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Farm Machinery Utilization and Maintenance Effects on Sustainable Development of College Farms

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ABSTRACT: In order to expose students in tertiary institution learning agricultural science to the concept of farm mechanization, which could aid self-reliance after graduation, the federal government of Nigeria has provided farm machinery to make teaching and learning effective in this regard. The focus of this study therefore is to assess farm machinery deployment, management and maintenance effect on mechanization for sustainable development of college farms in Nigerian. The study population comprised all federal and state colleges covered by tertiary institution trust fund (tetfund). Sample of 24 colleges offering agricultural education was randomly drawn for the study. A structured questionnaire was used for data collection. Data obtained was statistically analysed using mean from a 4 point likert rating scale. Results obtained revealed that out of the 252 farm machinery available in the sampled colleges, 25 percent are tractor, 20 percent each are plough and harrow while 18percent are ridger and planter/fertilizer distributor respectively. The mean response of 2.4, 2.2 and 2.3 in disagreement to the research questions shows that there is need to improve in farm machinery utilization and maintenance as well as for teaching and learning in the colleges.

KEYWORDS: Farm machinery, Mechanization, Maintenance, Sustainability, College farm

1.0 INTRODUCTION

Farm mechanization is the use of farm machinery to make farming activities from land clearing to harvesting as well as post-harvest faster and easier. It has relieved man of use of crude implement such as machete and hoes which causes extreme physical exertion. It has also proved to be more advantageous in terms of labour input, yield, expansion and diversification. Research has shown that to grow beyond subsistent farming, farmers must adjust to tractor farming which can see cultivated land increase beyond 20 ha with high yield and increase income [1];[2].

It has been noted that the benefit of mechanizing farm power can never be over emphasized when weighed on both economic and social scale. On economic scale, farm mechanization results in higher and effective utilization of labour, reduction in costs, larger cultivated land area higher yields, adopting of novel crops, reducing waste both in harvest and post-harvest operations, and earning income through renting amongst others. On the social scale, application of mechanized farm power leads to less workloads, increase safety, gaining self-esteem, and encouraging younger and more inventive individuals to stay in rural areas and work on the land [2]. In spite of the great advances in farm power and machinery deployment to increase awareness amongst the students on the gains of applying agricultural mechanization on farms, it appears that the level of tractors and implements deployed is not enough and the utilization of available ones needs to be scaled up to prevent usage of traditional tools for various farm activities in the colleges farm [1].

There also seems to be lack of robust maintenance plan for anticipated breakdowns of farm machines as workshop and garages to this effect as well as skilled manpower to man workshop for the machine's maintenance and services appears to be inadequate, posing challenge to sustainability and productivity. Research has shown that suitability of application and performance of farm machines relies on the dependability of the machinery used, the environment of operation, and efficiency of maintenance plan [3]. According to [4], adequate utilization and maintenance improve the economic advantage of tractors. [5], in their reports proposed that proper care in terms of maintenance be given to tractors in order to prevent avoidable wears and failures. This is obvious because adequate attention means proper lubrication, cleaning and timely inspection. It should be noted that mismanagement, carelessness and low-quality maintenance are the main constraints which reduces tractor efficiency. Every machine needs maintenance even if it is of the greatest of design. Hence, the maintenance must be made when it may have the least disturbances in its utilization [6].

[7] noted that though government both at federal and state levels have made some advancements in machinery deployment, a lot of setbacks are still militating against agricultural machinery utilization among which are: lack of competent management and stringent supervision; lack of

training of individuals responsible for operating, maintaining and repairing of the equipment; lack of workshop and repair tools; lack of responsible and skilled operators.

In terms of utilization, [8] observed that a tractor is made to work with a certain power and ability to pull prescribed load with hourly period to perform farm operations and that not following this gives rise to underutilization. [9], highlighted factors that contribute to underutilization of farm machinery to include the unavailability of farm implements, using poorly trained tractor operators and inadequate land area cultivation as well as inconsistent cropping system. Thus, [10] was of the opinion that the minimum rates of utilization of farm machines should be adhered to for effective productivity.

