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Impact of adoption of organic fertilizer on vegetable farmers income in Niger State, Nigeria

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Abstract

This paper examined the impact of adoption of organic fertilizer on vegetable farmers' income in Niger State, Nigeria. One hundred and Ninety-six (196) farming households were selected for the study. Data were collected using structured questionnaire coupled with interview schedule and were analyzed through the use of frequency count, and simple percentages. The results showed that the average age of 38.2 years. majority (61.2%) of the respondents were male while 72.9% of the respondents were married. Farm size and age influences the adoption of organic fertilizers significantly. Also, male farmers are more likely to adopt organic fertilizers than female farmers. The propensity scores results showed that the overall average propensity score among the sampled households was about 0.67. Households who adopted organic fertilizer had earned between #8,823 thousand naira to #14,041 thousand naira more average per hectare farm income compared to non-adopters of organic fertilizer. The study concluded that adoption of organic fertilizer had positive impact on households' farm income in the study area. the study recommends the need for consumer sensitization on the potential benefits of patronizing organically grown vegetables.

Keywords: Adoption, Income, Organic Fertilizer, Vegetable

1. Introduction

Organic farming represents a deliberate attempt to make the best use of local natural resources and it is an environment friendly system of farming. It relies much on ecosystem management which excludes external input, especially the synthetic ones. Anderson *et al.,* (2005) [5] stated that organic farming is a production system that excludes the use of synthetically manufactured fertilizer, pesticides, growth regulators and livestock feed additives. The system lies on crop rotation, crop residues, animal manures, and legumes, green manures, off farm organic wastes, minimum mechanical cultivation and aspects of biological pest control to maintain soil nutrients. It became obvious that organic management affects soil macro biological and chemical properties by increasing soil nutrient availability, microbial biomass and microbial activity which represent a set of sensitive indicators of soil quality (Marinari, Mancinelli, Campiglia, and Grego, 2010) [12]. Organic farming improves ecological health because it helps farmer maintain nutrient balances in soil through locally available organic materials or recycled farm waste (Omotesho, Fakayode and Tariya, 2012) [14].

Therefore, the fertility management in organic farming relies on a long-term integrated approach rather than the short term. The organic agriculture has been associated with returns on investment because it offers farmer a much more secure income than when they rely on only one or two inputs (Babasola, Olaoye, Alalade, Matanmi and Olorunfemi, 2017) [6]. Organic farmers adopt practices to conserve resources, enhance biodiversity and maintain the ecosystem for sustainable production and can lead to increased food production. In many cases, the use of organic fertilizer has been resulting into doubling of yields which makes an important contribution to increasing the food security of a region (Marinari *et al.*, 2010) [12]. Yet, many factors have been reported to limit the use of organic fertilizer among farmers in Nigeria. However, it has been observed that, there has been disparity and conflicts of ideas on the constraints to the use of organic fertilizer by farmers.

In Nigeria, crop production is mostly practiced on subsistence scale with majority of the farmers wallowing in poverty. The resultant effect is that they are faced with several constraints in the use of fertilizers. Some of major constraints amongst others are: ever increasing price of fertilizers, unavailability or late arrival of fertilizers, insufficient quantities of fertilizers, cultural barriers, political interference in distribution, not conducting soil test, poor fertilizer recommendation or lack of appropriate information on correct usage, lack of incentives and unintended subsidies (Akpan and Ayan, 2012) [4]. Recognizing the myriad

of deficiencies inherent in the use of fertilizer in developing countries, many agriculturally based agencies have advocated the use of organic fertilizers as alternatives to inorganic fertilizer (Emuh and Ofioku, 2011) [7]. The commonly used organic manures by vegetable farmers in the country are: cow dung, goat droppings, pig and poultry dropping. Poultry dropping however seems to be the most preferred among farmers probably due to its relative affordability and availability on demand (Babasola *et. al.*, 2017) [6].

Pornpratansombat, (2010) [16], have reported that for agriculture to be sustainable, inorganic fertilizers are not suitable because of environmental degradation caused by their usage. It can affect current production negatively as well as jeopardize the agricultural productivity levels and compromise future production which will result in poverty in the long term. Pornpratansombat, (2010) [16] submits that inorganic fertilizer usage in agriculture contributes to biodiversity losses, however available literature on the quantitative estimates is scanty. Organic fertilizers on the other hand promote the living of the soil by providing conditions that are suitable for diverse living organisms to coexist in the soil environment.

