SOCIO-ECONOMIC DETERMINANTS OF IRRIGATED VEGETABLE PRODUCTION SYSTEMS IN ANAMBRA AGRICULTURAL ZONE, ANAMBRA STATE, NIGERIA

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ABSTRACT
The study analyzed the socio-economic factors influencing the type of irrigation technique practiced by dry season vegetable farmers in Anambra agricultural zone of Anambra State, Nigeria. A total of 70 respondents were interviewed using structured questionnaire. Data was analyzed using multinomial logit model. The results showed that most (41%) of the farmers were in their productive age range (31-40 years). Majority (84%) were females with with having household sizes (55%) ranging from 5-8 persons and highest educational level of GCE or O level. Many (44%) of the farmers rented land with average land size of 0.49 ha. The multinomial logit result indicated that while sources of fund were positively and highly significantly related to the probability of the farmer practicing traditional (bucket) and small pump irrigation system, farmer's income was negatively signed and highly significantly related to the probability of practicing traditional (bucket) and small pumps. Also, the farming experience was positively and significantly related to the probability of the farmer practicing small pumps irrigation system while farmers' age was negatively and significantly related to the probability of the farmer practicing small pumps irrigation system. It is hoped that these factors will act as a guide for policy makers in providing irrigation technologies in the study area. Credit facilities should be provided to the dry season vegetable farmers.

Keywords: Determinants, Irrigation and Vegetable

INTRODUCTION
Dry season vegetable production has become an important revenue generation for most farmers in the South-eastern part of Nigeria. Nigerian agriculture is predominantly small holder, subsistence based and weather dependent. Most farmers produce mainly food crops using traditional extensive cultivation methods, making limited use of modern technologies and purchased inputs. Nigerian agriculture which is mainly rain-fed has two main cropping seasons; early and late rainfall seasons. Dry season production of vegetable in Anambra State is common along the banks of rivers that cut across cities and towns, inundated lands closer to cities or towns characterize by high population density. Dry season vegetable production has been ongoing for decades providing employment and income for the increasing population during prolong dry season (Sabo and Zira, 2009).

The country's vast irrigation potential remains largely unexploited: less than 1 percent of cultivated area is under irrigation (Vision 20-20-20). According to Spore, (2008) irrigation enables farmers to make use of water from rivers or groundwater sources to extend their cultivation period, adding off season crops to traditional rainfed ones during the dry season. Irrigation is likely to increase the size and weight of individual fruit and to prevent defects, such as toughness, strong flavor, poor tip-fill and pod-fill, cracking, blossom-end rot, and misshapen fruit. Most vegetables are rather shallow-rooted. Even short periods of two to three days of moisture stress can damage marketable yields. This could be because vegetables are 80 to 95 percent water and their yield and quality suffer rapidly when subjected to drought (Grubben and Denton, 2004). Thus, for good yields and high quality, irrigation is essential to the production of most vegetables. If water shortages occur early in the crop's development, maturity may be delayed and yields reduced. If a moisture shortage occurs late in the growing season, quality is often reduced even though total yields may not be affected.

Van Leeuwen (2001), noted that water resources are limited and irrigation is very labor demanding because in many dry season farming, irrigation water is carried by hand from the well, reservoir or

river to the field. Irrigation schemes in developing countries especially in sub-Sahara Africa (SSA) suffer from very low water use efficiency, resulting in water logging and salinity problems.

According to Sabo and Zira (2009), vegetable production in Nigeria, is constrained by inadequate infrastructure, agronomic and socio-economic variables. Following widespread failure of large scale irrigation projects throughout the Sub Sahara Africa (for example the Green Revolution initiative of 1970s). To ensure food security, many policy makers, stakeholders, governments and donor agencies have shifted attention to small scale farmer based floodplain agriculture (World Bank, 2001), which is an alternative to large scale irrigation farming. Investigating the socio- economic factors influencing the practice of these alternative irrigation systems becomes imperative.

Since agricultural practices in Nigeria are mainly rain-fed coupled with its attendant continued widening food demand supply gap, there is near absence of information on the factors influencing types of irrigation system practiced by dry season vegetable farmers in the area. The need for irrigated farming and hence research into it is paramount. The objectives of this study therefore are: to examine the socio-economic characteristics influencing the types of irrigation techniques practiced by dry season vegetable (fluted pumpkin) farmers, method of production, and farm sizes as well as identifying the constraint to dry season vegetable farming in the study area.

