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CONSTRAINTS TO THE USE OF NARICT NEEM ORGANIC FERTILIZER AMONG SMALLHOLDER TOMATO FARMERS IN KADUNA STATE, NIGERIA

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ABSTRACT

Recognizing the myriad of deficiencies inherent in the use of inorganic fertilisers in developing countries, many agricultural-based agencies have advocated the use of organic fertilizers as an alternative to inorganic fertilizers. Therefore, this study described the constraints to the use of NARICT neem organic fertilizer among smallholder tomato farmers in Kaduna state. Four Local Government Areas (LGAs) were randomly selected from the four ADP zones of the state. One village was randomly selected from each of the four selected LGAs and then 11% of the tomato farmers from each of the four villages were randomly selected to arrive at the sample size. Data was collected using a structured questionnaire and both inferential and descriptive statistics were used in the analysis of the assembled data. The major constraint to the use of NARICT neem fertilizer was availability with 52.3% of the farmers, acknowledging it as a constraint and was ranked 1st, with slow action being ranked 2nd with about 45.6% while the high cost of transportation was ranked 4th with 41.7%. The average productivity of tomatoes in the study area was 1,820.3kg per hectare for non-NARICT organic fertilizer users, while for NARICT fertilizer users, their average tomato productivity was 2,226.1kg per hectare. Based on the research findings, it was concluded that even though NARICT neem organic fertilizer had some major use constraints, in the study area, its use results in some significant level of influence on the farmer's productivity and income.

Keywords: Constraints, NARICT neem organic fertilizer, smallholder tomato farmers

INTRODUCTION

Soil productivity maintenance is a major constraint on tropical agriculture. In the past, crop cultivation was usually moved between fields to enable the utilization of only fertile soils, without the use of fertilizers, for some years. However, this cannot be sustained to meet the demands of an increasing population. Tropical soils are adversely affected by sub-optimal soil fertility and erosion, causing the deterioration of the nutrient status and changes in soil organism populations (Economic Commission for Africa, 2011). The use of inorganic fertilizers can improve crop yields and soil pH, total nutrient content and nutrient availability, but its use is limited due to scarcity, high cost and soil acidity (Agbede, Ojeniyi and Adeyemo, 2010).

Inorganic fertilizers while beneficial in the short term; have serious longer-term side effects, such as soil compaction, erosion and declines in the overall soil fertility along with health concerns as a result of the toxic chemicals entering the food supply; inorganic fertilisers are poisonous chemicals, pesticides and weedicides in which large number of the population that feed on this toxic substance used in conventional agriculture have fallen prey to diseases like cancer and other unknown diseases (Nnodim and Sunday, 2017).

Recognizing the myriad of deficiencies inherent in the use of inorganic fertilizers in developing countries, many agriculturally based agencies have advocated the use of organic fertilizer as an alternative to inorganic fertilizers (Emuh and Ofuoku, 2011). Also, Smile (2010) advocated that;

organic fertilizer should be used as a means of maintaining and increasing soil fertility. It is in response to some of the challenges faced by the smallholder farmers; in Nigeria and improving food supply towards ensuring food security that the National Research Institute for Chemical Technology (NARICT) Zaria, in pursuance of its mandate, began studies aimed at producing minero-organic neem fertilizer that would be affordable, accessible, and eco-friendly.

Neem-base organic fertilizer also known as NARICT neem organic fertilizer is formulated from the neem tree which is a species of the mahogany family (*meliancea*) commonly known locally in the Hausa language as Dogonyaro, Bedi, Darbejiya or Maina. With the advancement in biotechnology, NARICT has explored commercial uses of the neem tree in organic fertilizer and related areas. NARICT fertilizer can be used on different crops, among which is tomato (NARICT, 2015). Tomato (*Lycopersicon esculentum*) is an important vegetable crop in many parts of the world. It is one of the most important vegetables grown for its edible fruits in virtually every part of Nigeria. It is also one of the most widely cultivated crops in the world. It is an important source of vitamins and an important cash crop for smallholder commercial farmers (Shankara, Joep, Marja, Martin and Barbara, 2005).

