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Economic rationale of commercial organic fertilizer technology in vegetable production in Osun State of Nigeria

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Abstract

The fragility and high susceptibility of the soils in Nigeria to degradation and loss of nutrients make augmentation through the use of fertilizers necessary to obtain reasonable crop yield. The use of market oriented organic fertilizer is being encouraged to improve soil fertility and there is the need to determine the economic rationale of this technology. This study determined the change in net income of users of commercial organic fertilizer (UCOF) relative to non-users of fertilizers (NUF) in vegetable crop production in Osun State of Nigeria to find out if its use should be encouraged based on economic reason only. Nested sampling technique was used in selecting UCOF and NUF respondents. Data on yield, quantities and prices of inputs and output; and reasons for non-use of commercial organic fertilizer were collected and analyzed using descriptive and inferential statistics, partial budgetary technique, sensitivity analysis and importance ranking. Analyses indicated that UCOF applied 610kg ha^{-1} of commercial organic fertilizer resulting in additional yield (3,375kg ha^{-1}) and rate of returns (401%) over and above the NUF, making the use of organic fertilizer technology economically superior to non-use of fertilizers. Constraints to the use of commercial organic fertilizer are doubtful efficacy, offensive odour, heavy weed infestation, bulkiness and lack of funds in descending order of importance which if eliminated will boost demand for commercial organic fertilizer and improve production of vegetable for consumption.

Key words: Vegetable, commercial organic fertilizer, marginal rate of return, constraints, Osun State, Nigeria

Introduction

Nigeria is one of the countries in Sub-Saharan Africa (SSA) where self-sufficiency in food production remains a critical challenge even in the absence of wars and natural disasters (ADB, 1999). It is reported that the population in SSA is rising at about 2.5% which outstrips food production that is growing at about 1.5%. The results of population pressure and the demand of land for non-agricultural uses lead to decrease in available agricultural land and consequently small farm size. Olutawosin and Olaniyan (2001) noted that Nigeria is a nation of smallholder farmers cultivating an average of 2 hectares per household under traditional system of farming. Spencer (1991) opined that about 90% of food production in SSA (Nigeria inclusive) comes from smallholder farmers under traditional system of farming. In a situation of small farm size, agricultural intensification is the key to effectively addressing the problem of self-insufficiency in food production (Pinstrup-Anderson and Pandya–Lorch, 1994). Agricultural intensification is defined as the production of more food per unit area of land. Agricultural intensification is usually portrayed either as an opportunity or as a threat to the environment. The advocates of the concept argue that it holds great promise as an instrument to simultaneously alleviate poverty and meet food needs at all times while the opponents express great concern that it may lead to degradation of natural resources and unparalleled loss of soil nutrients. No doubt, agriculture is the most important user of environmental services including water, forests, pastures and soil nutrients. Hence, intensive land use without appropriate soil management practices leads to environmental degradation (Senjobi *et al.*, 2000). DFID (2002) stated that environmental degradation can compromise with current agricultural productivity, undermine future production and perpetrate poverty. In order to alleviate such threat, the proposed soil management practice must ensure the sustainability of the agricultural production environment. A sustainable agriculture has been defined to be one that over a long term enhances environmental quality and resource base on which agriculture depends; provides for basic human food and fibre needs; is economically viable and enhances the quality of life of farmers and society as a whole (CGIAR, 1988).

Although, various soil conservation practices under different categories of farming systems have evolved over the time (Olayide *et al.*, 1981), it is essential for countries to promote policy measures that will enable farmers to make use of their natural advantages (DFID, 2002). Systems that allow intensification using mainly locally available resources, such as organic fertilizers may play an important role in soil fertility management thereby reducing hunger through increased agricultural productivity. Organic fertilizers are generally made from plant and animal by-products and natural minerals that may originate from the farm itself (crop residue, livestock manure) and is thus a nutrient–saving technology, or they can be obtained from other sectors or from products manufactured elsewhere, and as such constitute a nutrient adding technology. Greg (1996) stated that apart from producing more vigorous growing and high yielding crop, the improvement in overall soil quality resulting from the use of organic soil amendments may reduce the potential for nutrient contamination of ground and surface water. Organic fertilizers have been confirmed to improve the physical properties of soil (Swarup, 1987), the biological status of soil (Chai *et al.,* 1988); soil fertility and consequently crop yield (Lal and Mathur, 1989).

