Case Study

REASONS PROMPTING THE ADOPTION OF ORGANIC FERTILIZERS IN VEGETABLE PRODUCTION IN AGOTIME-ZIOPE DISTRICT, GHANA

ABSTRACT

The objective of this research was to identify the reasons prompting the adoption of organic fertilizers in vegetable production and also to establish the factors that discourage organic fertilizer usage in vegetable production. Data from 50 purposively selected farmers based in Agotime-Ziope District was used. A binomial logistic regression analysis was fitted to a data of 50 farmers. Results show that five factors; *X4* (Easy access), *X5* (Less processing needed), *X8* (More economical), *X9* (Consumer preference of organic products), and *X11* (Enhanced healthy ecosystem) were statistically significant in the prediction of the adoption of organic fertilizers with a predicted adoption rate of 93.64%. Furthermore, respondents were unanimous on "Doubtful efficacy", "Health risk", and "Labour intensive" as the factors that discourage organic fertilizer usage in vegetable production. It was therefore suggested that entrepreneurs and investors should be incentivized by Government through duty exceptions and endowments among others things to put resources into setting up all the more more composting sites as composting help remove some portion of the constraints related with raw fertilizer for example, the requirement for drying which expends time and builds opportunity cost. Finally, there is the need for buyer refinement by nutritionists on the potential advantages of belittling naturally developed vegetables. This could extend the interest for naturally developed vegetables and the readiness of shoppers to pay a top notch cost and hence stimulate organic production by farmers.

Keywords: Organic, Fertilizer, Adoption, Logistic regression

INTRODUCTION

According to the Department for International Development (2002) sustainable agriculture means ceaselessness and duration in gainful creation. It includes farming practices that can be rehashed without the exhaustion of accessible fundamental assets that help agribusiness. It likewise implies rural practices that won't obliterate the environment. More than 8 million tons . Over 8 million tons of supplements are mined from soils in Sub-Saharan Africa consistently. In Ghana, around 5 Kg of soil supplements per hectare is taken out by crops (Henao & Baanante, 2006). They further shown that if Africa is to have the capacity to encourage its poor and hungry individuals, the utilization of inorganic manures ought to be advanced by Governments and partners as opposed to natural composts which have a greater number of advantages than the supplements that they give (Department for International Development, 2002). In Ghana, the present level of inorganic manure use is around 8 Kg for every hectare (Ministry of Food and Agriculture, 2008). In its endeavor to build the utilization of inorganic composts, the Government of Ghana presented the manure appropriation program in 2008 (Yawson et al., 2010). However, the subsidy policy is bedeviled with issues, for example, deficiencies and high exchange costs. Little scale agriculturists who shape around 80% of the ranchers in Ghana griped that even with the endowment, the inorganic composts were as yet costly (Yawson et al., 2010). There is a solid contention by Savci (2012) that inorganic manures utilized are compelled by their high expenses and indeterminate returns under rain-bolstered agriculture.

Furthermore, Alimi *et al*. (2006) additionally expressed that inorganic composts don't enhance soil physical properties, for example, dampness maintenance limit and mass thickness among others, which natural manures can do. McGuinness (1993) and Alimi et al. (2006) showed that the filtering of inorganic manure minerals into more prominent profundities, defile groundwater

and realize conditions, for example, water hardness. Alimi et al. (2006) included further that the minerals are filtered past the scope of plant roots. McGuiness (1993) and Heal (2004), have announced that for farming to be economical, inorganic composts are not appropriate in view of ecological debasement caused by their utilization. It can influence current generation adversely and also endanger the farming efficiency levels and bargain future creation which will bring about neediness in the long haul. Recuperate (2004), presents that inorganic manure use in agribusiness adds to biodiversity misfortunes, however accessible writing on the quantitative appraisals is meager. Natural manures, then again, advance the living of the dirt by giving conditions that are appropriate to different living creatures to exist together in the dirt condition (Heal, 2004). Savci (2012) expressed that compound composts are horticultural toxins and that they can act medical issues such like disease. These issues raise a worry of critically discovering options, for example, natural manure. In any case, Barnard and Nix (1979) place that ranchers will supplant a current info just when the new information will yield an incremental positive net return or that the new costs (both direct and exchange costs) per unit related with that information is much lower than the related advantages. Delgado (1998) likewise showed that if exchange costs related with an information are seen to be high, ranchers might be demoralized from utilizing that info asset, henceforth agriculturists are probably going to pick one contribution over another when the cost suggestions, and the advantages, are more ideal contrasted with the option being

the selection of natural composts in vegetable generation

and furthermore to build up the elements that dishearten natural manure utilization in vegetable production.

