Role of Agricultural Mechanization in Rural Development in North-Central Nigeria: A Case Study of National Centre for Agricultural Mechanization (NCAM)

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Abstract: Mechanizing agricultural production have crucial importance for crop quality and yield per unit area depending on the type of technology used. The focus of this study is to examine the role of agricultural mechanization by adopting the developed technologies of the National Centre for Agricultural Mechanization (NCAM) in reducing drudgery and improving quality of life of farmers in the study area. Ten farming communities within four local government areas of Kwara State (North-Central Nigeria) were selected for the study. A structured questionnaire was administered to determine the socio-economic characteristics of the respondents, productivity and income levels the respondents. Results of the study indicated that 90% of the respondents were males. About 80% were in their active productive years. Similarly, 97% were the legal owners of their farm lands, 63% of the male respondents have no formal education while all the female respondents have a minimum of elementary education. The study also shows that about 2% of the respondents owned land of between 9 – 10 hectares while 35% have less than 1 hectare. The study shows that most of the respondents have considerable increase in their output with the introduction of NCAM's technologies, thus recording corresponding increase in their living standards.

Keywords: *Agricultural Mechanization, Rural Development, Equipment, Drudgery.*

INTRODUCTION

Agriculture is by far the oldest and largest business in the world (FAO, 2009). Before 1960's, the dominant role of agriculture in Nigerian's economy was taken for granted (FMARD, 2004). With very little support from government, Nigerian agriculture was able to grow at a sufficient rate to provide adequate food for an increasing population, raw materials for the growing industrial sector, increasing public revenue and foreign exchange for government and employment opportunities for an expanding labour force. It employs over 65% of the country's population (FMARD, 2004).

This indicates how central it is to the survival of most people in Nigeria. According to Igbore (2002), between 60 – 80% of Nigerian population lives in rural areas and depend on agricultural activities as their source of living. The little support provided by government for agricultural development was concentrated on export crops such as cocoa, groundnut, palm produce, rubber and cotton as self-sufficiency in food production seemed not to pose any problem worthy of public attention. There was no debate as to the fact that Nigerian agriculture performs better in the 1960s than in 1980s, 1990s and now. This was because even though most of the farmers no longer use traditional tools for production, they do not fully adopt and understand the operational techniques of the mechanized tools that would raise their production rate (Tsegaye, 2003; Igbeka, 2002). When the low levels of agricultural growth rate are contrasted with the population growth rate estimated at about 3.2% per annum (Ijare and Idachaba, 1983), the enormity of the problem was appreciated; positive changes may not be established (Wejnert, 2000). The per capita rate of growth of agriculture, especially of food production, has been declining with corresponding increase and severity of poverty, hencethe growing desire to modernize agriculture in Nigeria.

Acting on this, the Federal Government established the National Centre for Agricultural Mechanization (NCAM) in 1978 having recognized the need for the development of indigenous mechanization in order to improve agricultural output realizing that imported mechanical technology does not seem to be solving the agricultural production problems in the country, FMA (2006).The overall objective of establishing the Centre was to accelerate the pace of mechanization in the agricultural sector of the economy in order to increase the quantity and quality of agricultural products. Government was convinced of the indispensable role of agricultural mechanization to the actualization of Nigeria's self-sufficiency in food and fibre production. This, coupled with the ever-present constraints of imported agricultural mechanization technologies, most of which are not compatible with Nigeria's pedi-climatic conditions, crops and cropping patterns with their attendant poor after sales back up services, irregular supply of spare parts and other socio-economic considerations necessitated the establishment of NCAM to address these problems. The status of the Centre as established by Decree No. 35 of 1990 gave it a semi-autonomous status within the then Federal Ministry of Agriculture, Water Resources and Rural Development. Thus, NCAM was established by government to actualize Nigeria's self-sufficiency in food and fibre production using home-grown technologies. The Centre is located in Ilorin, North Central Nigeria. It is strategically located between the transition of the forest and savanna ecologies in order to cover as many as possible the forest and savanna crops and livestock in its machinery research and development (FMA, 1986; Jimoh, and Ishola, 2009). Three sub-centres were also proposed to be located at Samaru (cereal crops), Akure (tree crops) and Umudike (root crops) while testing and demonstration outstations for adaption of proven technologies were to be determined from time to time by the Management Board of the Centre. NCAM as presently structured is composed of five core technical and scientific departments, and two supporting departments. The technical departments are responsible for research activities.