Vegetable crops are usually described as the tender edible shoots, leaves, fruits and roots of plants that are eaten whole or partly raw or cooked as a supplement to starchy food (Udoh, 2013) [18]. Currently, there are no restrictions on the use of organic manure for vegetable crop cultivation. Vegetable production is popular in Nigeria because of its short gestation period, easily affordable, nutritive value and high gross margins (Akpan and Aya, 2012) [4]. These crops are consumed in relatively small quantities as a side dish with the staple food. In recent times, there has been a tremendous interest and increase in vegetable crop production in the country. The crop is cultivated on upland during rainy season and in wetland or *FADAMA* area during dry season.

With the increasing vegetable production rate in Niger State, and the efforts made by the government and other development partners to enhance adoption of organic fertilizer by farmers in the state, it is no surprise that the rate of adoption of organic fertilizer has significantly increased with about 62 percent of the farming households adopting the use of organic fertilizer (Abdullahi, Salihu, Umar and Hassan, 2018) [1]. Furthermore, there is a dearth of information on the effects of adoption of this specific technology on household income, and the transaction costs involved. Thus, to fill this gap, this study sought to examine the effect of adoption of organic fertilizer on smallholder farmers' income in Niger state, Nigeria. Therefore, the specific objectives were to:

1. Identify factors influencing the adoption of organic fertilizers in vegetable production in the study area;
2. examine the impact of organic fertilizer usage on vegetable farmers' farm income in the study area.

2. Methodology

2.1 Study area

This study was conducted in Bosso, Kontagora and Lapai Local Government Areas of Niger State, Nigeria. Niger State was created out of the former North Western State and became a fully autonomous State on 3rd February, 1976, with headquarter at Minna. Niger State is in the North-central part of Nigeria and lies in between longitude 3^0 30^1 and 7^0 20^1 East of the Greenwich Meridian and latitude 8^0 20^1 and 11^0 30^1 North of the equator. The State presently comprises of 25 Local Government Areas (LGAs) and it is made up of three major ethnic groups which are the Nupe, Gbagyi and Hausa. However, the total inhabitants in the State are over 3,954,772 people (National Population Commission of Nigeria, 2016) [13] from 2006 population census. But, going by the annual population growth rate of 2.5 percent in Nigeria (NPC, 2016) [13], the population of Niger State was projected to be 5,556,200 (NPC, 2016) [13].

The study population comprised of all the vegetable farmers in Niger State. A three-stage sampling technique was adopted to select sample for this study. The first stage involved random selection of one Local Government Area from each of the three (3) agricultural zones in the state. The second stage involved random selection of three (3) villages from each of the selected LGA. The third stage involved the use of 10% of the sample frame thus, a total of 196 respondents were selected as sample size from the 1,960 registered vegetable farmers in the selected villages in the study area. Based on the estimated proportion of the adopters and non-adopters of organic fertilizer in the study area, whereby adopters in the area were about 62 percent and non-adopters were about 38 percent of the population. Therefore, proportionally, 121 farming households (62 percent of the sample) and 75 farming households (38 percent of the sample) were selected from the lists of adopters and non-adopters respectively.

Primary data were used for this study. Data collection was conducted through structured questionnaire complemented with an interview schedule. Descriptive statistics involving mean, percentages and frequency distribution. In addition, a 3-point Likert type of scale was used to measure constraints to adoption of organic farming practices among vegetable farmers thus, a reference means of three (3) was derived (3+2+1=3) and used as decision rule:

Severe Constraints (SC) =3, Not Severe Constraints (NSC) =2 and Not Constraint (NC) =1. Also, Propensity Score Matching (PSM) was used to examine the effect of organic fertilizer usage on vegetable farmers' farm income, and Multinomial Logit Model was used to determine the factors influence adoption of organic fertilizer.