LITERATURE REVIEW

Sources of Organic Fertilizers

Alimi *et al*, (2006) commercial natural manures are natural composts that are advertise arranged. That accessible available incorporate Bone supper, blood/angle/bone, blood feast, dried fertilizers, Epsom salts, angle dinner, foot and horn, shake phosphate, ocean growth supper and wood slag (Bary, Cogger, and Sullivan, 2000). Bone feast is very rich in phosphate to advance root development. It is normally great to sprinkle a little in the planting opening. Blood, fish and bone, for example, is an adjusted all round compost. Blood feast, dissimilar to dried fertilizer, is high in nitrogen. It can be utilized as a snappy tonic for tired plants in the dry season. Dried composts have all the follow components yet very are low on NPK so a greater amount of it is expected to give satisfactory adds up to crops. Epsom salts are a dissolvable type of magnesium. Fish feast contains nitrogen and phosphate. Foot and horn are rich in nitrogen. It deals with moderate discharge and should be connected seven days before planting. Shake phosphate advances establishing and is a decent

Rock potassium is very helpful as a wellspring of unadulterated potash. It functions as a moderate discharge and is decent manure for vegetables. Ocean growth supper is likewise very amazing, it is a moderate releaser of supplements, and an overall manure. It contains cytokines and hormones that advance photosynthesis and protein combination. Slag from wood is high in potassium and some phosphate - the amounts rely upon the sort of wood, be that as it may (Bary et al.,2000 and Jokella et al., 2004).

Aside from natural manures acquired from advertise obvious, a few agriculturists attempt their own fertilizing the soil for self-use and any overabundances sold for money or given to different ranchers (Odhiambo and Mag, 2008). A current wonder in the Greater Accra Region is the foundation of various fertilizing the soil plants to create organic composts for farmers use. Most of these composting plants get raw materials from natural waste created by the masses. Zoomlion Ghana Limited a waste administration organization in Ghana has built up a high limit plant at Medie in the Ga West Municipality to process squander materials into natural manures. Alimi et al., (2006) distinguished two noteworthy hotspots for acquiring natural manures: those that experience the market trade framework, i.e. business natural composts and those that don't experience the market trade framework. Odhiambo and Magandini (2008) sets that fertilizer, for example, is gotten principally from neighboring ranches or from ranchers possess animals in this manner for agriculturists who occupied with blended farming.

Factors Influencing the Adoption of Organic Fertilizer Technology

Boateng (2000) observed that Ghanaian ranchers pick inputs in light of elements, for example, accessibility, openness, showcase value, the wage level of agriculturists, past experience of agriculturists with a specific sort of manure and in addition financial factors, for example, work, capital and land. Likewise, a few components keep running crosswise over ranchers in various regions whiles others may change from place to put contingent upon winning conditions (Bonabana-Wabbi, 2002). There are various variables that decide if an agriculturist would receive a given innovation or not. Bonabana-Wabbi (2002) places that these elements incorporate Government approaches towards an innovation, mechanical change, advertise

