International Journal of Organic agricultural Research & Development
Volume 19 (1) (2024)

EFFECT OF FARM MECHANIZATION ON MAIZE FARMERS' OUTPUT IN OYO STATE NIGERIA

Ayandele, Ayanbukola Oluwaseun, Oyetoro, John Oyewole and Adewole, Williams Adekunle
Department of Agricultural Extension and Rural Development
Ladoke Akintola Univeristy of Technology, Ogbomoso, Nigeria.
Corresponding author: jooyetoro@lautech.edu.ng

ABSTRACT

There is supply-demand gap in maize production in Nigeria which has culminated into scarcity and hike in prices of maize and its products which need urgent increased production. This gap could be bridged through mechanization of maize production. Thus, the study analyzed the effect of mechanization on maize farmer's output in Oyo Sate, Nigeria. A multistage sampling procedure was used to select a sample size of 138 maize farmers, comprising of 108 users of farm mechanization and 30 non-users farmers. Primary data was used to elicit information from the maize farmers through the administration of a well-structured interview schedule. The data were analyzed using descriptive statistics tools like frequency, percentages, mean, standard deviation and Weighted Mean Score (WMS) while T-test were used as the inferential tool to test the hypothesis. The result revealed that tractor was the most utilized farm machines and ranked first with weighted mean score (WMS) of 2.97. Additionally, Paired T-test analysis revealed a significant difference in output per hectare of users and non-users of farm mechanization in maize production (t = 7.728) with a mean difference of 587.39kg at 1% level of significance. This confirms a wide gap in output per hectare between users and non-users benefiting users. The study concludes that despite the high cost of using farm mechanization, it is still beneficial to the users as they earned more income than the non-users. It was therefore recommended that farmers should organize themselves into cooperative society so as to pull resources together in order to purchase farm machines.

Keywords: Mechanization, Farm machines, Maize Farmers, Maize, Maize Output

INTRODUCTION

Maize is a major cereal crop cultivated in the rainforest and derived savannah zones of Nigeria (Iken and Amusa, 2014). It is significant among grains like rice, sorghum, and millet due to its adaptability to various ecological conditions and its importance to farm families (Adekunle and Nabint, 2010). Maize contributes approximately 43% of calorie intake in Nigeria and has a daily consumption rate of 53.20g per capita this is according to Food and Agricultural Organization Statistics (FAOSTAT, 2017). Despite its importance, maize production per hectare remains low (1.3 tonnes per hectare), insufficient to meet the demands of the growing population (Ayinde *et al.,* 2020). This calls for mechanization of agriculture especially for maize production.

Mechanization involves using machinery to accelerate production, reduce human labor, and enhance productivity (Abubakar, 2015). It includes: Development and introduction of mechanized assistance at various technological levels: Efficient selection, operation, repair, maintenance, and replacement of machinery. Use of farm equipment and power sources for field production, water control, material handling, and post-harvest operations (Simeon and Jijingi, 2017).

Mechanization offers numerous advantages that appeal to farmers, including: Ensures agricultural activities like planting are completed within optimal timeframes. Enables the cultivation of larger areas and more efficient farm operations. Decreases the physical labor required for farming activities. Enhances soil conditions for seed germination and plant growth. Facilitates large-scale production and higher yields. Provides consistent water supply through irrigation systems. Drains waterlogged farms, making them suitable for cultivation. Improves the economic conditions of farmers. Reduces post-harvest losses and wastage (Faborode, 2011).

The supply-demand gap in maize production is due to several factors: Traditional Farming Methods**:** Such as reliance on rudimentary tools and techniques like cutlass, hoe, bush burning,

and manual harvesting. (Akinola et al., 2019). This has made Nigeria to continue to face a threatening food security crisis with its growing population becoming increasingly dependent on imported foods.

The food crises could be attributed to low level of agricultural mechanization in Nigeria. Previous efforts in mechanization of agricultural productivity by various governments had been through the importation of tractors and implement into Nigeria. This has however not been able to solve the problem of our laggard embrace of mechanization. However over the years, little in term of policy guidelines have been formulated to achieve the objectives of effective agricultural mechanization process in the Country. Notwithstanding, there have been several programmes and projects that have been created to improve agricultural productivity with each having different implementation challenges. As a consequence of this, peasant farmers using primitive tools still constitute the bulk of producers of the food crops consumed in the Country. Nigeria is blessed with 98.3million hectares of arable landmass but only 35 per cent of the arable land is under actual cultivation (FMA, 2016). Despite the high proportion of cultivated landmass relative to the total available space, food production to feed the teeming populace has remained a mirage.