All these attributes of organic fertilizers serve to eliminate the fears of negative impacts of agricultural intensification in the use of organic fertilizer technology. Traditionally, farmers engage in composting to supply organic fertilizers at the subsistence level to their farms and such organic fertilizer commodity does not pass through the market exchange system. However, there is the recent development whereby organic fertilizers are produced in commercial quantity by organic fertilizer manufacturing enterprises for farmers' use in crop production and its use is being encouraged.

It is therefore necessary to empirically study the economics of commercial organic fertilizer technology in crop production. Preliminary investigations indicated that commercial organic fertilizer was used mostly for vegetable crop production (largely *Amaranths* spp.) and that there were different categories of farmers in relation to the use of fertilizers. These categories are: users of commercial organic fertilizer only, users of inorganic fertilizers only, farmers combining both organic and inorganic fertilizers and non-users of fertilizers. In order to reveal the full effect of use of commercial organic fertilizer, the non-users of fertilizers were compared with users of only commercial organic fertilizer in vegetable production. The goals of the study were to determine if the use of commercial organic fertilizer for vegetable production was economically better than non-use of fertilizer and identify constraints to its use. The specific objectives were to: i) determine and compare the vegetable yields of UCOF and NUF, ii) determine the marginal rate of returns on the use of commercial organic fertilizer, iii) identify and rank the constraints to commercial organic fertilizer use.

Achievements of these objectives will assist the vegetable farmers and the agricultural policy makers on the need to use and encourage, respectively commercial organic fertilizer.

Materials and methods

Study area: The study was conducted in Osun State of Nigeria. Osun State occupies an area of about 10,456km^2 and has a population of about 2,551,522 (FOS, 1997). Osun State is the most urbanized State in Nigeria with a rate of urbanization of 5 percent per annum (UNS, 2001), thereby, constituting a large market for agricultural products. The State has two seasons: wet season that spans from April to October; and dry season starting from November through to March. The wet season supports vegetable production without irrigation water while proximity to perennial water source for irrigation is necessary during the dry season.

Method of data collection and analytical techniques: There were two populations of interest. These are the users of only commercial organic fertilizer (UCOF) and the non-users of any kind of fertilizers (NUF). A nested sampling technique was used to select respondents (UCOF and NUF) for interview. One Agricultural Development Programme (ADP) zone was selected out of the three zones in the State, five Local Government Areas (LGAs) from the selected zone, and five town/villages from each of the five LGAs were chosen using purposive sampling technique at each of the stages. The purposive sampling was based on the relative availability of vegetable farmers. A list each of UCOF and NUF was compiled in each town/village and five each of the UCOF and NUF were selected using simple random sampling technique. In all, a total of one hundred and twenty five each of UCOF and NUF respondents were selected for interview. Primary data were collected from all the respondents on the prices and quantities of vegetable production inputs and output. In addition**,** data on commercial organic fertilizer were obtained from UCOF only; and information on constraints for non-use of commercial organic fertilizer and their ranking from NUF only. Data collected were analyzed using descriptive and inferential statistics, partial budgetary technique, sensitivity analysis and importance ranking.

Descriptive and inferential statistics: Frequency distribution tables, means and standard deviation were the descriptive statistics used to present and summarize yield, organic fertilizer and farm size. Inferential statistics of t-test of difference between two population means was used to establish significant difference in the mean yields of UCOF and NUF as well as in their farm sizes.

Comparison of mean vegetable yields of UCOF and NUF: The null hypothesis (H_0), that the mean vegetable yield of NUF is equal to that of UCOF (equation 1) was tested against the alternative hypothesis (H_1) that the mean vegetable yield of NUF is not equal to that of UCOF (equation 2) using the t statistic stated in equation 3 and at 5% level of significance (Karmel and Polasek, 1977). This is with the intention of determining if using commercial organic fertilizer brings about vegetable yield different from non-use of fertilizers. Sample mean, variance, population mean of NUF and UCOF were calculated.

$$H_O : \mu_1 = \mu_2 \quad (1)$$

$$H_I : \mu_1 \neq \mu_2 \quad (2)$$

$$t_c = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad (3)$$

Such that $\overline{X}_I, S_1^2$, μ_1 and n_1 are the sample mean, sample variance, population mean and sample size of NUF, respectively; and $\overline{X}_2$, S_2^2, μ_2 and n_2 are the sample mean, sample variance, population mean and sample size of UCOF, respectively

Partial budgeting, marginal and sensitivity analyses: Partial budgeting and marginal analyses were used to indicate the superiority of the use of commercial organic fertilizer over non-use of fertilizers.