Also, it was stated that achieving maximum returns from farm tractors, requires that the owner must regulate the utilization and productivity of the tractors. Tractor utilization can be expressed as the duration of time within which the tractor is fully utilized for its productive work. Utilization is also expressed as a percentage of the effective hours that the tractor has operated in a year with respect to the budgeted hours. [8], therefore reported that if the planned working hours per annum of a tractor is 1000 h and it only worked 500 h, then the tractor is utilized only 50%

[11], from their studies in Edo State tractors-hiring section reported that lack of implements for tractors use and poor maintenance culture contributes to tractor under-utilization in the state. [12], studied the maintenance knowledge of tractor operators in Kwara State, Nigeria. Their report showed that only a few could undertake major maintenance jobs. He then suggested adequate training of operators on maintenance as this will help to make tractors available for use when given quick repair attention.

The main impact of mechanizing primary tillage operations is to increase the area under cultivation. This in turn creates a demand for additional labour for subsequent operations and provides opportunity for expansion. College tractors can play a pivotal role in a community where this colleges are situated, hiring out tractors provides support to poorer households and encourage corporative to benefit from innovative research in farming methods and supply of high yield crops [2]. This research will access farm power and machinery type available for College farm mechanization in colleges of education in Nigeria, examine maintenance program formulation and application for sustainable farm power and machinery operation, find out investment on cropping systems and returns for farm project sustainability, ascertain the extent to which students' knowledge on farm machines and its application have improved through practical use for demonstration in learning and any limitation imposed by curriculum content

2.0 METHODOLOGY

2.1 Description of study area

The study was conducted in the colleges of education benefiting from tetfund and having department of agriculture both in state and federal, within the six geopolitical zones of Nigeria. Twenty-four colleges out of the population of the colleges was randomly selected and represented by A(South-south), B(South-east), C(South-west), D(North-east), E(North-west) and F(North-central), four from each zone with two each of state and of federal colleges of education respectively. From each of the 24 colleges, staff drawn comprises of college management representative, head of departments, farm managers, tractor operators, farm hands and students.

Data was collected by questionnaires, interviews. Questionnaire with the caption: Farm machinery utilization and maintenance effects on mechanization for sustainable development of collage farms in Nigerian colleges of education was administered. The questionnaires was designed to elicit response on the proposed parameters of the study namely: farm power and machinery type available, investment on crop and returns, maintenance programme formulation and extent to which students knowledge on farm machinery and its application have improved.

2.2 Data Analysis

The questionnaire administered to the staff and students from each of the colleges across each zone was retrieved. Data retrieved was sorted and analyzed using inferential statistics. A total number of farm power and machinery type identified in the colleges was recorded as y whereas individual farm power and machinery type was recorded as x. From this, the percentage of machines available and its functionality was calculated using: $z = \frac{x}{y} \times 100$

Where z = Percentage of type of farm power and machinery
x = Total number of farm power and machinery type
y = Total number of farm power and machinery identified in the sampled colleges..

Data obtained was also analyzed using mean values based on four-point Likert scale rating of Strongly Agreed (SA=4) , Agreed (A=3), Disagreed (D = 2) and Strongly Disagreed (SA = 1) used to elicit responses from the respondents. A decision rule of 2.5 was established by taking the mean values:

Decision rule = $\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$.

Hence mean response on any item below 2.5 for which response is solicited was considered as disagreement with the specified statement while mean response above 2.5 was considered as agreement with the specified statement.

3.0 RESULT AND DISCUSSION

Results show that there are average of 252 farm machinery identified from the sample colleges visited in the six geopolitical zones A to F. Table 1 shows percentage distribution on average of farm machinery types.