Mathematically, it can be represented as:

$$\text{Score } (X_i\ K) = \beta_k X_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where *Xi* is the vector of explanatory variables describing observation *i*,

βk is a vector of weights (or regression coefficients) that corresponds to outcome *K* and

score (*Xi, K)* of assigning observation *i*, to category *K.*

In discrete choice theory, where observations represent people and outcomes represent choices, the score is considered the utility associated with person *i*, choosing outcome *K.*

3. Results and discussion

Socio-economic characteristics of the respondents

The results in Table 1 reveals that majority (82.1%) of the respondents were between the ages of 21-50 years with an average age of 38.2 years. This implies that the farmers are young and still in their productive age, thereby constituting readily available labour force for organic vegetable farming. This agrees with the findings of Adesope *et. al.* (2012) [2],

who reported that young farmers are mostly cosmopolitan in nature and therefore tend to recognize and adopt farm innovation with little bottleneck. Similarly, majority (61.2%) of the respondents were male while (38.8%) were female. The more involvement of male in vegetable farming may probably be due to the cultural and religious belief of the rural people in Northern Nigeria which tends to restrict women to household domestic chores. In most rural communities, women are usually not allowed to own land and where women own land; they usually delegate its responsibility to their senior male child, brother or husband (FAO, 2013) [8]. This implies that the high involvement of male in vegetable production is connected to the role of male gender as the household head. This finding agrees with that of Solomon (2016) [17], who reported that male gender dominated the crop farming enterprise in Northern Nigeria.

The result further reveals that majority (72.9%) of the respondents were married and this comes along with responsibilities to the family. Therefore, additional responsibilities attached to marriage especially provision of nutrition may have been the motivation for venturing into organic vegetable farming. This agrees with the findings of Oyesola *et al*. (2011) [15] who observed that marital responsibility led farmers to expand their land cultivation so as to increase food security in the household. In similar vein, the result revealed that farmers had a fairly large household size with a mean value of seven (7) members per household in the area. This has implication on the availability of family labour for farm work. The large number of household members in the study area may be due to the polygamous nature of the rural people who tend to recognize household population as a symbol of authority among farmers. Although, the larger the household size, the higher the demand for food by each person within the household. This result agrees with the findings of Abdullahi, Salihu, Umar, and Hassan (2018) [1] who observed that as the household size increases, the likelihood of expanding cultivated farm land is expected to be high among rural crop farmers.

Table 1 further reveals that majority (49.4%) of the respondents had formal type of education involving attending primary, secondary and tertiary institutions while 50.6% had non-formal type of education related to skills acquisition and training. Given this level of literacy, it is expected that information on organic practices may be disseminated with ease among farmers and this could influence their decision to adopt organic practices. This finding agrees with Yengoh (2010) [19] who reported that personal characteristic especially, education influences adoption of new technology among rural crop farmers in Nigeria.

Table 1: Socio-economic characteristics of the farmers

Variables	Frequency	Percentages	Mean
Age (Yrs.)			
≤ 20	16	8.16	38.2
21 – 30	41	20.9	
31 – 40	79	40.3	
41 – 50	41	20.9	
≥ 51	19	9.7	
Gender			
Male	120	61.2	
Female	76	38.8	
Marital Status			
Married	143	72.9	
Single	38	19.4	
Divorced/Separated	6	3.06	
Widowed	9	4.60	
Formal Education			
Non formal	99	50.5	
Primary	31	15.8	8
Secondary	39	19.9	
Tertiary	27	13.7	
Farming Experience			
≤ 10 years	79	40.3	14
11 – 20 years	81	41.3	
21 – 30 years	21	10.7	
≥ 31 years	15	7.65	
Household Size			
≤ 5	91	46.4	7
6 -10 people	86	43.9	
11 – 15 people	19	9.7	
Farm Size (Ha)			1.91
< 2	132	67.3	
> 2	64	32.7	

Source: Field Survey, 2021

Factors Influencing the Adoption of Organic Fertilizers in Vegetable Production

Table 2 shows the effects that significant factors have on the adoption of fertilizers in the study area. The marginal effects which show the magnitude of the changes that occur in the dependent variable when there are corresponding changes in the independent variables were estimated. The three choices were the adoption of organic fertilizers, inorganic fertilizers and the adoption of both. The base was the choice of inorganic fertilizers, with Hausman test for independence of irrelevant alternatives (IIA) assumption conducted to establish the validity of the model. The test indicated that the choice of one alternative was independent of others, hence the test failed to reject the null hypothesis that the alternatives are independent of each other, therefore the multinomial logit model fits the data. From table 2, factors such as income from organic fertilizer usage, income from inorganic fertilizer usage, access to credit and type of market significantly influence the choice of more than one alternative with respect to the base alternative. Farm size influences the adoption of both types of fertilizers. As pointed out by Abdullahi *et. al.,* (2018) [1], farm size is a significant determinant of the adoption of farming technologies. As shown from Table 2, the larger the farm size, the more likely a farmer is to adopt both fertilizers. This result therefore re-affirms the assertion made by Abdullahi et. al., (2018) [1].