CIMMYT (1988) noted that partial budgeting is a method of organising data and information about the costs and benefits of various alternative treatments/technologies. The alternative treatments in this study are commercial organic fertilizer use and non-use of fertilizers in vegetable production. The relevant costs to use in Partial Budget Analysis (PBA) are costs that vary between alternative technologies, which for this study are material (commercial organic fertilizer) cost (at the farm gate price), and labour (for application of organic fertilizer, weeding and harvesting of vegetable output) cost. These costs are added together to obtain Total Cost that Vary (TCV) which is subtracted from Gross Field Benefits (GFB) to give Net Benefit (NB). GFB is the product of yield (kg ha^{-1}) and the price per unit (₦ kg^{-1}) of output (gross revenue).

Marginal analysis in PBA is the comparison of change in TCVs with change in NBs. This comparison reveals the change in benefits associated with a given change in cost for using a technology (commercial organic fertilizer). PBA is based on per unit, which in crop farming is on per hectare basis. Thus, in this study, PBA is based on a farm size of one hectare, and variable costs and benefits are assumed to vary directly with farm size. It is basically the computation of Marginal Rate of Return (MRR), which is compared with Acceptable Minimum Rate of Return (AMRR). MRR is the ratio of marginal net benefit to marginal cost. The marginal net benefit is the difference between the NBs of two consecutive treatments while the difference between the TCVs is the marginal cost. AMRR is the minimum return that farmers expect to earn from an enterprise or technology, which technically is the sum of returns to management and capital. In this study AMRR is assumed to be 100 percent of marginal cost. A technology/alternative treatment is considered economically worthwhile if MRR is higher than AMRR.

Sensitivity analysis (determining the break-even level) was performed to show the change in the mean of each of the commercial organic fertilizer price, yield and price of vegetable that will make the use of commercial organic fertilizer in vegetable production uneconomical. It implies redoing a marginal analysis with alternative values of the decision variables (price and yield). Price sensitivity analysis was carried out by varying each of the mean prices of commercial organic fertilizer and vegetable output. The formula for calculating the break-even yield (Alimi and Manyong, 2000) was employed to determine the break-even yield of vegetable (Equation 1). These assist in establishing the degree of economic superiority of commercial organic fertilizer over non-use of fertilizers to justify the encouragement of its use.

$$q^* = \frac{[\Delta TVIC \times AMRR] + TVIC_2 + NB_1}{P} \qquad (4)$$

Where,

q* = level of vegetable yield below which the use of commercial organic fertilizer becomes unviable.

ΔTVIC = change in total variable input costs of the two technologies

AMRR = acceptable minimum rate of return

$TVIC_2$ = total variable input cost of technology 2 (commercial organic fertilizer)

NB_1 = net benefit of technology 1 (no-use of fertilizer)

P = price of vegetable output (₦ kg^{-1})

Importance indices: The importance index was constructed using matrices A, B and C as indicated below. In order to determine the relative importance of constraints to the use of commercial organic fertilizers, importance index was constructed using the methodology adopted by McLean-Meyinsse *et al.* (1994). For the construction of the indices, NUF were asked to give and rank the reasons for non-use of commercial organic fertilizer on an ordinal scale, (1 being assigned to the most important, 2 to the next most important and sequentially in descending order of importance). For analysis, the scale was reversed for ease of index construction. The mean score computed for each identified reason for non-use of commercial organic fertilizer was multiplied by the percent of NUF identifying the reason for non-use as the most important; to obtain the importance index. Jose and Valluru (1997) used importance index to identify price risk as the most important in the opinion of the farming communities in Nebraska. Importance indices method was used by Alimi (2002) to identify regular feed supply as the most important reason for integration in poultry production; and by the same method, Alimi (2005) identified low okra price and moisture stress as the most important constraint to okra production in the rainy and dry seasons, respectively.