Over the years, the Centre was able to establish some necessary infrastructures, develop some appropriate farm tools, equipment and machines as well as provides facilities for conducting trainings in mechanization activities. The Centre has also tested and certified some imported tractors, machines and implements in line with its mandates and also established some test codes and standards. NCAM's expected activities encapsulate a totality of operations involved in crop production, land clearing, land development, irrigation, erosion control, weeding, harvesting, crop processing, produce handling, storage, haulage and packaging, the use of small-scale tools and equipment, and animal draft power systems. Some of these were executed in collaboration with other relevant research institutes/establishments working on similar production operations to avoid duplication of efforts.

Some of the completed research projects that were extended for farmers for adoption include Indigenous Drip Irrigation System; Cassava Peeling Machine; animal draw groundnut digger; seed treatment drum; manual fertilizer spreader; crop planters and harvesters; manually operated ridge profile weeder; continuous process melon washer; melon mechanical depodding machine; among others (NCAM, 1993; 1995 and 2011). The developed technologies were made available for adoption in order to reduce drudgery, increase yield and raise the living standards of the end users. However, some farmers were reluctant in adopting these technologies which could be due to farmer's attitude to change as observed by Wandel and Smithers (2000). This could perhaps be due to fear of negative outcome as well as their sustainability (Antle and Diagana, 2003; Bearenkla, 2005; Bell *et al* 2001). It could also be due to poor pricing of agricultural products as such the farmers could not raise enough capital to procure such equipment; FMARD (2006).The thrust of this study was, therefore, to examine the role of agricultural mechanization through use of NCAM developed technologies in order to raise production, reduce drudgery and improve the living standard of the farmers.

MATERIALS AND METHODS

The study area consists of some selected farm settlements in Moro, Ifelodun, Asa and Ilorin West Local Government Areas of Kwara State, North-Central Nigeria. There was a reconnaissance survey of the study area to familiarize the researchers with some farm settlements that were aware and benefited from the activities of the Centre. An informal discussion with select farmers in these settlements was done. This was to intimate them with the purpose of the research. Based on this survey, some rural settlements were selected for the study being farm settlements that were either aware or ignorant of the activities of the Centre with regards to the development of agriculture.
Strategies were adopted for the purpose of comparative analysis of the major difference between the beneficiaries or otherwise. The study utilized primary data obtained from the farmers in the study area.

Multistage random sampling procedure was employed in selecting the respondents (sample) from where the data were collected Babbie, (1994). This method ensured a high degree of representation by providing the respondents with equal chances of being selected as part of the sample. A structured questionnaire was randomly administered to one hundred (100) respondents to provide information that formed the basis of the analysis. Twelve (12) communities were involved in the survey from within the study area (Table-1). Multistage random sampling procedure was employed in selecting the sample from where the data was collected Babbie, (1994). This method ensured a high degree of representation by providing the farmers with equal chances of being selected. The data collected from this research was subjected to descriptive statistics to determine the level of adopting NCAM developed technologies versus the status of the beneficiaries of the technologies before and after adopting NCAM technologies.

Table-1 Distribution of Sample Farmers Involved in the Study

S/N	Community	No. of Respondents
1.	Gatta	8
2.	JimbaOja	11
3.	KabbaOwode	9
4.	Falokun	8
5.	Idofian	7
6.	Elerin-Jare	9
7.	Ganmo	10
8.	Amoyo	9
9.	Shao	8
10.	Otte	5
11.	Lanwa	10
12.	Afon	6
Total		100