powers, ecological factors, for example, nature of the dirt and soil ripeness, statistic factors, for example, age and instruction, institutional factors, for example, access to data and the systems for conveying the technology.However, for a given innovation, not every one of the variables may apply in this way a relapse investigation is a method for knowing which ones would apply in a specific situation. These incorporate Market factors including accessibility of work, asset necessities of the innovation, size of the homestead, expected advantages and the exertion required to apply the innovation. Social factors, for example, the age of the rancher, social remaining of the agriculturist, instructive level of the agriculturist, cultivating knowledge and the sexual orientation of the rancher, enrollment to agriculturist based associations. Administration factors like Access to credit and Institutional/innovation conveyance instrument, for example, the entrance to data and augmentation contacts and related knowledge with utilizing the innovation, ecological wellbeing concerns (Bonabana Wabbi, 2002). Kebede et al. (1990) extensively arranged the components that impact selection of advancements into Social, Economic and physical classifications. Makokha et al. (2001) recorded factors, for example, expansion contacts, enrollment in an association, family unit estimate, employed work for excrement application, off-cultivate salary among others similar to the huge elements impacting the utilization of inorganic compost innovation and fertilizer in maize generation in Kiambu area, Kenya. Waithaka, Thornton, Shepherd, and Ndiwa (2006) gave factors, for example, agriculturist attributes, cultivate qualities among others as elements that decide the selection of compost and excrement by smallholder ranchers in the Vihiga area of Kenya utilizing a couple of Tobit models. They characterized selection of the two innovations in wording their proceeded with use underway over in excess of a season. Bonabana-Wabbi characterized appropriation as far as acknowledgment of the innovation by the objective gathering and learned the variables that

impact the selection of coordinated vermin administration in cowpea, sorghum and groundnut development in the Kumi area of Uganda by utilizing the Probit, Logit and Tobit relapse models. She found that Low levels of appropriation were related with five of the advances and furthermore that three advances had elevated amounts of reception. She likewise demonstrated that agriculturists earlier investment in bug administration preparing were altogether connected with expanded selection of most Integrated Pest Management hones. Makhoka et al. (2001) identi

METHODOLOGY

This study used descriptive, cross-sectional study design. The setting was the Agotime-Ziope District in Volta Region, Ghana. The population for this study included sampled farmers who use organic fertilizer. A total of 50 farmers all in the district were selected for the research. The sample size for the study was calculated based on the Yamane's formula. Determination of sample size is based on the estimated target population size (n=95) which was obtained from the Ministry of Food and Agriculture, Agortime-Ziope District. The formula is stated below.

$$n = \frac{N}{1 + Ne^2}$$

Where$n = Sample\ Size$

$$N = Size\ of\ Population$$

$$e = The\ desired\ level\ of\ precision\ or\ level\ of\ acceptable\ error$$

$$Total\ sample\ size\ (n)\ = \frac{95}{1 + (95)(0.1)^2}$$

$$= \frac{95}{1 + 0.95}$$

$$= \frac{95}{1.95}$$

$$= 48.7$$

$\cong 49$

Based on the above, the appropriate sample size selected for the study was 49. However, to account for attrition, the of subjects was increase to 50.

The study employed a purposive sampling technique in selecting the farmers located in various parts of the district. This is where the researcher makes a deliberate choice of an informant due to the qualities the informant possesses and also respondents available at the time of the research given the questionnaire to answer.

Data for the study was obtained using questionnaire. The questionnaire had two sections. The first section consisted of demographic information such as gender, age, and years of farming. The second section consisted of information on the reasons prompting the adoption of organic fertilizers in vegetable production and also the factors that discourage organic fertilizer usage in vegetable production.

Data for the research was analyzed using logistic regression with the help of SPSS version 23.

Definition of Variables

Below are the predictor variables considered for this study.

X1= Age
X2= Gender
X3= Farm size
X4= Easy access
X5= Less processing needed
X6= Reduce soil erosion
X7= Fertility status of soil
X8= More economical

X9= Consumer preference of organic products

X10=Premium payment of organic products

X11 = Enhanced healthy ecosystem

***X12*=**Less risk of plant injury

Dependent variable construction and pre-processing

The data preparation step deals with the choice and creation of the desired variables dependent and covariates.

In this study, a binary dependent variable adoption (Y) was created.

$$Y_i = \begin{cases} 1 \text{ adoption; farmers who use organic fertilizer} \\ 0 \text{ non} - \text{adoption; farmers who do not use organic fertilizer} \end{cases}$$

This criterion is consistent with the general definition of adoption. Since including all variables will make the model unnecessarily large, the principle of parsimony will justify small model. The researcher employed statistical procedures such as forward and backward selection processes to verify consistency of variables selected in the model.