Table 2 further shows that the age of respondents influences the adoption of organic of fertilizers significantly. It can be deduced from results that the older the farmer, the more likely that he/she will adopt organic fertilizers in comparison to adopting inorganic fertilizers alone. This could be due to the fact that older farmers are likely to be more experienced in vegetable production so they may have used both fertilizers in the past and know the benefits that each type of fertilizer would likely bring, as well as the benefits of combining the two types. In doing so, they stand to reap the combined benefits that will accrue from using both. Also, membership of organization a farmer belong to negatively influences the adoption of both types of fertilizers with respect to the base alternative. The results show that farmers who belong to farm-based organization are less likely to adopt both fertilizers as compared to

adopting inorganic fertilizers alone. This is because farmer-based organisations offer platforms for the farmers to learn and they are more likely to learn about the potential benefits of using both types of fertilizers together. The fertility status of the soil negatively influences the adoption of both types of fertilizers, hence the more fertile the soil is perceived by the farmer, the less likely he/she will adopt both fertilizers as compared to adopting inorganic fertilizers alone. Furthermore, table 2 reveals that the income that a farmer gains during the periods when he does not apply any fertilizer positively influences his decision to adopt a mixture of both fertilizers as compared to adopting inorganic fertilizers. This is supported by Babasola *et. al.*, (2017) [6] who reported that income of a farmer was key in choosing technologies to adopt. Government subsidy on inorganic fertilizers negatively influenced the adoption of both fertilizers as compared to the adoption of inorganic fertilizers. The result suggests that the higher the subsidy on inorganic fertilizers, the less likely the vegetable farmers in the study area are to adopting a mixture of both types of fertilizers. Perhaps this goes to re-enforce the assertions made by Yengoh *et. al.*, (2010) [19], that the Government's fertilizer policy is fraught with problems such as shortages and high transaction costs, which make the subsidized fertilizers less attractive.

With regards to the gender of vegetable farmers in the study area, male farmers are more likely to adopt organic fertilizers than female farmers, hence a positive relationship. The Consumer preference for organically grown vegetables negatively influences the adoption of organic fertilizers with respect to the adoption of inorganic fertilizers. This could be due to the fact that majority of farmers reported they were not influenced by the preference of consumers for organically grown vegetables when it comes to choosing which type of fertilizer to patronize. This did not conform to a prior expectation, but then again, it could have been because of the fact that consumers in Niger State are not demanding organically grown vegetables.

Table 2: Marginal effect of factors influencing adoption of organic fertilizers

Variable	All Fertilizers		Organic Fertilizer	
Gender	0.0042	(0.7921)	0.00384***	(0.000)
Age	0.04622***	(0.000)	-.0005821	(0.7121)
Inorganic income	0.000301***	(0.000)	-0.000288***	(0.002)
Organic income	0.0363***	(0.000)	0.00322**	(0.0432)
Membership of Org.	-0.0034***	(0.000)	-0.6634	(0.6892)
Farm Size	0.00424***	(0.000)	-0.8729	(0.4956)
Access to Credit	0.00211*	(0.041)	-0.06543*	(0.0486)
Fertility Status	-1.0834e-4***	(0.000)	0.1416	(0.4619)
Fertilizer Subsidy	-3.426e-4**	(0.029)	-0.00059	(0.867)
No Fertilizer Income	0.0059***	(0.000)	0.0008617	(0.8920)
Observation (N)	196			
Wald Chi^2 (38)	2942.36			
Prob>Chi^2	0.0000			
Pseudo R^2	0.3242			
Note: P values in brackets and *significant at 10%, ** significant at 5% and *** significant at 1%.				