RESULTS AND DISCUSSIONS

A. Socio-economic Characteristics of the Respondents

Sex and Age Distribution

Results obtained from the study shows that all the 100 questionnaires distributed were returned. Only 10% of the respondents of them are females while the remaining 90% are males. Men, therefore, constituted a good proportion of those who engaged in various forms of agricultural production in the study area. Studies on gender issues in agricultural production and technology adoption have been conducted by many researchers indicating the different roles men and women play in technology adoption. In their studies on the 'Adoption of chemical weed control technology among cassava farmers in south eastern Nigeria' with special reference to Abia State, Udensi*et al.,* (2012) agrees with this finding concerning roles played by both gender. Results obtained also indicates that majority of the farmers (65%) were within the ages of 20 – 50 years (Fig. 1). This corroborates reports of FAO (1997) which placed the active age of farmers between 40 – 50 years thereby reflecting the active nature of farmers in the area. It was also discovered that only about 15 % youth of the age of 21 – 30 years were being attracted into farming possibly because youth of this age bracket were either in schools or travelled to urban centres in search of white collar jobs.

However, respondents whose age bracket ranged between 31 – 40 years constitute 33%. These sets of farmers were observed to be flexible, more likely to be dynamic and willing to take risks associated with farming with hope of improving their income levels. Individuals within this age group in the study area were however, constrained by lack of access to land for farming and collateral security for access to credit facilities.

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Only a few of them could afford to own land due to customary laws concerned with property inheritance.These observations were in agreement with the study conducted by Mishra *et al.,* (2002) that energetic and matured farmers were innovative and ready to accept and adopt new technologies that reduce time spent on farming.Women above 50 years of age do not show much interest in farming activities in the study area. They were mainly engaged in petty trading and other domestic activities.
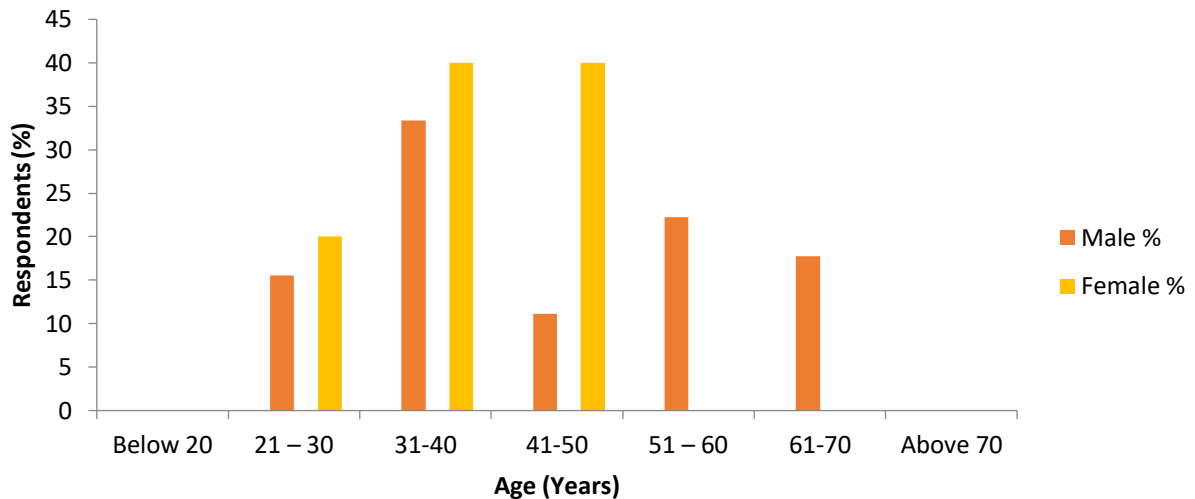

Fig. 1 Age Distribution of the Respondents

This figure represents the percentages (frequency) of the respondents (farmers) and not their numbers.