Analytical Tools

The study makes use of the logistic regression model. Logistic regression is based on binomial probability theory. It is a mathematical modeling approach used in describing the relationship of several independent variables to a dichotomous dependent variable or a limited dependent variable. The logit function is employed because the dependent variable default‟ is dichotomous, whereas the proposed covariates were mixture of continuous and categorical random variables. Thus the model was chosen over others due to the data structure and purpose. Also, the independent variables need not be an interval, nor normally distributed, nor linearly

related, nor equal variance within each group. The logit model is a derivative of the odds function. The odd of a function is the ratio of the probability of success to that of failure. Thus

$$Odds(Y = 1) = \frac{P(Y = 1/\ X = x)}{P(Y = 0/\ X = x)}$$

where $Odds(Y = 1)$is the odds of adoption; $P(Y = 1)$ is the probability that adoption occurs given a set of explanatory variables and $P(Y = 0)$ is the probability of non-adoption given a set of explanatory variables.

If the odds of adoption are greater than one, it means there is a higher probability of adoption compared to that of non-adoption. A value less than one indicate a higher probability of non-adoption than that of adoption.

RESULTS AND DISCUSSION

This subsection looks at the summary statistics of the respondents. A total of 50 farmers completed the questionnaire on the reasons prompting the adoption of organic fertilizers in vegetable production. Table 1 summarizes the socio-demographic information of the respondents.

Table 1: Demographic information of the participants (n=50)

Variables	Frequency	Percentages
Gender		
Male	39	78.0
Female	11	22.0
Age		
29 - 38	11	22.0
39 - 48	31	62.0

49 - 58	8	16.0
Years of farming		
Less than 5	7	14.0
6 - 10	14	28.0
11 and above	29	58.0

From table 1 above; out of the 50 respondents 78% of them were male, whiles 22% were females. Also, 22% of the respondent were between the ages of 29 and 38; 62% of them are between 39 and 48 age group, and finally the rest 16% were in the age group of 49 and 58 years' age group. The analysis further revealed that about 14% of the respondents have been cultivating vegetables for about less than 5 years; 28% have been cultivating between 6 to 10 years; and finally, 58% of them have been cultivating between 11 years and above.

Table 2: Logistics Regression Estimates of Reasons Prompting the Adoption of Organic Fertilizers in Vegetable Production

							95.0% C.I.for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
X1	0.171	0.218	0.616	1	0.433	1.187	0.774	1.821
X2	-0.274	0.170	2.601	1	0.107	0.760	0.545	1.061
X3	0.036	0.239	0.023	1	0.880	1.037	1.098	3.535
X4	**-0.843**	0.200	17.693	1	**0.000**	**0.430**	0.291	0.638
X5	**0.737**	0.242	9.293	1	**0.002**	**2.091**	1.301	3.359
X6	0.293	0.223	1.727	1	0.189	1.341	0.866	2.076
X7	0.008	0.167	0.002	1	0.963	1.008	0.727	1.398
X8	**0.952**	0.214	19.861	1	**0.000**	**2.591**	1.704	3.937
X9	**0.678**	0.298	5.174	1	**0.023**	**1.971**	0.649	1.657
X10	0.149	0.270	0.307	1	0.580	1.161	0.685	1.969
X11	**0.871**	0.151	1.652	1	**0.000**	**2.389**	0.613	1.107
X12	0.146	0.140	1.096	1	0.295	1.158	0.880	1.523
Constant	0.294	1.688	0.030	1	0.862	1.342		

Table 2 shows the result of logistic regression estimates of the various reasons prompting the adoption of organic fertilizers in vegetable production. The significance value of the Wald statistics for each independent variable indicates the contribution or importance of each of predictor variables (P<0.05).

From the table, column six (6) determines the variables that contribute significantly to the predictive ability of the model at 0.05 level of significance. These variables are, *X4* (Easy access), *X5* (Less processing needed), *X8* (More economical), *X9* (Consumer preference of organic products), and *X11* (Enhanced healthy ecosystem).