Source: Field Survey, 2021

Impact of Organic Fertilizer Usage on Vegetable Farmers' Income

Results of Propensity Score Matching for Impact of Organic Fertilizer on Income

The propensity score matching (PSM) technique was used to compute the impact of organic fertilizer adoption on households' farm income. The household's agricultural income per hectare of farm land for the year 2013/14 was used. Taking participation (adoption decision) as 1 if the household has been participating in adoption of organic fertilizer and 0 otherwise, propensity scores were estimated using probit regression. All variables hypothesized to influence adoption decision of organic fertilizer were included to predict the probability of each households' participation in organic fertilizer adoption. These variables include: age, gender, household size, education level of household head, farm income, experience, farm size, perception of farm fertility, number of livestock units, access to credit, extension visits, access to information through information media, membership to farmer groups, labour, marital status, distance to the nearest market and highest education level among the family members.

As shown in table 3, the overall estimated propensity scores lie between 0.039 and 0.836. Amongst the adopters of organic fertilizer, the propensity scores vary between 0.039 and 0.784 while amongst the non-adopters it lies between 0.106 and 0.836. This shows that the region of common support would lie between 0.039 and 0.836 dropping observations with propensity scores below 0.039 and above 0.836. Furthermore, the propensity scores results showed that the overall average propensity score among the sampled households was about 0.67 implying that the average probability of participating in adoption of organic fertilizer for individual sampled households was about 67 percent.

Table 3: Distribution of the Estimated Propensity Scores

Categories	Obs.	Min	Mean	Max	SD
Organic fertilizer non-adopters	75	0.106	0.523	0.836	0.179
Organic fertilizer adopters	121	0.039	0.342	0.784	0.156
Total	196	0.039	0.672	0.836	0.181

Source: Field Survey, 2021

Choice of Matching Algorithms

The choice of matching algorithms was guided by the criteria's such as number of balanced covariates after matching (number of covariates with no statistically significant mean difference between adopters and non-adopters of organic fertilizer after matching), Pseudo-R^2 and matched sample size. A matching estimator which balances all covariates and bears low psuedo-R^2 value as well as with

large matched sample size is preferable for impact assessment (Tolemariam, 2010). Based on the above discussed criterion, table 4 showed that kernel matching and nearest neighbour matching were equally found to be the best matching methods in assessing the impact of organic fertilizer adoption on household's farm income. Therefore, both matching algorithms were used in the impact assessment of this study. Since the results of performance analysis for kernel matching showed equal number of balanced covariates, equal Psuedo-R^2 and equal matched sample size for all included band width (0.06, 0.1, 0.25, and 0.5), any one of the listed band width can be used to perform the analysis. This study has therefore used the band width of 0.06.

Table 4: Results on Performance of Different Matching Algorithms (*N*=196)

Matching Estimator	Balancing test*	Pseudo-R^2	Matched Sample Size
Nearest Neighbour Matching			
NN (1)	9	0.014	121
NN (2)	9	0.012	121
NN (3)	9	0.005	121
NN (4)	9	0.007	121
NN (5)	9	0.005	121
Radius Matching			
Calliper of 0.01	9	0.005	114
Calliper of 0.25	7	0.02	121
Calliper of 0.50	5	0.06	121
Kernel Matching			
Band width 0.06	9	0.002	121
Band width 0.10	9	0.002	121
Band width 0.25	9	0.002	121
Band width 0.50	9	0.002	121

Note: * Number of covariates exhibited no significant mean difference after matching between adopters and non-adopters of organic fertilizer.

Testing the Balancing Properties of Propensity Scores and Covariates

Before estimating the impact of organic fertilizer adoption on household's farm income, the balancing properties of propensity scores should be checked to test whether the observations have had the same distribution of propensity scores or not. According to Tolemariam (2010), balancing test seeks to examine if at each value of the propensity score, a given characteristic has the same distribution for the treated and comparison groups. The results presented in Table 5 showed that five variables exhibited significant mean difference before matching while no variable showed significant mean difference after matching. This implies that there is high degree of covariate balance between the sample participants and non-participants of organic fertilizer adoption. Therefore, it was concluded that the specification was successful in terms of balancing the distribution of covariates between the matched adopters and non-adopters of organic fertilizer.