Literacy Level

Farmers in the study area are well acquainted with conventional farming techniques acquired over generations, but lack the knowledge of contemporary farming techniques and technologies. Level of farmer training is relatively low and opportunities for further training were limited and expensive. Farmers in the study area who have accepted and adopted improved technologies were in most cases observed to have a certain level of education. These observations were in agreement with an earlier study conducted by Caswell *et al.,* (2001) that education creates a psychologically favourable mental attitude for effective and efficient acceptance and adoption of new technologies. Education enhances the farmer's ability to make accurate and realistic management decision as well as makes them good adopters of innovations. Results of the study also show that 63% of the male respondents have no formal education while all the female respondents have a minimum of elementary education. It shows that 15% of the male respondents have elementary education, 13% has secondary education while the remaining 9% acquire a post-secondary education (Fig. 2). Further analysis shows that literacy level is generally low making comprehension of new farming techniques difficult.
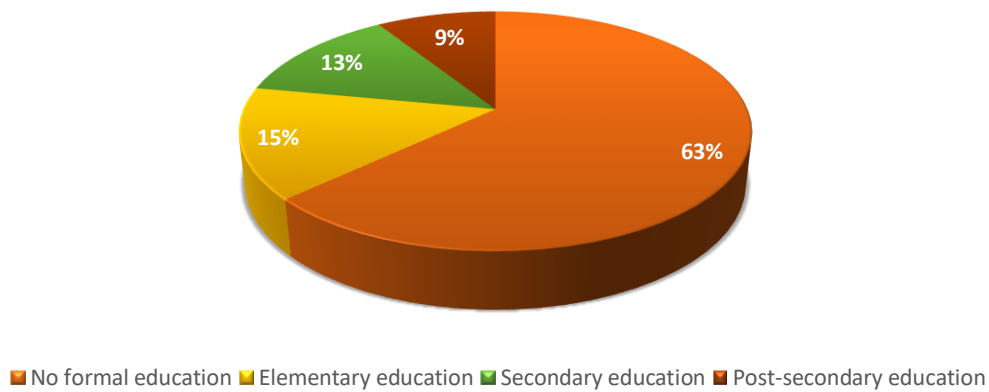
No formal education ■ **Elementary education** ■ **Secondary education** ■ **Post-secondary education**

Fig. 2 Educational Level of Respondents

Marital Status and Household Sizes

Results of study shows all the male respondents were married while 40% of the female respondents are widowed. Most female respondents were forced into farming after the death of their husbands as they were left with a sizeable household to maintain. Of the male respondents, studies shows that about 58% are married to a minimum of two wives irrespective of their religious beliefs. Family sizes play an important role in the rural economy of the rural areas. This is partly because the family is the main source of most rural labour in Nigeria. Family sizes are often used to determine wealthy farmers in the rural set-up. However, with the provision of tractor services and other farmer-friendly technologies by NCAM, it was observed that most of the farmers utilize their manual labour in operations such as planting, harvesting, weeding and conveyance of farm produce. Land preparations and sometimes weeding (by use of post-emergence herbicides to substitute weeding) are done with the help of services offered by the Centre. As a result of this, farmers in the study area have started sending their children to schools since they appear to have surplus labour. Fig. 3 shows the average household sizes of the respondents.
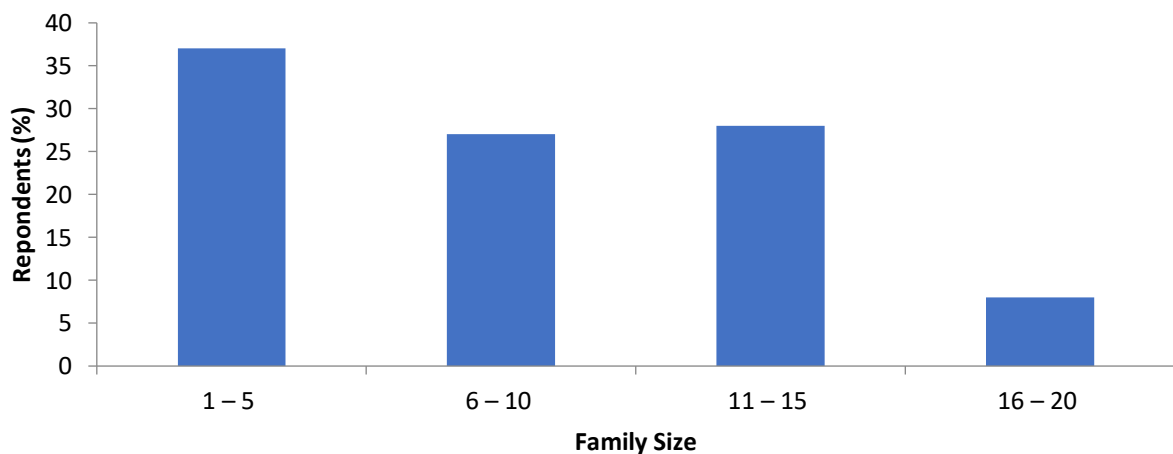