METHODOLOGY

The study was conducted in Anambra State Nigeria; Anambra State is in South-eastern Nigeria. Its boundaries are formed by Delta State to the West, Imo State to the south, Enugu State to the East and Kogi State to the North. The State was created on 27th August 1991 and has a population of 4,182,032 (NPC, 2006). The State lies within longitudes 60 19^1 60 E and latitudes 7^0 $0^1$0N and (Nfor, 2006). The state experiences dry season from late October to early May and has at least six dry months in the year. The vegetation consists of rainforest. Other parts consist of wooden savannah and grasslands. The state is drained by five major rivers and their tributaries. These are the River Niger, Anambra River, Mamu/Ezu River, Idemili River and River Ulasi. In addition to these, there are smaller perennial streams like the Oyi, Nkisi, and Obizi. In-land valley ponds and lake occur, with the Agulu Lake draining a collection of towns in the state (Nwadukwe, 2000). These make the state suitable for dry season vegetable cultivation.

Anambra State occupies an area of 4,844km^2 (NPC, 2007). Seventy percent is arable land and less than 55 percent of this arable land is under cultivation. The farming system of the State is essentially crop based. The major crops cultivated are vegetables such as fluted pumpkin, amaranth, tomato and okra. Others are yam, rice, maize, oil palm, plantain /banana and beans. Anambra State is made up of 21 Local Government Areas divided into four agricultural zones namely: Aguata Zone, Anambra Zone, Awka Zone, Onitsha Zone (ASADEP, 2003). Anambra Zone, comprising Anambra East, Anambra West, Oyi and Ayamelum was the focus zone for this study.

Purposive and simple random sampling techniques were employed in this study. Anambra zone was purposively selected for this study. This is because of the predominance of dry season vegetable farmers in the zone. The list of the farmers in the zone was gotten from ASADEP. Twenty dry season vegetable farmers were randomly selected each from Anambra East, Anambra West and Oyi L.G.Areas while ten farmers were randomly selected from Ayamelum L.G.Area. This gives a total sampling frame of seventy. Data were collected mainly from primary sources. Primary data for the study were elicited with the aid of a well structured questionnaire administered to farmers. Data were elicited on the socio-economic characteristics of the farmers such as age, sex, household size, educational status, plot size (ha), extension services, sources of fund, types of irrigation technique practiced, and the production systems.

Analytical Procedure

The multinomial logit model was used to estimate the influence of socioeconomic factors on the type of irrigation technique practiced by the farmers. This was because the dependent variable (types of irrigation technique practiced) was coded with the following values: 1 for traditional or Bucket

System, 2 for small pumps, 3 for large scale or motorized. It was therefore of a categorical nature, with numbering arbitrarily assigned so that it did not imply any order of importance or magnitude. Moreover, in situations where the farmers practiced two types of techniques, which were rare in the study area, the major technique practiced was considered.

The multinomial logit model can be estimated with a set of coefficients, $\beta^{(1)}, \beta^{(2)}, \beta^{(3)}$ as follows:

$$\Pr\ (Z = 1) = \frac{\ell^{X\beta(1)}}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + \ell^{X\beta(3)}}$$

$$\Pr\ (Z = 2) = \frac{\ell^{X\beta(2)}}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + \ell^{X\beta(3)}}$$

$$\Pr\ (Z = 3) = \frac{\ell^{X\beta(3)}}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + \ell^{X\beta(3)}}$$