The importance index was constructed using matrices A, B and C as indicated below:

$$A = \begin{bmatrix} f_{11} & f_{12} & \cdot & \cdot & \cdot & f_{1n} \\ f_{21} & f_{22} & \cdot & \cdot & \cdot & f_{2n} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ f_{m1} & f_{m2} & \cdot & \cdot & \cdot & f_{mn} \end{bmatrix}.$$

$$B = \begin{bmatrix} w_1 \\ w_2 \\ \cdot \\ \cdot \\ \cdot \\ w_m \end{bmatrix}$$

$$C = AB = \begin{bmatrix} f_{11} & f_{12} & \cdot & \cdot & \cdot & f_{1n} \\ f_{21} & f_{22} & \cdot & \cdot & \cdot & f_{2n} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ f_{m1} & f_{m2} & \cdot & \cdot & \cdot & f_{mn} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \cdot \\ \cdot \\ \cdot \\ w_m \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ \cdot \\ \cdot \\ \cdot \\ c_m \end{bmatrix}$$

Matrix A gives the distribution of NUF according to reasons for non-use of commercial organic fertilizer ranks. The matrix indicates that there are m reasons for non-use, to be put in n categories of rank.

Matrix B is the weight attached to each of the ranks, w_i is the weight attached to rank j where i = j, i =1,2….m and j =1,2….n. w_1 is the weight attached to rank 1,w_2 to rank 2 *etc.*.

Matrix C gives the product of matrices A and B, (AB). It is the total value of importance attached to each reason for non-use of commercial organic fertilizer. For example $C_3 = f_{31}w_1 + \ldots\ldots + f_{3n}w_m$ = total value of importance attached to reason 3 for non-use. C_i is the total value of importance attached to reason i for non-use.

Importance rating for reason i = $\frac{1}{\lambda_i} C_i$

Where, $\lambda_i = f_{i.} = n$ = total number of NUF selecting reason i as important.

$$\text{Importance index} = \frac{C_i}{f_{i.}} \cdot \frac{f_{i1}}{\sum_{i=1}^{m} f_{i1}}$$

Such that $f_{i.}$ is the number of NUF (frequency) ranking reason i as the most important (highest rank). This will assist in ordering constraints to the use of commercial organic fertilizer for attention to increase its use if found more profitable (economical) than non-use of fertilizers. Increasing its use will increase demand for commercial organic fertilizer and higher business activity for commercial organic fertilizer enterprises.

Results and discussion

Sample size: Information collected from three and two respondents of the NUF and UCOF, respectively was incomplete and these respondents were dropped from further analyses. Thus, the sample size for NUF was 122 and that of UCOF was 123.

Characteristics of vegetable farm enterprises: Most of the vegetable farm enterprises were located in relatively urban centres where demand for vegetable by the non-farming households is high. The distribution of NUF and UCOF by vegetable farm size is indicated in Table 1. None of the vegetable farmers in the two categories (NUF and UCOF) cultivated smaller than 0.01ha and none as large as 1.00 ha. None of the NUF had larger than 0.79 ha while some UCOF (6%) cultivated between 0.80 and 0.99 ha farm size category. The mean farm size of NUF was 0.424 ha which was just 85.48 percent of the mean farm size of UCOF (0.496 ha). The vegetable farm size of UCOF was significantly larger than that of NUF (t_c = 2.41), although both belonged to the smallholder group. The vegetable output from the two sources attracted the same selling price as consumers (buyers) did not discriminate between the vegetable outputs derived from the two sources to justify difference in prices.

None of the UCOF applied less than 300 kg ha^{-1} of commercial organic fertilizer and none as high as 800 kg ha^{-1}. High proportion of the UCOF (52%) used between 500 and 699 kg ha^{-1}. The mean quantity of commercial organic fertilizer applied by the UCOF was 610 kg ha^{-1}. The trade name for the most common commercial organic fertilizers used by the UCOF is Pace setter A (PSG-A) and its nutrients composition (g kg^{-1}) is N- 2.58, P- 1.10, K- 0.68, Ca- 0.36 and Mg- 0.11(Ipinmoroti *et al.*, 2003).

The yield (kg ha^{-1}) obtained by the vegetable farmers varied between 3000 and 10,499kg ha^{-1}. While none of the UCOF obtained yield that was lower than 6000 kg ha^{-1}, NUF obtained yield as low as 3000 kg ha^{-1}. None of the NUF realized yield as high as 7500 kg ha^{-1}. More than half (56%) of the NUF were in the yield class of 4500 to 5999 kg ha^{-1}, and over three-quarters (77%) of UCOF operated in the yield class of 7500 to 8999 kg ha^{-1}. The mean yield of UCOF was 8235 kg ha^{-1} and was 69% higher than the mean yield of NUF (4860 kg ha^{-1}).

Comparison of mean vegetable yields of NUF and UCOF: In testing the null hypothesis of no significant difference in the mean yields of UCOF and NUF (equation 1), and applying the test statistic in equation 3, the null hypothesis is rejected (t_c = 32.1) for the acceptance of the alternative hypothesis. This shows that UCOF obtained larger mean vegetable yield than the NUF and that commercial organic fertilizer assisted in increasing the yield of vegetable crop significantly.