Fig. 3 Household sizes

Occupation

Results of the study shows that about 89% of the respondents practice farming as their main occupation,while the remaining 11% were either civil servants, drivers of commercial vehicles, mechanics, traders etc., that takes farming as their supplementary jobs to make the two ends meet.Farm practices in the study area was observed to be predominantly subsistence; mainly family-based labour; equitable small land distribution; low levels of agriculture extensions; and very limited access to credit.

Credit Facilities

The study observed that the most important source of capital available to most respondents was through their personal savings or by sale of their previous year's proceedings. There was virtually no institutional credit facility available to the respondents. Only about 9% of the respondents - constituting mostly the civil servants that enjoy loan facility from the Nigerian Agricultural and Cooperative Bank. About 10% of the remaining respondents secure other loans from cooperative societies.Majority of the farmers (71%) in the study area had no access to credit. Lack of credit facilities may also be the major reason of the minimal progress generally observed among the farmers in the study area. Awotide*et al.,* (2012) found access to credit as being the key element prerequisite for improving agricultural production and poverty reduction. This could enable them acquire relevant tools required for the acceptance and adoption of improved technologies for more profitable farming.

B. Agricultural Productivity and Income Level

Land Tenure and Farm Sizes

Results obtained from the study shows that 97% of the respondents are the legal owners of their farm lands - mostly owned through heritage and extended family system. The remaining 3% of the ownership are either rented or borrowed land. In agriculture, farm sizes are important for more efficient use of machines. Size of farm lands in Nigeria is fragmented over time by inheritance and because of this; the general structure farm land in the study area is small. The study also shows that about 2% of the respondents owned land of between 9 – 10 hectares while those that have less than 1 hectare constitutes the majority as indicated in Fig.4.By virtue of their limited land holding, these farmers may not be able to produce maximally since it may not be economical for them to procure equipment that may aid their farming activities. The study agreed with Polson and Spencer (1991who rightly found that only farmers with larger farms were more likely to pay close attention towards accepting and adopting farming technologies. Results obtained does not also contradicts the findings of Polson and Spencer (1991) that subsistence producers have traditional ownership rights to farmland either through inheritance or as part of communal village holdings.
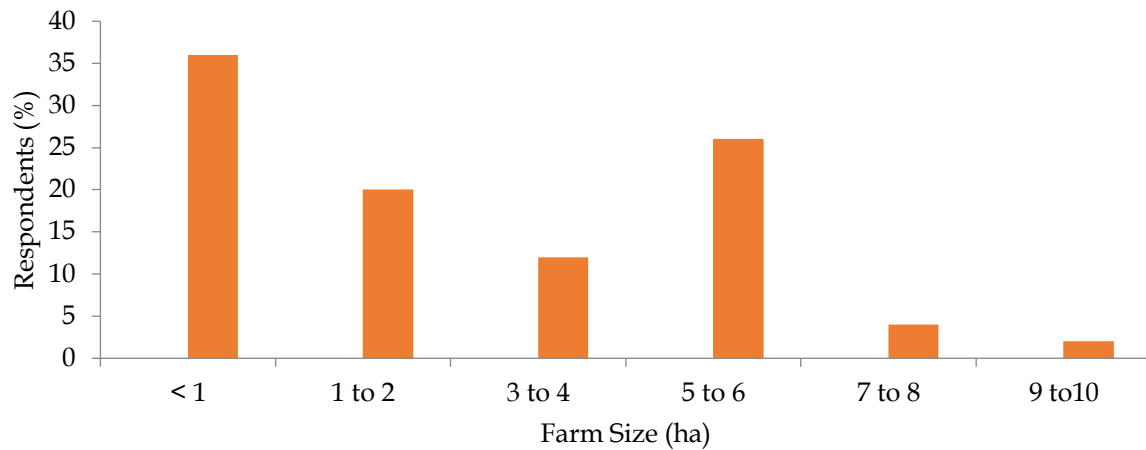
Fig. 4 Farm sizes

