

Constraints to liquid fertilizer usage in dry season vegetable production in the Southern Guinea Savannah Zone of Nigeria

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Abstract. Despite the fact that liquid fertilizers have been available for more than a decade in Nigeria, there is no information available on the constraints encountered in its usage in dry season vegetable production. This study identified the users of liquid fertilizers and assessed the severity of constraints encountered in its usage. A three-stage random sampling procedure was used to select 309 vegetable farmers who were surveyed in regard to their fertilizer use. Data was collected using a structured interview schedule. Data analysis was done using frequency counts, percentages and Likert type scales. The results revealed low levels of liquid fertilizer usage. Seven constraints to use were identified in the study. Lack of usage instructions ranked highest with a weighted score (WS) of 253 out of a maximum score of 435, while low effectiveness of liquid fertilizer (WS=134) ranked the lowest. The study therefore recommended that smaller units of the liquid fertilizer with labelled wrappers be made available to farmers, along with training for selling agents and Extension Officers.

Keywords: soil fertility, technology adoption, challenges, random sampling, Likert type scale, usage instructions.

Introduction

Low levels of fertilizer usage still abound in Nigeria. This is due to the relatively low level of availability and affordability of the fertilizer input (Liverpool-Taise, Barrett & Sheahan 2014). Consequently, vegetable productivity, like other food crops is far below what it could be. In the last ten years, a lot of emphasis has been placed on increasing fertilizer use in Nigeria as a way of increasing output of farmers to improve food security status. Several efforts have been made by the government in Nigeria to ensure the availability and affordability of fertilizer, with very little success.

Commercial liquid fertilizers were first introduced into the country in 2003, possibly as an alternative source of fertilizer to the scarce and expensive granular fertilizer. These liquid fertilizers are known to improve the quality and quantity of crops (Akanbi et al. 2007; Deore et al. 2010; Criollo et al. 2011). Thus, its ability to increase the nutritional content of food crops can address the problem of 'hidden hunger' that is so prevalent in many developing countries like Nigeria. Furthermore, because they come in liquid form, the nutrients are easily absorbed by the plants which enable them to respond rapidly following application. Despite these attributes of liquid fertilizer, not much appears to have been documented on its usage in Nigeria. The scarce literature on liquid fertilizer may be a result of low product usage. This, in turn may be due to the challenges encountered in its adoption by farmers.

Farming in Nigeria is dominated by small scale farmers, and these farmers will normally adopt a new technology only when they are sure that it will increase their income to a reasonable extent, without it being too risky (Straub 2009; Hochbaum 2011). Thus, an in-depth analysis of the constraints users of liquid fertilizer face will help put these challenges into better perspective so that a measure of their severity will be accessible for policy makers and fertiliser companies. Also, an analysis of the constraints faced in liquid fertilizer usage will help to identify and quantify the possible factors that may have contributed to farmers' lack of interest in the technology, with a view to removing such bottlenecks, or modifying the technology where possible. Furthermore, it is worthy of note that the gains in the usage of liquid fertilizer for dry season vegetable production may not be realized if they are not utilized effectively due to the challenges the farmers face in its adoption. Thus, by not adequately identifying these challenges and finding solutions to them may make usage of liquid fertilizer among dry season vegetable farmers undesirable and deny the farmers and the general public the likely benefits of improved year-round vegetable production.

Objectives

In view of the foregoing, the study set out specifically to: (i) identify the users of liquid fertilizers; (ii) identify the constraints faced by the dry season vegetable farmers in the usage of liquid fertilizers; and (iii) measure the severity of the constraints identified.

Methodology

Study area

This study was carried out in the Southern Guinea Savannah Zone of Nigeria. It is the most luxuriant of the savannah vegetation belts in Nigeria. The area is characterized by low rainfall and long dry periods of up to six months, with the soils low in organic matter and chemical fertility.

Sampling technique

Two states, Kwara and Niger States, were randomly selected from the six states in the Southern Guinea Savannah Zone. Locations where dry season vegetable production was predominantly carried out were identified using the 2012 Crop Area Yield Survey (CAYS) manual from both states' Agricultural Development Project (ADPs). Twenty-five percent of the identified locations in each of the States were randomly selected from the 33 locations identified in Kwara State and 35 identified in Niger State. This gave a total of eight and nine locations in Kwara and Niger States respectively. Next, the different farmer groups in each of the selected locations were identified with the help of the Extension Officers in charge of each of the selected locations. A minimum of two different farmer groups were identified in each of the locations. A list of all dry season vegetable farmers was obtained from the leader of each of the groups. From those lists, another list was compiled to give the total number of vegetable farmers in that location irrespective of their group membership. From the compiled list, twenty-five percent of the listed vegetable farmers were randomly selected from each location to give a sample size of 160 vegetable farmers for Kwara State and 157 vegetable farmers for Niger State. Thus, a total of 317 vegetable farmers were interviewed for the study. Data for only 309 farmers were eventually useful for analysis due to insufficient information given by eight respondents.