The adoption of NARICT neem organic fertilizer by tomato farmers is expected to have a positive effect on farmers' yield, and income and can also help in protecting the soil and its eco-friendliness

over the inorganic fertiliser (Ibeawuchi, Alagba, Ofor, Emma-Okafor, Peter-Onob and Obiefuna, 2015). Even though NARICT neem organic fertilizer has long been disseminated to farmers, particularly smallholder tomato farmers in Kaduna State, there have been limited or no studies on the described constraints in its use or determine the productivity and income of farmers who have adopted the technology.

The specific objectives are:

1. To identify and described the constraints associated with the use of NARIC neem organic fertilizer among the smallholder tomato
2. To determine the productivity and income of the tomato farmers in the study area.

METHODOLOGY

Kaduna State lies between Latitude 10°30' 37.6704" N and Longitude 7° 24' 59.418" E, with an area in approximately 48,473.2 square kilometres (Country coordinate, 2021). The population in the State is about 15,044,643 in 2021 Kaduna State Bureau of Statistics; (2020). The typical weather is mostly characterized by the constant dry and wet seasons. The state is within the tropical grassland of Sudan savannah in the north and Guinea savannah in the north, with prevailing vegetation of tall grasses and big trees of economic importance. The crops produced

in the state include cotton, groundnut, tobacco, maize, beans, guinea corn, millet, rice, ginger, cassava, yam, and sweet potatoes. Another important aspect of agriculture engaged by the people is the rearing of cattle, sheep, goats, pigs, and poultry farming.

Four Local Government Areas (LGAs) were randomly selected from the four ADP zones of the state. One village was randomly selected from each of the four selected LGAs. This was followed by a random selection of 11% of the tomato farmers from each of the four villages, which constitute the sample size of tomato farmers. This is in line with the recommendation of Glen (2013), who asserted that 11% of a population can be taken as sample size once the total sample taken exceed one thousand (1000). A total sample size of one hundred and ninety-one (191) tomato farmers using NARICT Neem organic fertiliser were selected Furthermore, a corresponding sample of 191 farmers was drawn randomly from the population of the farmers not using NARICT Neem organic fertilizer. The total sample size for the study was three hundred and eighty-two (382) tomato farmers. However, only 160 and 190 questionnaires were retrieved from farmers using NARICT Neem organic fertilizer and those not using the NARICT.

Neem organic fertilizer respectively. Therefore, the total sample used for analysis was three hundred and fifty (350).

Table 1: Summary of sample distribution

KADA Zone	LGAs	Rural villages	No of famers in the selected villages	No of farmers using NARICT organic fertilizer	Sample size of farmers using NARICT organic fertilizer (11%)	No of farmers not using NARICT organic fertilizer	Corresponding Sample size of farmers not using NARICT organic fertilizer
Lere	Igabi	Birnin Yero	11,500	575	63	10,925	63
Maigana	Soban-gari	Sakadadi	10,000	500	55	9,500	55
Birnin Gwari	B/Gwari	Kuyallo	10,000	500	55	9,500	55
Samarun Kataf	Kachia	Awon	3250	163	18	3,087	18
Total			34,750	1,738	191	33,012	191

Source: Reconnaissance survey 2019

Data for the study was collected using a structured questionnaire, and both descriptive and-inferential statistics were used in the analysis of assembled data. Descriptive statistics was used to describe the constraints associated with the use of NARICT neem organic fertilizer as identified in the study, while inferential statistics, specifically the Z-

test was used to determine the productivity and income of the farmers who adopted the technology. The Z-test model was used to compare the mean values of the income of the adopters and non-adopters. The comparison provided statistics for evaluating whether the difference between the two means is statistically significant or not and at the same time to determine if

the adoption of NARICT Neem organic fertilizer has any significant effect on the productivity of tomato farmers in the study area. The formula is presented below:

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_{z1}^2}{n_1} + \frac{s_{z2}^2}{n_2}}} \dots\dots\dots 1$$

Where $Z = z$ value

\bar{x}_1 = the sample mean of the productivity of the adopting farmers

\bar{x}_2 = the sample mean of the productivity of the non – adopting farmers in the study area.