The results of the study also implies that majority of the respondents were peasant farmers producing on a small scale to feed their families and a small quantity for sale. It could also be inferred that the farmers have small capital base, poor access to farm input and lack of extension education. Findings of this study, therefore, agree with the assertion of Polson and Spencer (1991) that the agricultural sector has been left largely in the hands of poor and subsistence farmers. Similarly, the study observed that increasing farm size requires use of machines and tools that leads considerable increase in production and income (Van Den Berg *et al.,* 2007) and decreasing energy inputs compared with manual activities (Nkakini*et al.,* 2006); while some others revealed that the using mechanization has caused to productivity growth in agriculture thus, agreeing with the findings of Chen *et al.* (2008).

Crop Yield and Level of Income

Although about 30% of the respondents refused to disclose their actual crop production or their average annual income probably for fear of more taxes; the study observed that most of the respondents have considerable increase in their output with the adoption of NCAM developed technologies. They have also recorded corresponding increase in their income - and hence their living standards. Fig.5 shows income distribution of the respondent before and after the establishment of NCAM while Fig.6 indicates the average crop yield of the respondents and estimated yield before and after adopting NCAM technologies. The study does not record any decline from any respondent after adopting NCAM technologies. Results of the study, thus agrees with Awotide*et al.,* (2012) that mechanizing agriculture is a sure way of improving the living standards of the farmers.
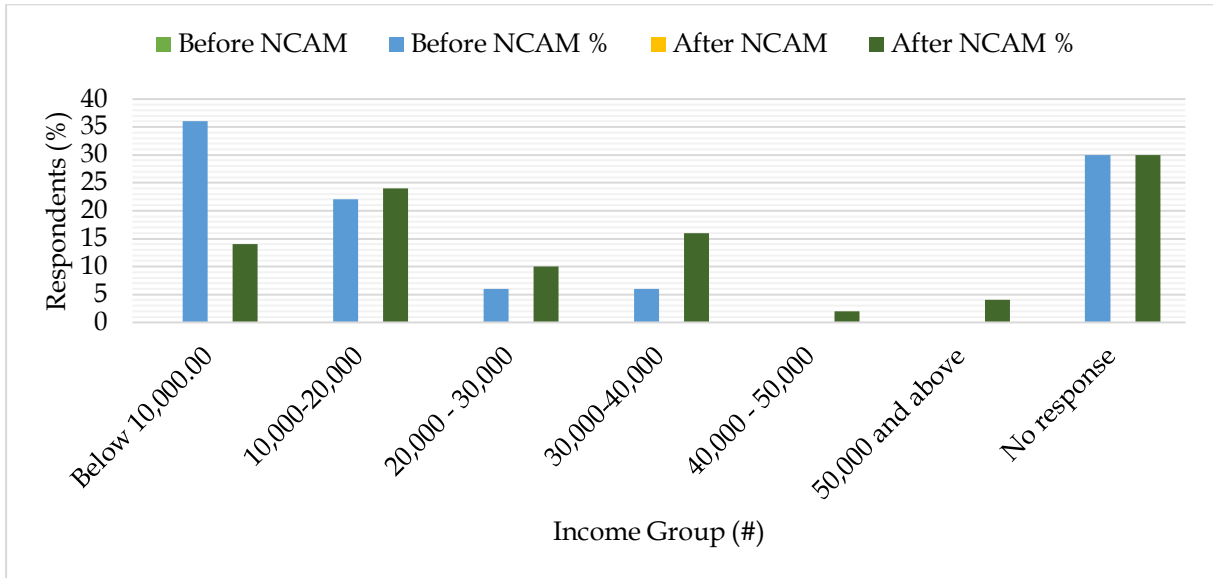
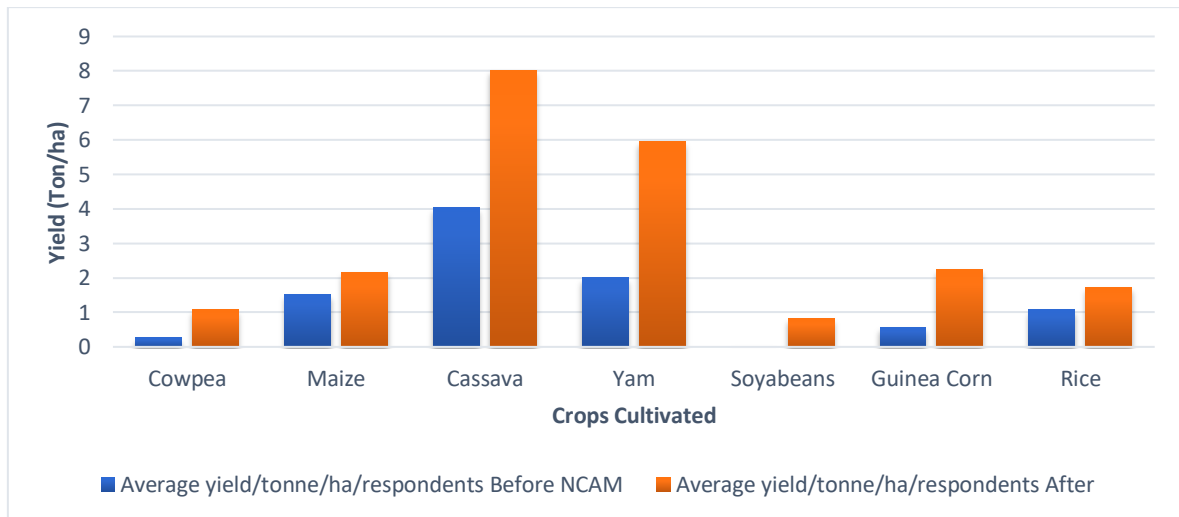Fig. 5 Income distribution of respondents before and after