Therefore the study examined the effect of farm mechanization on maize farmers output in Oyo state, Nigeria. The study specifically described the socioeconomic characteristics of the respondents, identified the different forms of farm mechanization available to the respondents, determined the usage level of the available farm machine, identified the benefits of using farm mechanization, investigated the constraints to the usage of farm mechanization on maize production and determined the output of maize production per hectare of mechanized and non-mechanized maize farmers.

METHODOLOGY

The study was carried out in Oyo state, Nigeria. The study employed a multistage sampling procedure and used simple random technique to select Ogbomoso and Oyo Agricultural zones. From the selected zones, 50% of the local government were randomly selected from each zones. In Ogbomoso zone; Oriire, Surulere, Ogo-Oluwa were randomly selected while in Oyo zone; Iseyin, Oyo west and Oyo East were randomly selected based on the number of registered maize farmers under the umbrella of AFAN (All Farmers Association of Nigeria). In the list obtained from selected local governments, 5% of the registered maize farmers using mechanized tools and non-mechanized tools were selected to give sample size of 138 maize farmers. For this study, primary data was used to elicit information from the maize farmers through the administration of a structured interview schedule that contained both open and close ended questions. The interview schedule contain questions that aids the collection of useful information in relation to the stated objectives of this study. The dependent variable is the output of maize farmers in Oyo state. This was measured as the output of maize production in kilogram/hectare. A comparison was done to determine the effects by comparing the output of mechanized farmers with that of non-mechanized farmers. Data for the study was analyzed using descriptive statistics tools like frequency, percentages, mean and standard deviation and T-test were used as the inferential tool to test the hypothesis.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of users and non-users of farm mechanization on maize production

The distribution of respondents by age as shown in Table 1 revealed that for the users of mechanization, the mean age of respondents was 47.6 years while that of non-users was 52.5years. Though the non-users were relatively older than the users of mechanization, they were still in the middle and productive age and are expected to be willing and prompt to accept any innovation including mechanization that would improve their production processes.

The result also revealed that 80.6% of respondents of the users were male while 19.4% were female. For non-users, 63.3% of respondents were male while 36.7% were female. This implies that more men were involved in the use of farm mechanization in the study area than women.

This could be to the fact that men are very fearless and courageous having ability to try out innovation unlike women who are generally seen as conservative and careful in taking risks. This finding also corroborates the observations of some researchers that most rural farming households are mostly male which have the required strength and pleasure to carry out farming activities (Ajibade *et al.,* 2013).

Additionally, the mean year of schooling of users of mechanization was found to be 8.2years while that of non-users was 6.1 years. Though the users of mechanization were a little more educated than non-users. The results implies that majority of the respondents did not even complete secondary education which is an indication that respondents were at low level of education and this could have negative effects on their ability to adopt or use agricultural mechanization. Having adequate education is usually an avenue to understand things which will be useful in the pursuit of livelihood activities and other areas of life.

The mean household size for users of mechanization was 7 members while that of non-users was 8 members. Though non-users had a slightly higher household size than the users. This implies that respondents had relatively large household size, which could also serve as impediment to the use as farm mechanization as majority of the farmers in the rural areas generally involve their

The mean year of maize farming experience was 29 years while that of non-users was 31.2 years. The result implies that respondents were experienced maize farmers and should know and understand the effects the use of mechanization would have on their production.

Equally, based on the year of mechanization experience, the mean year of farm mechanization experience was 18.4 years. The mean farm size of the users of mechanization was 14.3 hectares while that of non-users was 2.3 hectares. The result implies that respondents were large scale farmers and the use of farm machineries will really improve their farming activities. The mean hectares of maize cultivated by the users of mechanization was 8 hectares while that of non-users was 1.8 hectares.

Availability and Level of mechanization usage among maize farmers

The distribution of respondents by the availability of mechanization revealed that 93.5% of respondents claimed the availability of tractor, 77.3% mentioned planter, 69.4% indicated plough while 51.9% attested to the fact that harrower was available. Other available mechanization among maize farmers were sprayer (72.2%), harvester (15.7%), seed drill (51.9%), fertilizer spreader and irrigation tools (32.4%), tyne cultivator for wedding and rotavator (7.4%), thresher 59.3% and grain dryer (29.6%). The result implies that tractor and planter were the most available mechanization to the respondents. This could be due to the fact that tractor is the major farm machine that is used in land clearing and land preparation before planting. So it an essential and indispensable farm machinery for maize production all over the word.