Thus the logistic function is given by the equation (2) below:

$$P(Adoption) = \frac{1}{1 + e^{-(0.294X4 + 0.737X5 0.952X8 + 0.678X9 + 0.871X11)}}$$

Furthermore, the odd ratio ($Exp(\beta)$) for the significant factors, shows the increase (or decrease if the ratio is less than one) in odds of being in one outcome category (adoption or no adoption) when the value of the predictor increases by one unit. From table 2, the odds or risk of a farmer adopting the organic fertilizer, is 0.430 for *X4* (Easy access). This indicates that the risk of a farmer adopting organic fertilizer is 0.430 times higher for a farmer when there is an easy access to the organic fertilizer, all other factors being equal. For *X5* (Less processing needed), the odd ratio indicates that risk of a farmer adopting the fertilizer is 2.091 times more likely to adopt if the perceive the processing needs to be less, all other factors being equal. For *X8* (More economical), the odd ratio of 2.591 indicates that the risk of a farmer adopting the fertilizer is 2.591 times higher for a farmer who perceives the organic fertilizer to be more economical than for a farmer who does not perceive the organic fertilizer to be more economical, all other factors being equal.

Also for *X9* (Consumer preference of organic products), the odd ratio is 1.971 which means that for any preference of organic products by the consumer, the risk of a farmer adopting the organic fertilizer increases by 1.971, all other factors being equal. Finally, the odd ratio of 2.389 for *X11* (Enhanced healthy ecosystem) indicates that for any perceive enhanced healthy ecosystem by farmers, the risk of adopting increases by a factor of 2.389, all other factors being equal.

Table 3: Response to Factors that Discourages Organic Fertilizer Usage in Vegetable Production

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Doubtful efficacy	Group 1	<= 2	2	0.04	0.50	0.000
	Group 2	> 2	48	0.96		
	Total		50	1.00		
Offensive odour	Group 1	<= 2	28	0.56	0.50	0.480
	Group 2	> 2	22	0.44		
	Total		50	1.00		
Health risk	Group 1	<= 2	10	0.20	0.50	0.000
	Group 2	> 2	40	0.80		
	Total		50	1.00		
Bulkiness	Group 1	<= 2	31	0.56	0.50	0.127
	Group 2	> 2	19	0.44		
	Total		50	1.00		
Inadequate storage	Group 1	<= 2	21	0.20	0.50	0.213
	Group 2	> 2	29	0.80		
	Total		50	1.00		
Labour intensive	Group 1	<= 2	12	0.24	0.50	0.000
	Group 2	> 2	38	0.76		
	Total		50	1.00		

The variables above are indicators of the factors that discourage organic fertilizer usage in vegetable production. From the table above, group 1 (<= 2) are those who strongly disagree or disagreed to the variables indicating the factors that discourage organic fertilizer usage in

vegetable production; group 2 (> 2) are those who strongly agreed and agreed. At a significant value of 0.05; it appears that three exact significant values except three are less than 0.05, suggesting that the respondents are unanimous on them as the factors that discourage organic fertilizer usage in vegetable production. The significant variables are “Doubtful efficacy”, “Health risk”, and “Labour intensive” with 87%, 88% and 82% agreement respectively.

However, those that have a significant value greater than 0.05 are "Offensive odour”, “Bulkiness” and “Inadequate storage". The implication of this is that the respondents are divided on the effectiveness of that statement as factors that discourage organic fertilizer usage in vegetable production.

CONCLUSION AND RECOMMENDATION

The study revealed that five (5) factors; *X4* (Easy access), *X5* (Less processing needed), *X8* (More economical), *X9* (Consumer preference of organic products), and *X11* (Enhanced healthy ecosystem) were statistically significant in the prediction of the adoption of organic fertilizers with a predicted adoption rate of 93.64%. This indicates that there is a probability that 93.64% of farmers, with the given characteristics, are likely to adopt organic fertilizer. Also, respondents were unanimous on “Doubtful efficacy”, “Health risk”, and “Labour intensive” as the factors that discourage organic fertilizer usage in vegetable production.

Therefore, entrepreneurs and investors should be incentivized by Government through tax exemptions and subsidies among others things to invest in setting up more composting sites as composting help remove some of the constraints associated with raw manure such as the need for drying which consumes time and increases opportunity cost.

Finally, 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 there is the requirement for shopper refinement by nutritionists on the potential advantages of disparaging naturally developed vegetables. This could extend the interest for naturally developed vegetables and the eagerness of buyers to pay a top notch cost and subsequently fortify natural generation by farmers.

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