Method of data Collection

Data for the study were collected for the 2013/2014 (October –March) dry season vegetable production using a structured interview schedule that involved vegetable farmers. Focus Group Discussion (FGD) was also organized with the local leaders of the vegetable farmer groups to supplement the data obtained from the interview schedule. Some of the constraints included in the survey instruments were identified from literature that had to do with challenges small-scale farmers encounter in the adoption of new technologies. The farmers were asked to rate the problems they encountered in the usage of liquid fertilizer in dry season vegetable production on a 5 point numerical rating scale of: *extremely serious problem* =5, *very serious problem* =4, *moderately serious problem* = 3, *mild problem*= 2 and *not serious at all*= 1. Vegetable farmers were expected to tick against each constraint listed according to the degree of severity. The farmers were also asked to state and rate any other additional constraints encountered that were not included in the instrument. The survey instrument was subjected to review by experts in the Department of Agricultural Extension and Rural Development, University of Ilorin to establish its validity. To establish reliability, pretesting was done with 30 dry season vegetable farmers who were not included in the sample. Internal consistency approach using Cronbach's alpha was adopted and data analysis was done using the SPSS software. An alpha value of 0.816 indicated a reliable scale.

Analytical techniques

Descriptive statistics which include measures of central tendencies such as frequency distribution and percentages were used to identify the users of liquid fertilizers. The weighted score of each constraint the vegetable farmers encountered in the usage of liquid fertilizer was computed to show the severity of the constraint. This was specified as follows:

Weighted score (WS) - This was obtained as total scores of each constraint, i.e.

$$X_w = 5(F_5) + 4(F_4) + 3(F_3) + 2(F_2) + 1(F_1) \quad (1)$$

where:

X_w = Weighted score

5-1 = Rating scale of extremely serious problem (5) to not a problem at all (1)

F_5 - F_1 = Frequency of the respondents in each scale

The values of the WS were then used to rank the constraints faced by the vegetable farmers in the usage of liquid fertilizer.

Results and discussion

This section presents the empirical results for the data analysis done for the study.

Identification of liquid fertilizer users in the study

The results for the users of liquid fertilizers are shown in Table 1. Less than one-third of the farmers used liquid fertilizers (Table 1). The low level of usage of the technology was mainly due to the fact that the technology was not yet widely known in the study area. More than 45 percent of the non-users of the liquid fertilizer attested to the fact that they had never heard about the technology. The majority of those who had never heard about the liquid fertilizer technology were those who stayed in locations that were farther from the city centres. The low level of knowledge of the technology is a major challenge for the adoption of the technology because innovations must be widely known to be adopted.

Table 1. Distribution of dry season vegetable farmers based on liquid fertilizer usage

Categories of fertilizer usage	Frequency	Percentage
Liquid only	44	14.20
Liquid with non-liquid	43	13.90
Non-liquid only	222	71.90
Total	309	100.00

Source: Field Survey, 2015.

Severity of constraints encountered in the usage of liquid fertilizers

This section discusses the constraints encountered in the field by the vegetable farmers who use liquid fertilizer. These constraints include: high cost of liquid fertilizer, low availability of the liquid fertilizer, high cost of application, difficulty of adhering to application time and rate, perceived low effectiveness of the liquid fertilizer and lack of adequate instruction on usage of liquid fertilizer. These are shown in Tables 2.

Table 2. Distribution of vegetable farmers according to severity of challenges faced in the usage of liquid fertilizer

Constraints	Extremely serious	Very serious	Moderately serious	Mildly serious	Not serious	WS	Rank
Lack of instruction on usage	23(26.44)	15(17.24)	7 (8.05)	15(17.24)	27(31.03)	253	1 st
Low availability of LF	19(21.84)	4 (4.60)	8 (9.20)	10(11.49)	46(52.87)	201	2 nd
Inability to adhere to application time	10(11.49)	7 (8.05)	14(16.09)	22(25.29)	34(39.08)	198	3 rd
Inability to adhere to application rate	8 (9.20)	5 (5.75)	16(18.39)	23(26.43)	35(40.23)	189	4 th
High cost of LF	10 (11.49)	1 (1.15)	8 (9.20)	10(11.49)	58(66.67)	156	5 th
High cost of application	3 (3.45)	3 (3.45)	9 (10.34)	18(20.69)	54(62.07)	144	6 th
Low effectiveness of LF	6 (6.90)	2 (2.30)	3 (3.45)	11(12.64)	65(74.71)	134	7 th

Note: Figures in parenthesis are percentages. WS = Weighted Score
Source: Field Survey, 2015.