Base on the level of use of mechanization, tractor was ranked first with Weighted Mean Score (WMS) of 2.97, this was closely followed by planter with WMS of 2.19. Next is sprayer with WMS of 2.14 while plough was ranked fourth with WMS of 2.06. Others are in the following order: harrower (WMS=1.66), thresher (WMS=1.64), seed drill (WMS=1.53), fertilizer spreader (WMS=1.27), harvester (WMS=1.20), grain dryer (WMS=1.12), irrigation tools (1.01), rotavator (kill weeds, incorporates manures/fertilizers (WMS=0.84), tyne cultivator for weeding (WMS=0.69). The result implies that tractor was the most utilized of all the available farm machines. This is in alignment with Chapoto *et al*., (2014), who opined that an increased number of medium-scale farmers who are also tractor owners creates new potential for hiring-out services to cater to the needs of smaller farmers, who are otherwise unable to afford investing in larger scale machinery or technologies. Also the greater access to institutional credit allows these farmers to purchase or use modern machinery with less financial burden, and also creates an opportunity for farmers to generate additional revenue (Mottaleb *et al,* 2016).

Benefits of the use of farm mechanization on maize production

The distribution of respondents by the benefits of mechanization as revealed in Table 3 showed that timely sowing and thus avoids loss that could be incurred was ranked first with WMS of 3.26, this was closely by reduction in the human drudgery and enhance the agricultural productivity with WMS of 3.25. Next is mechanization encourages timeliness of farm operations with WMS 2.98 while best return on farm income with MWS of 2.97 ranked fourth. Other identified benefits are ranked in the following order: Improves the quality of agricultural produce (WMS=2.96), increase the food production capacity of farmers leading to reduced poverty and improved livelihoods (WMS=2.93), increase the prospects of the local agro-allied industry (WMS=2.83), contribution in enhancing cropping intensity (maize population) (WMS=2.65), mitigation of the shortage of farm labour (WMS=2.60) while employment of human labor was ranked last with WMS of 2.48. The results suggest that the most significant benefits of mechanization, as identified by maize farmers, are the ability to sow crops timely, thereby avoiding potential losses, and the reduction in human drudgery, which enhances agricultural productivity. The results aligns with that of Ayodele (2012), who opined that access to machinery not only reduces the physical strain associated with certain farming activities but also saves time in land preparation. Sims and Kienzle (2017) also corroborated this findings when he also reported that reduction of drudgery and difficulty in farming tasks can significantly enhance agricultural productivity and improve the overall lifestyles of farmers.

Constraints to usage of farm mechanization on maize production

The results in Table 4 highlight the various constraints faced by respondents in farm mechanization for maize production. The top-ranked constraints, both with a Weighted Mean Score (WMS) of 1.98, are the affordability and cost-effectiveness problem and poor access to maintenance services and spare parts. This is followed closely by inadequate training to operate and maintain farm equipment, which has a WMS of 1.94.

Other significant constraints include infrastructure limitations such as poor road networks and inadequate storage facilities (WMS=1.89), and adverse weather conditions like extreme rainfall or drought, ranked fifth with a WMS of 1.89. Additional constraints are ranked as follows: Field topography and size (WMS=1.56): Limited availability of appropriate and functional farm machinery (WMS=1.48): Unfavorable government policies and interventions (WMS=0.96): Socio-cultural factors, such as beliefs against using machines (WMS=0.71) and Energy availability issues, such as fuel or electricity scarcity or expensiveness (WMS=1.60). The findings imply that the most significant constraints for the respondents are affordability and cost-effectiveness, as well as poor access to maintenance services and spare parts.

The high cost of farm machinery makes it difficult for local farmers to purchase them. Even when some farmers manage to buy the equipment, maintaining it becomes another a significant challenge. These results aligns with the study by Houmy *et al.* (2023), who reported that agricultural systems in many African countries, particularly in Sub-Saharan Africa (SSA), are primarily based on subsistence farming. The cash incomes of farmers remain relatively low due to not only low production and productivity but also the lack of added value to crops sold. Consequently, many farmers lack the financial capacity to purchase or utilize farm machinery services.