Table 1: Farm power and machinery type available for school farm mechanization in colleges of education in Nigeria

	Zone A -F	
Machine types	Availability/ Functionality (%)	
Tractor	25	10
Plough	20	8
Harrow	20	7
Ridger	18	5
Planter/fertilizer distributor	18	3

On average, out of the 252 farm machinery available in the sampled colleges, 25 percent are tractors with 10 percent of available tractors functional. 20 percent are plough and harrow respectively but 8 percent and 7 respectively are functional, whereas 18 percent are ridgers and planter/fertilizer distributors respectively, while 5 percent and 3 are functional respectively. This is vividly depicted in figures 1 and 2.

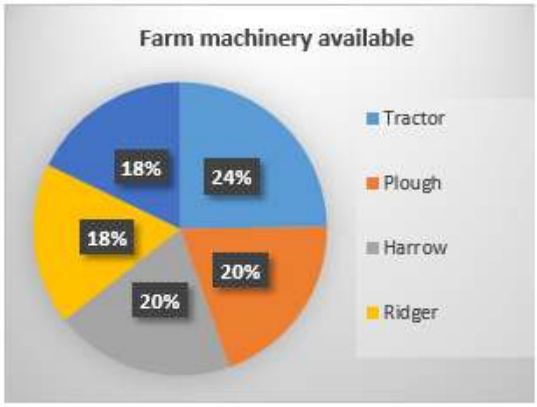

Figure 1: Percentage of farm machinery available in the sampled colleges

Figure 2: Percentage available and functionality of farm machine in the sampled colleges

Table 2 shows response to research question 2 which seeks to find out if there is availability of record of investment on crops and returns for farm project sustainability. Respondent agree as shown in the mean value of item 1 that the colleges have school farms for demonstration of farming activities.

Respondents also agree on item 4 that various crops are planted on the school farm. However, respondents disagree on item 2, 3 and 5 showing that the school farms have little records of various crops planted and harvested annually, and less attention is given to specified periods and procedure for planting and maintenance of the farm.

Table 3 shows response as to the proper management of tractor and maintenance. The disagreement of statements in items 1, 2 and 3 shows that machinery operators do not receive regular training for farm machinery routine maintenance. And so performs less routine maintenance such as checking of farm machinery joints for greasing, regular removing of dirt from cutting edges, cleaning of sensitive parts and coating with paints in storage for the next farming season.

Respondents however agree to the statements in items 3 and 5. There is no farm machinery maintenance manager to direct farm workshop as none is provided and hence there is no record of routine maintenance- fuel, oil, water, tyre pressure checks followed before operation.

Table 4 shows respondent response as to the availability of formulated maintenance program developed by the Agricultural department of the colleges and applied for sustainable farm power machinery operation. The mean values of item 1 and 3 shows that respondents disagreed on the statement, implying that there is currently no designed maintenance approach for farm machinery maintenance in the colleges as well as adequate tool for farm machine maintenance.

Similarly, respondent agrees on statements of items 2, 4 and 5. There is no provision for machinery maintenance workshop in the college. Repairs of and servicing of the farm machines are carried out by experts from outside the school. Arrangement for tractor repair and maintenance is made only when there is a breakdown of machinery.

Table 5, shows the effect of curriculum content on practical use of farm machinery for demonstration. Respondents disagree on the statements in items 1, 2 and 3. As shown from the mean values, curriculum contents do not permit express practical activities with farm machines. Students are taken out to observer how tractors and farm implements operates on farm but less often. From indication, they need to be satisfied from what they learn from practical outings.

Respondents however agree to the statements in items 2 and 4. There is no permanent provision for practical demonstration of use of farm machinery for farm operation and more is needed to be done for farm power and

machinery practical to deepen student's knowledge and appreciation of the concept of farm mechanization

3.1 Discussion of findings

The first research question of this study for which the questionnaire item was designed to address was to ascertain if there is farm power and machinery type available for school farm mechanization in colleges of education in Nigeria.