Fig. 6 Average crop yield of respondents before and after adoption

Quality of Life and Ownership of Luxury Properties

Increase in agricultural production is directly proportional to the increase in rural income. This is also believed to go a long way towards improving the quality of the rural life, such as living in good houses, patronizing modern hospitals and acquiring certain properties for luxury or necessities. This includes bicycle, motorcycle, cell phone, car, radio, fridge, starlight, grinding machines and commercial vehicles etc. Study shows that more than 90% of the respondents live in iron roofed houses due to the improvement of the output. Although some of them still live in mud houses, about 65% of them have houses built with cement blocks. There is no respondent that lives in thatched hut or rented houses. Another index used to determine the quality of life is by close examination of other items acquired that are often based on pleasure as shown in Fig.7.

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Fig. 7 Ownership of personal/luxury items

Studies further revealed that about 60% of the respondents either benefits from modern health facilities or the services of experienced pharmacists when such needs arises. Of the remaining 40%, almost all of them visit patient medicines stores while about 10% combine both the modern and traditional medical systems. Only very few still stick to the traditional medicine system that had been the normal practice before adopting NCAM developed technologies. With the exception of Falokun, all the other settlements enjoy the rural electrification system either through communal efforts or jointly with government assistance. There were access roads (though untarred in most cases) linking all the settlements. This makes transportation of inputs to the rural areas and farm produce to the urban centres relatively cheaper. All the settlements enjoy good sources of water either through the pipe-borne system, wells, bore holes or streams to a lesser extent.

CONCLUSION

The role of agricultural mechanization in rural development was examined to give way for the in-depth analysis of the socio-economic characteristics of the respondents, their productive power and level of income. There was a corresponding increase in status of the respondents who adopted NCAM developed technologies. This also influences their ability to send their children to school due to less dependence on of family labour. The study shows that mechanizing agriculture could contribute to improved agricultural production and economic transformation of the rural settlements if appropriate technologies are more accessible and effective.

RECOMMENDATION

The study recommends the creation of awareness through exhibitions, training and publicity of the developed technologies would greatly improve the adoption such technologies.

CONTRIBUTION TO KNOWLEDGE

This study has established that the adoption of improved agricultural technologies greatly increase the production capacity, reduce drudgery and improve the living standard of the farmers

DECLARATION OF CONFLIT OF INTERST

The authors declare no competing interest

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