Output and income per hectare of users and non-users of farm mechanization on maize production

The data in Table 5 illustrates the significant output and income of user and non-users of machinery in maize production. Specifically, users of farm machines achieved a mean output per hectare of 1,807.04 kg and a mean income per hectare of N840,050.44. In contrast, non-users of farm machines had a mean output of 1,220.20 kg per hectare and a mean income of N622,600.93 per hectare. This substantial difference in both output and income underscores the positive impact of mechanization on agricultural productivity and profitability. These findings are consistent with the research by Srisompun et al. (2019), which

emphasizes that the primary objectives of agricultural mechanization include reducing labor requirements, lowering production costs, and enhancing overall productivity.

Paired T-test analysis showing significant difference between the output per hectare of users and non-users of farm mechanization on maize production.

The result of Paired T-test analysis revealed there is significant difference in output per hectare of users and non-users of farm mechanization in maize production (t = 7.728) with a mean difference of 587.39kg at 1% level of significance. The analysis indicates that the use of farm mechanization has a significant and positive effect on maize production. Specifically, users of mechanization produce an average of 587.39 kg more maize per hectare compared to non-users. This difference is statistically significant at the 1% level, implying a very strong likelihood that the observed difference is due to the effect of mechanization rather than random chance. The findings strongly suggest that farm mechanization enhances maize production efficiency, leading to higher outputs per hectare. This reinforces the benefits of mechanization as discussed, including timely sowing, reduced human drudgery, and increased agricultural productivity. The significant positive impact on maize yield highlights the importance of promoting mechanization among farmers to boost agricultural output and improve livelihoods.

CONCLUSION AND RECOMMENDATIONS

The study concludes that users of farm mechanization experienced higher output and income per hectare as compared to non-users. Tractor and planter were the most available and most used form of farm mechanization by the respondents. It was therefore recommended that Government should subsidize the cost of these machineries to the farmers so it can be accessible and affordable to them. Farmers can also organize themselves into producers cooperative so that cooperative can buy these machineries and then hire it for members use at lower price.

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Table 1: Distribution of users of farm mechanization by socio-economic characteristics

	Users (n=108)			Non-Users (n=30)		
Socio-economic characteristics	**Frequency**	**Percentage**	**Mean**	**Frequency**	**Percentage**	**Mean**
Age						
<=30	9	8.3		2	6.6	
31-40	25	23.1	47.6	12	40.0	52.5
41-50	34	31.5		8	26.7	
51-60	22	20.4		3	9.9	
Above 60	18	16.7		5	16.7	
Sex						
Male	87	80.6		19	63.3	
Female	21	19.4		11	36.7	
Years spent in School						
1-5	16	14.8	8.2	6	20	6.1
6-10	46	42.6		18	60.0	
11-16	46	42.6		6	20	
Household Size(People)						
1-3	6	6.6		2	6.6	
4-6	34	31.5		11	36.7	
7-9	38	35.6	7	14	46.7	8
Above 10	26	24.1		3	9.9	
Years of farming Experience						
1-10	20	18.5		3	9.9	
11-20	19	17.6		10	33.3	
21-30	27	25.0	29.0	7	20.3	31.2
31-40	17	15.7		4	20.0	
41-50	23	21.3		4	20.0	
Above 50	2	1.9		-	-	
Years of Mechanization						
1-10	38	35.2		0	0.0	
11-20	30	27.8	18.4	0	0.0	
21-30	29	26.8		2	6.6	
31-40	11	10.2				
Farm Size (Hectares)						
1-5	21	19.4		18	60.0	
6-10	43	39.8		12	40.0	2.3
11-15	23	21.4	14.3	-	-	
16-20	21	19.4		-	-	
Maize farm size(Hectares)						
1-5	64	60.3		22	73.3	
6-10	18	16.7	8.0	8	26.7	1.8
11-15	17	15.7		-	-	
Above 15	8	7.4		-	-	