Table 2: Is there record of investment on crops and returns for farm project sustainability

			Response scale						
S/N	Questionnaire Item	(X)	SA[4]	A[3]	D[2]	SD[1]	Total	Mean	Decision
1	There is land area for college demonstration of farming	F	8	-	3	2	24	3.04	Agree
		FX	32	33	6	2	73		
2	The school farm has a record of various crops planted and quantity harvested annually	F	-	5	10	9	24	1.8	Disagree
		FX	-	15	20	9	44		
3	Periods and procedure of planting and maintenance is contained in farm record	F	-	4	13	7	24		Disagree
		FX	-	12	26	7	45	1.9	
4	Various crops are planted and harvested on the school farm	F	7	12	4	1	24	3.04	Agree
		FX	28	36	8	1	73		
5	There is a record of annual return to investment of crop in the school farm	F	-	7	12	5	24	2.1	Disagree
		FX	-	21	24	5	69		
	Grand total							2.4	Disagree

Table 3: Is there proper management of tractor and maintenance by the operators?

			Response scale						
S/N	Questionnaire Item	(X)	SA[4]	A[3]	D[2]	SD[1]	Total	Mean	Decision
1	The operators receive regular training for some farm machine maintenance and minor repairs	F	-	1	12	11	24	1.6	Disagree
		FX	-	3	24	11	38		
2	Farm machinery rotating joints are greased and dirt removed from cutting parts regularly	F	-	2	15	7	24	1.9	Disagree
		FX	-	8	30	7	45		
3	There is no farm machinery maintenance manager to direct farm machine operations	F	8	13	1	2	24	2.7	Agree
		FX	32	29	2	2	65		
4	Sensitive parts of the farm machines are cleaned and coated with paints in storage for the next farming season	F	-	1	15	8	24		
		FX	-	3	30	8	41	1.7	Disagree
5	There is no record of routine maintenance- fuel, oil, water, tyre pressure checks followed before operation and no workshop.	F	10	10	2	2	24		
		FX	40	30	4	2	76	3.2	Agree
	Grand mean							2.2	Disagree

Table 4: Is there lack of maintenance program formulation for sustainable farm power and machinery operation?

			Response scale						
S/N	Questionnaire Items	(X)	SA[4]	A[3]	D[2]	SD[1]	Total	Mean	Decision
1	There is a designed maintenance approach for farm machinery in the college	F	-	1	12	11	24	1.6	Disagree
		FX	-	3	24	11	38		
2	There is no provision for machinery maintenance workshop in the college	F	9	13	1	1	24	3.3	Agree
		FX	36	39	2	1	78		
3	There is enough and adequate tool for farm	F	-	1	10	13	24	1.5	Disagree

	machine maintenance	FX	-	3	20	13	36		
4	Repairs of and servicing of the farm machines are carried out by experts from outside the school	F	10	14	-	-	24	3.4	Agree
		FX	40	42	-	-	82		
5	Arrangement for tractor repair and maintenance is made when there is a breakdown	F	9	13	2	-	24	3.3	Agree
		FX	36	39	4	-	79		
	Grand mean							2.6	Agree

Table 5: Have Students' knowledge on farm machinery and applications improved through practical demonstration

			Response scale						
S/N	Questionnaire Item	(X)	SA^4	A^3	D^2	SD^1	Total	Mean	Decision
1	Curriculum content permit express practical activities with farm machines	F	2	5	8	9	24	2	Disagree
		FX	8	15	16	9	48		
2	There is no permanent provision for practical demonstrate of use of farm machinery for farm operation	F	7	9	2	4	24	2.6	Agree
		FX	28	27	4	4	63		
3	Students are usually taken out to observer how tractors and farm implements operates on farm	F	2	4	12	6	24		Disagree
		FX	8	12	24	6	50	2.1	
4	More is needed for farm power and machinery practical to deepen student's knowledge and appreciation of the concept of farm mechanization	F	9	10	2	3	24	3.2	Agree
		FX	36	33	4	3	76		
	Students are satisfied by what they learn from farm power practical	F	2	2	9	11	24	1.8	Disagree
		FX	8	6	18	11	43		
	Grand mean							2.3	Disagree

The findings from the mean value of the respondents as shown in table 1 is that in each of the zones in the study sample, there is at least one each of the following: tractor, plough, harrow, ridger and planter at different levels of functionality. The chart shows the relationship between availability and functionality. Difference between number available and number in operation was attributed to theft and breakdown due to lack of maintenance. Nevertheless it is obvious therefore that there are machineries available for school farm mechanization in the colleges. However this depends largely on the objective for which the machinery were deployed. If the focus of the farm machines are for training students on the concept of farm mechanization for subsequently application as trained teachers or in real life farm project, then there is need for deployment of more farm machines. Also the issue of sustainability need to be given attention considering the percentage of machinery available and percentage functional. Without this, the objective for which the tractors are deployed may not be realized.