S_1^2 = sample standard deviation for the adopting farmers in the study area

S_2^2 = sample standard deviation for the non-adopting farmers in the study area.

n_1 = sample size of adapters in the study area.

n_2 = sample size of non-adopters in the study area.

RESULTS AND DISCUSSIONS

Table 1 reveals that 52.3% of the farmers indicated the unavailability of the NARICT Neem organic fertilizer in the market and ranked 1st. This contradicts the findings of Adeyemo (2009) who found that the market/availability of organic fertilizer had a significant influence on the adoption of agricultural technologies among cooperative farmers in Kano State, This is also contrary to the findings of Odhiambo and Madangini (2008) who reported open market organic fertilizer for vegetable farmers in Kwara State in the study area which could easily be purchased and as a result increase the likelihood to adopt the use of the organic fertilizer. Another study done by Makokha *et al* (2011) in consonant with the study on determinants of fertilizer and organic fertilizer use on tomato production in Kenya, reported high cost of labour and unavailability of organic fertilizer in the market and untimely delivery as the main constraint to fertilizer adoption The result further showed that slow acting (45.6%) was also a constraint to the use of NARICT Neem organic fertilizer. This agrees with the findings of Alimi *et al.* (2006) that slow-acting inorganic fertilizer use can be an advantage and disadvantage at the same time. The slowness may decrease current output but gradually release minerals that help decrease future cost of production and increase future output. Livestock feeding on the fertilizer was ranked 3rd (42.8%) as

another constraint identified by the farmers, sheep's feed on the fertilizer making the availability of the fertilizer to not be sufficient for the crop. Consequently, it constitutes a constraint to the use of NARICT Neem organic fertilizer. High cost of transportation was ranked 4th with 41.7% among constraints identified. This confirms the finding of Omotosho *et al.* (2012) who posited that major constraints in the use of organic materials by farmers include poor transport facilities and worm infestation of the organic fertilizer. It is also in consonance with the findings of Amadi *et al* (2006); who reported that the adoption of organic fertilizer could be inhibited by some factors which include difficulty in transporting. Bulkiness, offensive odour and slow acting. This also conforms with Ajewole's view (2010) who reported difficulty in transporting organic fertilizer. Furthermore, insufficient capital ranked 5th (38% of the farmers) as a constraint to using organic fertilizer among the farmers. This confirms the finding of Idris and Ogunbameru (2008), who reported that farmers in Northern Nigeria are generally constrained by problems of insufficient capital which usually limits their production activities. Uaiene *et al* (2009) that difficulty in accessing credit appeared to be one of the major constraints to adoption in the developing countries of Africa, Asia and Latin America. Also, Zavale *et al* (2006) reported that capital constraints and limited access to credit hinder the adoption of most agricultural technologies and inputs that require a high initial capital investment and high operational cost. Some of the farmers considered the organic fertilizer as being expensive which ranks 6th (25.1%). This is contrary to the findings of Alimi *et al.* (2006) who found that organic fertilizer is the main source adopted by vegetable farmers to supply nutrients to their crops probably because it is a cheap source of nutrients to their crops thus reducing the cost of production

Farmers experienced low yield when they used the NARICT neem organic fertilizer which ranked 7th (17.1%). This is contrary to the findings of Oladapo *et al.* (2009) who reported high yield when poultry manure as an organic fertilizer was applied. Also, according to the findings of Adedokum *et al* (2009), in the area of agricultural production, 45.3% of respondents indicate the greater benefit of using organic fertiliser by the increase in their crop yield.