Table 1. Distribution of vegetable farmers by farm enterprise characteristics

Characteristics	Distribution (%)		Mean		Standard deviations		t_c
	NUF	UCOF	NUF	UCOF	NUF	UCOF	
Farm size (ha)							
0.01-0.19	20	09					
0.20-0.39	15	20					
0.40-0.59	48	41					
0.60-0.79	17	24					
0.80-0.99	-	06	0.424	0.496	0.198	0.204	2.81*
Organic fertilizer (kg ha^{-1})							
300-399		05					
400-499		19					
500-599		11					
600-699		41					
700-799		24		610		118.3	
Yield (kg ha^{-1})							
3,000-4,499	35	-					
4,500-5,999	56	-					
6,000-7,499	09	12					
7,500-8,999	-	77					
9,000-10,499	-	11	4860	8235	915.4	719.2	32.1*

* Means significant at *P*=0.05

Partial budget analysis: In addition to the physical input-output data, the market situation relating to the prices of inputs and output is necessary to measure the economic feasibility of a change in technology. The physical input-output data assist in establishing the technical efficiency. Favourable technical efficiency is not enough for economic feasibility as input-output price ratio may cause the outcome of technical efficiency to be different from that of the economic efficiency. Partial budget analysis combines the information on physical input-output relationship with those of prices of input and output to determine the economic feasibility of a proposed technology (the use of commercial organic fertilizer). Table 2 shows the partial budget analysis of change from no-fertilizer technology to commercial organic fertilizer technology in the production of vegetable. Since there is no discrimination in the output of vegetable from the two sources, the farm gate price remained the same (₦76 kg^{-1}) and the gross farm gate benefit varies with the level of yield obtained from each technology. The gross farm gate benefit which is the product of average yield and farm gate price was ₦369,360 ha^{-1} and ₦625,860 ha^{-1} for no-fertilizer and commercial organic fertilizer technologies, respectively. The variable inputs were commercial organic fertilizer and labour for fertilizer application that were restricted to commercial organic fertilizer technology only, and labour for weeding and harvesting which affected the two technologies. Labour for weeding was higher for commercial organic fertilizer technology than no-fertilizer because the organic fertilizer encourages the growth of weed, thereby higher labour cost. Labour cost on harvesting was higher for organic fertilizer technology as a result of higher yield obtained than no-fertilizer. The total variable input cost was ₦35,796 ha^{-1} for no-fertilizer technology that is smaller than ₦86,943 ha^{-1} for

Table 2. Partial budget and sensitivity analyses for vegetable production under no-fertilizer and organic fertilizer technologies

S.N.	Items	No-fertilizer (Treatment 1)	Organic fertilizer (Treatment 2)	Break-even price of vegetable	Break-even yield of vegetable	Break-even price (₦`z) of organic fertilizer
	Gross farm gate benefits					
1	Average yield (kg ha^{-1})	4,860	8,235	8,235	6,206	8,235
2	Farm gate price (₦ kg^{-1})	76	76	57.27	76	76
3	Gross farm gate benefits (kg ha^{-1}) (1x2)	3,69,360	6,25,860	4,71,656	4,71656	6,25,860
	Variable input costs (₦ ha^{-1})					
4	Commercial organic fertilizer (₦ ha^{-1})	-	24,400 (40)	24,400 (40)	24,400 (40)	1,01,260 (166)
5	Labour –fertilizer application	-	6,100	6,100	6,100	6,100
	- weeding	15,572	21,111	21,111	21,111	21,111
	- harvesting	20,224	35,332	35,332	35,332	35,332
6	Total variable input costs (4+5)	35,796	86,943	86,943	86,943	163,803
	Net benefits					
7	Net benefit (₦ ha^{-1}) (3-6)	3,33,564	5,38,917	3,84,713	3,84,713	4,62,057
8	Change in net benefits from technology 1 to 2. (₦ ha^{-1})		2,05,353	51,149	51,149	1,28,493
9	Change in total variable input costs from technology 1 to 2 (₦ ha^{-1})		51,147	51,147	51,147	1,28,007
	Marginal rate of return					
10	Marginal rate of return (%) (8/9x100)		401	100	100	100

[Z] ₦ = Naira the currency of Nigeria. The mean exchange rate during the study period was: $1US = ₦137.

commercial organic fertilizer, producing a change in total variable input costs of ₦51,147 ha^{-1} between the two technologies. The net benefit was ₦333,564 ha^{-1} for no-fertilizer technology and ₦538,917 ha^{-1} for commercial organic fertilizer technology resulting in a change in net benefit of ₦205,353 ha^{-1} between the two technologies. The resulting marginal rate of return (MRR) is 401%. Since the resulting MRR is greater than the acceptable minimum rate of return (AMRR =100%), the change from no-fertilizer technology to commercial organic fertilizer technology in vegetable production is profitable.