Table 5: Balancing Test of the Covariates Based on Kernel Matching Method

	Pre-matching (N = 196)			Post-matching (N = 190)		
Covariates	**Treated**	**Control**	**t-test**	**Treated**	**Control**	**t-test**
Age	28.76	29.48	-0.11	30.01	29.29	0.20
Household size	3.56	3.51	0.36	3.49	3.53	0.19
Gender	0.43	0.46	-0.09	0.43	0.41	0.05
Farming Experience	13.44	13.39	0.04	13.42	13.32	0.08
Education	5.47	5.29	1.01*	5.43	5.43	-0.01
Soil Fertility	1.76	1.81	-0.19	1.84	1.82	0.12
Farm Size	1.97	1.89	-0.21***	1.89	1.88	0.13
Marital Status	2.16	2.12	0.32	2.14	2.18	-0.39
Membership	0.52	0.39	3.38***	0.52	0.55	-0.13

Note: *** and * indicate significance at 1% and 5% probability level respectively

Impact of Organic Fertilizer Adoption on Households Farm Income

Table 6 shows the impact of organic fertilizer adoption on households' farm income. The results presented earlier (table 4) showed that the kernel based matching algorithm and nearest neighbour matching with five closest neighbours could give the best results of impact assessment for this study. However, according to Becker and Ichino (2002), consideration of several matching algorithms in tandem is advantageous as it allows measuring the robustness of the impact estimates. Thus, in addition to kernel matching and nearest neighbour matching, radius matching and stratification matching methods were also employed to compare the difference of average farm income between the samples of adopters and non-adopters of organic fertilizer.

Accordingly, results from table 6 indicated that the households who adopted organic fertilizer had earned between #8,823 thousand naira to #14,041 thousand naira more average per hectare farm income compared to non-adopters of organic fertilizer. This implies that adoption of organic fertilizer is crucial to increasing farmer's farm income. The nearest neighbour matching, stratification matching and kernel based matching results were significant at 5 percent probability level while the results for radius matching were significant at 1 percent probability level. Kassie *et. al.*, (2013) posited that the use of compost had led to significant increase in yield of wheat, barley and *teff* grains in Tigrai region of Ethiopia while Abdullahi *et. al.*, (2018) [1] noted that there was better net income when vegetable producing farmers used organic fertilizer instead of chemical fertilizer. IFPRI (2010) [10] asserted that farm productivity can be increased by more than 10 percent when organic fertilizer is used compared to when chemical fertilizer is used. Moreover, the results affirm that adoption of organic fertilizer contributes to increased farm income among the farmers in Niger State, Nigeria.

Table 6: Propensity Score Matching Results

Matching Algorithms	Number of treated	Number of controlled	ATT	Std. Err.	t-value
NNM	121	75	9544.23	834.21	1.76**
KM	121	75	8823.49	802.34	1.79**
SM	121	75	11809.87	814.33	1.74**
RM	114	72	14041.21	765.86	2.70***

Note: *** and ** show significance at 1%, and 5% probability level respectively.

Where, NNM is nearest neighbour matching (5), KM is kernel matching (band width = 0.06), SM is stratification matching and RM is radius matching (calliper = 0.01).

4. Conclusion and recommendations

From the findings, it is obvious that farmers in the study area were mainly small land holders in their productive age and with high level of knowledge on organic farming which no doubt helped built their attitude towards adoption of organic farming practices in vegetable farming. Also, households who had adopted organic fertilizer earned better average per hectare farm income compared to the non-adopters. This implies that the adoption of organic fertilizer had positive impact on households' farm income in the study area therefore farmers should be encouraged to use organic fertilizer. Based on the findings of this study, the following recommendations are made:

- Organic fertilizer has the potential to increase farmers farm income. Emphasis should therefore be placed on improving knowledge level of farmers on the importance of organic fertilizers through the extension agents to stimulate or increase use among farmers. This will help increase their farm income and improve their livelihood.
- While there is the need to encourage farmers to adopt the use of organic fertilizers, there is also the risk of over application as organic fertilizers have been observed to be slow acting thereby taking the soils a longer period to fully break them down. Therefore, the use of organic fertilizers should be supervised by extension agents to make sure that excessive levels are not applied, as this could result in environmental pollution in the long run if left unsupervised.
- There is the need for consumer sensitization by nutritionists on the potential benefits of patronizing organically grown vegetables. This could expand the demand for organically grown vegetables and the willingness of consumers to pay premium price and hence stimulate organic production by farmers.

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