The second research question of this study for which the questionnaire item was designed to address was to ascertain if there is record of investment on crops cultivated and returns for farm project sustainability. The findings from the mean value of the respondents expressed in table 2 shows that though the colleges have school farms, plant various crops and make harvests, there is limited record of investment on crop cultivated and annual returns for farm project sustainability.

That there is limited records of periods, procedure of planting, maintenance, records of investment and returns highlight the need to attach more importance on elements of sustainability of the college farm. There is need to provide guideline tobe followed, source of financing the farm to sustain mechanization. This will ensure that the progress or otherwise of the farm does not solely depend on the initiative of the head of department.

In line with Mrema et al (2015) there is need to formulate agricultural mechanization policies and develop strategies for their implementation, at any of level of application

The third objective of this study for which the questionnaire item was designed to address was to ascertain if there is

proper management of tractor and maintenance by the operators for sustainability. The findings from the mean value of the respondents as shown in table 3 is that there is need for proper management of tractor and maintenance by the operators for sustainability. This is attributed to the overall objective for which the farm machinery are deployed for. If there is no clear objective and a follow up, there will a setback on sustainability. If the objective for the deployment of the farm machineries were to train students for self-reliance, to make the department a hub for new innovation in farming and to export knowledge to neighboring communities, there will be need for a farm maintenance engineering technician or technologist to ensure the efficient operation and maintenance of the machineries. Training and retraining of the operators becomes necessary to prevent avoidable errors in machine operation that may initiate damage to farm machinery.

The fourth objective of this study for which the questionnaire item was designed to address was to ascertain if students' knowledge on farm machinery and applications have improved through practical demonstration and any limitation imposed by curriculum content. Considering the mean value of the questionnaire items in table 4, this objective was not realized. The extent to which students' knowledge on use and application of farm machinery will be improved is dependent on the number of times practical on the use of the machines are carried out and the expected learning outcome met. And this is dependent on the curriculum content for the course of study which must permit express practical activities with farm machines with a permanent structure – a farm power and machinery workshop for component learning and specified land area for practical demonstration of effect of application of the farm machines.

It is obvious that for the students to be satisfied from what they learn from farm power practical, more needs to be done to improve on the usage of farm power and machinery for practical demonstration to deepen students' knowledge on application of the concept of farm mechanization. In line with Mrema et al. (2015) specifying the form and level of mechanization that is appropriate for the students and developing guidelines for determining, monitoring and evaluating how the guidelines are met will aid sustainability.

4.0 CONCLUSION

There are farm power and machinery available in the sample colleges surveyed, but they are underutilized in terms of being a centre for demonstration of the concept of farm mechanization. Curriculum content limit extent of usage of the machinery and its effect on learning outcome. There is currently need to design a maintenance approach for farm machinery in the colleges and there is also need to keep records of annual land area cultivated in association with farm power and machinery utilization for crop cultivation, harvesting or processed for sustainability of college farms. There is need to bridge the gap between what the students should really learn in practical terms to be stimulated so as to embrace enthusiastically the concept of farm mechanization and what is specified in the curriculum content. This will enable the effect of the machines base on its intended objective to be felt to a replicative degree by the students on graduation.

It is recommended therefore that there should be more deployment of farm machinery for the tertiary institution in Nigeria and provision for maintenance for sustainability. This should be matched with the development of workshop and land area designed specifically for teaching and practicing of the concept of farm mechanization as well as for exporting knowledge of the concept to neighbouring communities with specified objective enshrined in the curriculum.

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