractors (power-tillers) in many countries is proving to be a better and more appropriate intermediate technology. In the past three to four years, there has been an influx of two- wheel tractors into Nigeria and the demand has particularly been increasing in places where its use for the cultivation of low land rice is increasingly becoming popular. This paper examines the introduction of power tillers, adoption and utilization by small - farm holders in Nigeria.

Power tiller as a tool for improving small farm productivity

The experience in Bida, Niger State of Nigeria proved the appropriateness of the use of power tiller in increasing small farm productivity. Fashola et., al. (2004) reported that since 2001, when sawah systems as a technology was introduced to the Bida rice farmers, the farmers were left to solely manage their field, the only input supplied was the power tiller used for their land preparation. However, monitoring of the various activities by the farmers was done and the farmers were grouped into two categories namely (1) farmers with puddle and bunded fields (sawah plot) and (2) farmers with traditional tillage system (non-sawah plot). All farmers used about 30 kg N/ha with improved varieties. All farmers' fields with sawah technology out yielded the non-sawah plots (Figure 1). The yield for sawah plots ranged from 3.5 to 5.5 t/ha whereas in case of the non-sawah plot it ranged from 1.2 to 1.9 t/ha. On the sawah plots, higher yields were equally observed with plots that had Azolla on their field. The sawah system i.e. the puddling, leveling and bunding, enhanced the nitrogen fixation ability of Azolla.

A demonstration on the use of the power tiller at a farmer's field is depicted in the Figure 2. The power tiller is a simple two-stroke engine, hand driven machine with 13-horse power. It is an appropriate technology for the inland valleys (lowland cultivation). It is equally a multi functional and multipurpose machine and is also affordable. Having bunded the field into manageable plots, the soil can be leveled puddle and water management is better enhanced. This will enhance the buildup of the silt and clay in the water on the plots. The weeds are suppressed given that the rice has a better head start and reduced weeding frequency, also fertilizer



Figure 2. Demonstration of the use of the power tiller on a farmer's field.

use efficiency is greatly improved and the high yielding varieties would be able to demonstrate their inherent potential yields between 4 to 6 t/ha.

Problems, Issues and Constraints

The barriers that impede the growth and sustainability of farm mechanization industry and programs in this country can be classified into technological constraints, socio-cultural and behavioral barriers, financial and economic problems, and environmental issues. In some African countries, local manufacturers are still in the "cut and weld" level of manufacturing technology. Low or substandard machines continue to be peddled in the market, while some machines are not suitable to the farming conditions of the users. Farm machines are likewise beyond the reach of most farmers owing to high acquisition and maintenance costs. Small-size farm is a big issue when it comes to mechanization because it is against the "economies of scale." Mechanizing small, non-contiguous parcels of lands may prove to be inefficient especially in operations like land preparation and harvesting. Poor rural infrastructures such as roads, bridges, canals, and power network also pose as a major obstacle to farm mechanization. Also, in developing countries, farm labor is abundant; hence, the need for machinery is seldom recognized. However, the income of farmers has remained very low and the value of working day very cheap. In terms of environmental issues, high energy consuming large machines with emissions that pollute the environment have become an important concern.

Recommendations and Directions for Future

Due to the nature of small landholdings in Nigeria, the

following criteria for designing and developing machines have been identified in this study:

Technology and Systems Development

1. Machines should be compact, light, low powered, and multi-purpose. Locally-available materials must be incorporated in fabricating machines to reduce the manufacturing costs, manufacturing and designing parts must also be precise.
2. Small-size tractors, mini-power tillers, and small farm equipment must meet the needs of small farmers. Operator's safety and comfort must also be considered.
3. The high cost of fossil fuel in the country emphasizes the need to develop energy efficient machines by harnessing nonconventional sources of energy.

Adoption and utilization

1. Information dissemination activities through multi-media, fairs and exhibition, and similar modes should be actively pursued in strategic locations where machines are actually needed. Training local craftsmen in manufacturing technology, operation, repair and maintenance would promote local manufacturing of agricultural machinery.
2. Farmers' organizations or cooperatives can also be tapped, particularly in setting up joint use of farm machineries and other modern farm facilities.
3. Government-private sector complementation is vital in promoting farm mechanization. Service centers could be established in rural and remote areas; and financial assistance, loans, and subsidies must continue to provide machinery owners and users of continued

farm production operations.

CONCLUSION

The level and appropriate choice of agricultural mechanization has direct effects on land and labor productivity, farm income, environment, and the quality of life of small-scale farmers in Nigeria. Hence, basic farm mechanization requirements to cater small-farm needs must be met, such as: suitability to small farms; simple design and technology; versatility for use in different farm operations; affordability in terms of cost to farmers; and most importantly, the provision of support services from the government and the private sectors/manufacturers.

Cases of highly mechanized countries point to a common factor leading to successful farm mechanization programs, that is, strong political will. Hence, Nigeria's effort on small-farm mechanization must be anchored on a coherent strategy based on the actual needs and priorities of the small-scale farmers.

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