Table 2 reveals that the major challenge faced by the users of liquid fertilizer was the lack of information on how to use the liquid fertilizer. More than half of the vegetable farmers (about 60%), sourced their information on liquid fertilizer at the point of purchase. These vegetable farmers usually buy their liquid fertilizer from Sales Agents, Agro-dealers or Extension Agents who usually do not have the adequate and correct information on usage of these liquid fertilizers. The instructions on usage of liquid fertilizer intended to get to the users are written on the label wrapper on the one and four litre containers of the liquid fertilizer. However, it was gathered during the Focus Group Discussion (FGD) that most of the liquid fertilizer used by the farmers were the 250ml bottles which were usually sold for between ₦650 and ₦1200 (A\$1 = ₦270) depending on location and type. These 250ml bottles are filled from the four litre containers that were packaged by the manufacturers themselves. The preference for the smaller bottle was due to its affordability per time. Unfortunately, the smaller bottles that were re-packaged by the agro-dealers and sales agents did not come with the label wrappers that contain the instructions on how to use the product. As such, the farmers had no access to usage instructions. Hence, not consciously including the information on how to use these liquid fertilizers may increase the complexity of the technology, and decrease the compatibility of the product with values, experiences and needs of the farmers. This will in principle discourage the farmers from adopting even a simple innovation. Apart from increasing the complexity of the product, the absence of the label wrappers can also reduce the confidence the farmers have in the genuineness of the product

since the liquid fertilizers had no brand names. Also, identification of the brand of liquid fertilizers posed a challenge to the researcher, thus, identification was done based on colour in the absence of the label wrappers.

The second most severe constraint faced by users of liquid fertilizer was the relative low availability of the liquid fertilizer at the time when it was needed. This was because at the time of the field survey, it was noted that the majority of the liquid fertilizer sales was by sales agents and Extension Officers. This means that the availability of the products depended on the availability of these sales and Extension Agents. This constraint may have reduced the trial phase of the product, thus discouraging its usage.

Inability to adhere to application time and rate ranked 3rd and 4th with a weighted score of 198 and 189 respectively. These constraints were however considered not to be serious by more than 60 percent of the vegetable farmers. This was because a majority (70%) of the farmers claimed that they did fertilizer application any time of the day it was convenient for them. Ten percent preferred to do it in the evening while the remaining 20 percent applied the fertilizer in the morning. One often cited advantage of using liquid fertilizer is that it can be done at any time of the day, irrespective of whether or not irrigation has just been done (Wilkinson 2012). The same cannot be said for non-liquid fertilizers where its application is dependent on time during the day (morning or evening) and can only be applied just before or after rainfall or irrigation so that the fertilizer granules can dissolve (Fernandez, Sotiropoulos & Brown 2013). However, one of the liquid fertilizers used in the study was time-of-day dependent and this may have been disruptive to the routines and schedules of the vegetable farmers. According to Dobbins, Cockerill, and Barnsley (2001), innovations that are disruptive to routine tasks even when they bring a large relative advantage might not be adopted because of added instability.

High cost of the liquid fertilizer and the high cost of application ranked 5th and 6th respectively among the constraints the vegetable farmers faced in its usage. More than 60 percent of the users of liquid fertilizer in the study considered these constraints as not serious. Sometimes, the introduction of an innovation may come with increased cost such that a benefit (positive consequences of the innovation) – cost (negative consequences) analysis puts the innovation into a better perspective as to whether or not to adopt the innovation. Evidence from literature seems to suggest that no additional cost is incurred in liquid fertilizer application. In some instances, the farmers even saved some money in its application because they often timed pesticide application to coincide with fertilizer application so that only one cost of labour for application was incurred for both fertilizer and pesticide application (Dittmar 2007). This means that the 12 percent of the respondents who cited high cost of application of liquid fertilizer as a serious constraint were probably not able to combine pesticide and fertilizer application and so had to pay separate labour charges for both farm operations. This inability may have been due to lack of knowledge on the part of the farmers.

Low effectiveness of the liquid fertilizer had the lowest weighted score among the constraints identified.

Conclusion and policy recommendations

The study concluded that there was low usage of liquid fertilizer by vegetable farmers in the Southern Guinea Savannah zone of Nigeria. This was, despite the potential for its usage as an alternative source of fertilizer in dry season vegetable production to increase the productivity of the vegetable farmers and ensure sustained dry season vegetable production. Based on the findings, it was recommended that more advertising should be done to communicate the availability and benefits of liquid fertilizer as an alternative source to granular fertilizers. Also, manufacturers of the liquid fertilizers should consider the possibility of ensuring that smaller units of the product with labelled wrappers are supplied in the study area. This will reduce the complexity associated with the usage of the product and encourage the farmers to use it. In addition, there should be periodic training of the Extension Officers on the latest information concerning the usage of the liquid fertilizer. This will also foster availability of correct information on the product. Since many of the users of liquid fertilizer source their information from agro-shop dealers and sales agent, efforts should be made to give these people periodic training alongside the Extension Officers. Also, these liquid fertilizers should be made more readily available to encourage the vegetable farmers to try it, which may lead to its trial, and then, adoption. Finally, further investigation into the cost and returns associated with liquid fertilizer usage will throw more light on the benefit-cost associated with its usage and may encourage increased adoption.

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