Sensitivity analysis: Sensitivity analysis (Table 2) was used to determine the break-even price of commercial organic fertilizer, break-even yield of vegetable and break-even price of vegetable. The break-even yield obtained using the formula by Alimi and Manyong (2000) is 6206 kg ha^{-1}. This implies that adverse conditions beyond the control of the farmers such as technology failure and inclement weather condition would result in decreased yield obtained from commercial organic fertilizer by more than 2029 kg ha^{-1} or 24.64% to make commercial organic fertilizer technology less lucrative than no-fertilizer. An adverse change in market condition (increase in variable input price such as price of commercial organic fertilizer and or decrease in price of vegetable produced using commercial organic fertilizer) can affect the decision to change from no-fertilizer technology to commercial organic fertilizer technology. A more than 315% rise in price (from ₦40 kg^{-1} to more than ₦166 kg^{-1}) of commercial organic fertilizer will disfavour change from no-fertilizer technology to commercial organic fertilizer technology. If for whatever reason(s) consumers of vegetable develop a distaste for vegetable produced using commercial organic fertilizer, thereby reducing demand for it, and necessitating reduction in price of vegetable from this source, result of break-even analysis indicates that the price of vegetable output will have to decrease below ₦57.27 kg^{-1} for commercial organic fertilizer technology to be less viable than no-fertilizer technology.

Constraints to the use of commercial organic fertilizer: The constraints stated by NUF preventing the use of commercial organic fertilizer were its offensive odour, heavy weed infestation, doubtful efficacy, bulkiness and lack of funds to purchase (Table 3). The order of ranking starting from the most important was doubtful efficacy, offensive odour, heavy weed infestation, bulkiness and lack of fund. NUF were not convinced that commercial organic fertilizer could lead to appreciable yield increase to justify additional expenses on organic fertilizer. It is necessary for agricultural extension agents to mount demonstration plots to convince farmers on the higher profitability of commercial organic fertilizer technology for vegetable production. The issue of offensive odour could be addressed by adding inexpensive and harmless deodorant to make the application and handling of commercial organic fertilizer users' friendly. Commercial organic fertilizer encouraged the growth of both weed and vegetable thereby increasing labour cost on weeding. While rapid growth of vegetable is desirable, that of weed is not; cost saving weed control method(s) must be considered. The bulkiness of commercial organic fertilizer commodity makes its transportation difficult and expensive; research should consider means of reducing its bulkiness at no loss of quality.

Table 3. Constraints to the use of commercial organic fertilizer and their relative ranking

Constraints	Importance rating		Importance index	
	Mean	Standard deviation	Index	Rank
Offensive odour	3.56	1.27	121	2nd
Heavy weed infestation	3.07	1.39	64	3rd
Doubtful efficacy	4.15	0.90	216	1st
Bulkiness	2.33	1.41	23	4th
Lack of funds	1.89	1.10	9	5th

The study examined the relevance of commercial organic fertilizer technology in vegetable production in Osun State of

Nigeria. Primary data on quantities and prices of inputs and outputs were collected from non-users of fertilizers (NUF) and users of only commercial organic fertilizer (UCOF); and in addition data on commercial organic fertilizer from UCOF only and reasons for non-use of commercial organic fertilizers from NUF only. Data collected were analyzed using descriptive and inferential statistics, partial budgetary technique, and sensitivity analysis and importance indices. Results indicated that UCOF obtained significantly higher mean output and higher marginal rate of return than the NUF thereby making the commercial organic fertilizer technology superior to non-use of fertilizers. The constraints to non-use of commercial organic fertilizer in descending order of importance are doubtful efficacy, offensive odour, heavy weed infestation, bulkiness and lack of funds to purchase the commercial organic fertilizer commodity which should be addressed to boost commercial organic fertilizer production enterprise, increase profits to vegetable farmers and produce more vegetable for consumption.

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