Table 2: Major constraints associated with the use of NARICT neem organic fertilizer

Constraints	Frequency	Percent	Rank
Not available in the market	160	52.3	1 st
Slow action	155	45.6	2 nd
Other livestock feed on the fertilizer	151	42.8	3 rd
High transportation cost	146	41.7	4 th
Insufficient capital	133	8.0	5 th
Expensive compared to NPK and other fertilizers	88	25.1	6 th
Low yield	60	17.1	7 th

The result in Table 3 above shows that the average productivity of tomatoes in the study was 1,820.3kg per hectare for non-NARICT fertilizer users, while for NARICT fertilizer users, their average tomato productivity was 2,226.11kg per hectare. The average total income of Non-NARICT fertilizer users was ₦747, 173.7 whereas, the NARICT fertilizer users had an average total income of ₦1, 001,257.1, the pooled for both Non-NARICT neem organic fertilizer and NARICT neem organic fertilizer users was 2015.2 and 813, 051.4 respectively. By improving input/output relationships, new technologies tend to raise output and reduce the average cost of production, which in turn results in substantial gains in farm income.

The substantial gains in farm income as a result of the productivity due to the use of organic fertilizer which serves as both fertilizer and soil conditioner as they feed both soil and plants and they are carbon-based compounds that increase the productivity and growth quality of plants. This is one of the most important differences between chemical fertilizer use and the use of organic fertilizer in soil care and fertilizing. However, it is known that in fields under intensive monoculture which obtain only heavy applications of inorganic fertilizer, there will be a gradual decline in farm outputs. The application of organic fertilizer has proven to bring about a gradual improvement in soil productivity and crop performance (Morteza *et al.*, 2015).

Table 3: Average Productivity and Income of Tomato Farmers in the Study Area

Type of fertilizer used	Productivity of tomatoes (kg/ha)	Annual total Income (₦)
Non-NARICT	1820.3	747,173.7
NARICT Users	2226.1	1,001,257.1
Pooled	2015.2	813,051.4

Source: Field survey, 2020

Effect of adoption of NARICT Neem organic fertilizer on productivity of tomato farmers in Kaduna State

The results in Table 4 showed the effect of the adoption of NARICT organic fertilizer on productivity. The result depicts the average productivity of farmers that cultivated the same crop with NARICT neem organic fertilizer with those that did not produce the crop with NARICT fertilizer. The productivity for adopters was 2412.1kg/Ha while, for the non-adopters it was 1663.7kg/Ha. A difference between the two groups was found to be 748.42 kg/ha, and a significant difference at a 1% level. The standard

errors are relatively low, likewise is the standard deviation between the two groups of farmers. The result showed a statistically significant test on equality for both adopters (2412.1) and non-adopters (1663.7) respectively. Organic fertilizer improves soil fertility by increasing organic matter, microbial activity of the soil and chemical properties of the soil with a subsequent increase in productivity. This is in line with the findings of Adedokun (2009), who posited that 45.3% of his respondents indicated the greater benefit of organic fertilizer on increase in crop productivity.

Table 4. Effect of Adoption of NARICT Neem Organic Fertilizer on Productivity of Tomatoes farmers in Kaduna State

Productivity Variation	Group		Diff	Pr(Z > z)
	Non-NARICT Adopters	NARICT Adopters		
Observations	190	160		
Mean	1663.7	2412.1	748.42	0.0000***
Std.Err.	0.0725	0.0791	0.1073	
Std.Dev.	1.0000	1.0000	748.63	

Source: Field survey, 2020

CONCLUSION

Based on the findings from this study, the study concluded that the socio-economic and institutional characteristics of the farmers have a significant influence on the adoption of NARICT neem organic fertilizer. Similarly, a significant effect was found when farmers adopted the use of NARICT neem organic fertilizer on the productivity and income of farmers.

RECOMMENDATIONS

The study presents the following recommendations:

NARICT should come up with ways to make organic fertilizer available to farmers in the market at affordable prices.

Slow-acting fertilizer is another constraint raised by farmers, so the NARICT research institute should make efforts to educate farmers on the need to accommodate the slow-acting fertilizer with the help of extension agents. Organized symposium/ workshop to make farmers aware that the slow acting of organic fertilizer is advantageous (decreasing future cost of production and increasing future output due to the slow release of minerals into the soil).

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