Source: Field survey, 2024

Table 2: Availability and Level of farm mechanization usage among maize farmers

Forms of mechanization	Availability		Usage level				WMS	Rank
	Yes	No	Always	Sometimes	Rarely	Never		
Tractor	101	93.5	105(97.2)	3(2.8)			2.97	1st
Planter	77	77.3	64(59.3)	18(16.7)	9(8.3)	17(15.7)	2.19	2nd
Plough	75	69.4	67(62.0)	8(7.4)	6(5.6)	27(25.0)	2.06	4th
Harrower	56	51.9	40(37.0)	25(23.1)	9(8.3)	34(31.5)	1.66	5th
Sprayer	78	72.2	70(64.8)	8(7.4)	5(4.6)	25(23.1)	2.14	3rd
Harvester	17	15.7	15(13.9)	24(22.2)	37(34.3)	32(29.6)	1.20	9th
Seed drill	56	51.9	35(32.4)	25(23.1)	10(9.3)	38(35.2)	1.53	7th
Fertilizer spreader	35	32.4	16(14.8)	33(30.6)	23(21.3)	36(33.3)	1.27	8th
Irrigation tools (sprinklers)	35	32.4	15(13.9)	19(17.6)	26(24.1)	48(44.4)	1.01	11th
Tyne cultivator for weeding	8	7.4	5(4.6)	10(9.3)	40(37.0)	53(49.1)	0.69	13th
Rotavator (kill weeds, incorporates manures/fertilizers)	8	7.4	9(8.3)	12(11.1)	40(37.0)	47(43.5)	0.84	12th
Thresher	64	59.3	50(46.3)	11(10.2)	5(4.6)	42(38.9)	1.64	6th
Grain dryer	32	29.6	15(13.9)	21(19.4)	34(31.5)	38(35.2)	1.12	10th

Source: Field survey, 2024

Table 3: Benefits of the use of farm mechanization

Benefits of usage of farm machines on maize farming*	Always	Most times	Occasionally	Never	WMS	Rank
Mitigate the shortage of farm labour	69(63.9)	35(32.4)	4(3.7)	-	2.60	9th
Encourages timeliness of farm operations	106(98.1)	2(1.9)	-	-	2.98	3rd
Contribution in enhancing cropping intensity (maize population)	72(66.7)	35(32.4)	-	1(0.9)	2.65	8th
Employment of Human Labor	54(50.0)	52(48.1)	2(1.9)	-	2.48	10th
Timely sowing and thus avoids loss that could be incurred	106(98.1)	1(0.9)	1(0.9)	-	3.26	1st
Reduce the human drudgery and enhance the agricultural productivity	1(0.9)	104(96.3)	3(2.8)	-	3.25	2nd
Increase the prospects of the local agro-allied industry	90(83.3)	18(16.7)	-	-	2.83	7th
Increase the food production capacity of farmers leading to reduced poverty and improved livelihoods,	100(92.6)	8(7.4)	-	-	2.93	6th
Improves the quality of agricultural produce.	104(96.3)	4(3.7)	-	-	2.96	5th
Better return on farm income	107(99.1)	1(0.9)	-	-	2.97	4th

Source: Field survey, 2024

Table 4: Distribution of respondents by constraints to usage of farm mechanization on maize production

Constraints*	Major Constraint	Minor Constraint	Not a Constraint	WMS	Rank
Limited availability of appropriate & functional farm machineries	53(49.1)	54(50.0)	1(0.9)	1.48	7th
Affordability and cost -effectiveness problem	106(98.1)	2(1.9)		1.98	1st
Unfavourable Government Policies and Interventions	2(1.9)	36(33.3)	26(24.1)	0.96	8th
Inadequate training to operate & maintain farm equipment	105(97.3)	1(0.9)	2(1.9)	1.97	3rd
Infrastructure limitations such as poor road network, inadequate storage facilities	1(0.9)	102(94.4)	5(4.6)	1.96	4th
Field topography and size	2(1.9)	56(51.9)	50(46.3)	1.56	6th
Poor Access to Maintenance Services and Spare Parts	2(1.9)	102(94.4)	4(3.7)	1.98	1st
Adverse weather conditions such extreme rainfall or drought	1(0.9)	94(87.0)	13(12.0)	1.89	5th
Energy availability such as fuel or electricity scarcity or expensiveness	64(59.3)	43(39.8)	1(0.9)	1.60	10th
Socio-cultural factors. E.g A belief not to use machines	1(0.9)	8(7.4)	99(88.7)	0.71	9th

Source: Field survey, 2024

Table 5: Distribution of respondents by output and income per hectare of users and non-users of farm machines on maize production

Variables	Mean (users)	Mean (Non –users)
Output of maize per hectare (kg)	1,807.04	1220.20
Income per hectare (₦)	840,050.44	622,600.93

Source: Field survey, 2024

Table 6: T-test analysis showing significant difference between the output per hectare of users and non-users of farm mechanization on maize production

Variable	t	Significance	Mean Difference
Output per hectare of the users and non-users	7.728	0.000	587.39kg

Source: Field survey, 2024