The model, however, is undefined in the sense that there are more than one solution to $\beta^{(1)}, \beta^{(2)}, \beta^{(3)}$ that will lead to the same probabilities for Z = 1, Z = 2, Z = 3. To identity the model, one of the $\beta^{(1)}, \beta^{(2)}, \beta^{(3)}$ is arbitrarily set to zero (0), that is, if one arbitrarily set $\beta^{(3)}$ = 0, the remaining coefficient $\beta^{(1)}, \beta^{(2)}$ will measure the change relative to Z = 3. In other words, one will be considering the socio-economic factors that influence the type of a particular irrigation technique practiced by dry season vegetable farmers: {large scale or motorized (number 3) of irrigation}, with other form of irrigation (1 and 2). Therefore, using three category responses as in the model for this study and setting $\beta^{(3)}$ = 0, the equation becomes:

$$\Pr\ (Z = 1) = \frac{\ell^{X\beta(1)}}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + 1}$$

$$\Pr\ (Z = 2) = \frac{\ell^{X\beta(2)}}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + 1}$$

$$\Pr\ (Z = 3) = \frac{1}{\ell^{X\beta(1)} + \ell^{X\beta(2)} + 1}$$

the relative probability of Z = 1 to the base category which is

$$\frac{\Pr(Z=1)}{\Pr(Z=3)} = \ell^{X\beta(1)}$$

If this is called the relative likelihood and assume that X and $\beta_K^{(1)}$ are vectors equal to (X_1 -- X_η) and ($\beta_1^{(1)}$ -------- β_η^1) respectively, the ratio of the relative likelihood for one unit change in X_i relative to the base category is then stated as;

$$\frac{\ell_1^{\beta(1)} + ... + \beta_{i(}^{(1)}(Z_i + 1) + ... + \beta_k^1 xk}{\ell^{\beta}{}_1^{(1)} x_1 + ... + \beta_1^{(1)} x_1 + ...\beta_k^{(1)} xk} = \ell^{\beta i^{(1)}}$$

Therefore, the exponential value of a coefficient is the relative likelihood ratio for one unit change in the corresponding variable (StataCrop, 2003). The variable, "Type of irrigation technique practiced" has three possible values. If the farmer uses motorized or large-scale irrigation system three is assigned.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the respondents

The result in Table 1 shows that about 41% of the respondents were within the age range of 31 to 40 years. This suggests that most farmers were in their productive age. Almost all (84%) of the farmers

were females. This is not surprising because dry season vegetable production in the area is an occupation mostly practiced by women. Majority (55%) of the respondent had household sizes ranging from 5-8 people. Large household sizes may mean more family labor available for farm production activities. About 75% of the farmers were educated with educational level ranging from primary to secondary level. Higher educational attainment could make a farmer more receptive to new innovation which could enhance crop production.

Table 1. **Frequency distribution of respondents according to socio-economic characteristics**

Characteristics	**Frequency**	**Percentage**
Age in Years		
<30	8	11
31-40	28	41
41-50	23	32
Above 50	11	16
Total	**70**	**100**
Gender		
Female	59	84
Male	11	16
Total	**70**	**100**
Household size		
1-4	8	11
5-8	39	55.5
9-12	20	29.5
Above12	03	4
Total	**70**	**100**
Educational level		
No formal	17	24.3
FSLC	33	47
WASC/NECO/GCE/OL	20	28.7
OND/HND/BSc	0	0
Total	**70**	**100**
Farming experience		
1-5	4	5.7
6-10	22	31.4
11-15	24	34.3
Above 15	20	28.6
Total	**70**	**100 mean =13.91**
Farm size		
<0.20	12	17
0.21-0.40	17	24.3
0.41-0.60	17	24.3
0.61-0.80	15	21.4
Above 0.80	09	13
Total	**70**	**100 mean =0.49**
Land acquisition system		
Community (gift)	23	33
Inherited	10	14
Rented	31	44
Purchased	06	09
Total	**70**	**100**

Source: Field survey, 2012

The mean farming experience was 13.91 years with maximum of 33years and minimum of 4years. This is an indication that majority of the farmers were in the business for a long time and are therefore

conversant with the problems of dry season farming in the area. The farm sizes ranges from <0.20 ha to above 0.80 ha, the mean farm size was 0.49 ha with maximum of 1.14 ha and min of 0.07 ha. This implies that the farmers were basically small scale farmers.

Production environment of the farmers

The study shows that about 44% of the farmers rented land for the vegetable production; about 30% acquired land through gift while 14% and 09% inherited and purchased land respectively. The major source of manure used was poultry (65%). Most of the respondents noted the soil fertility level supports their vegetable production, hence did not apply inorganic fertilizer. About (47%) of the respondents practiced traditional (bucket) system of irrigation.

Table 2 shows the multinomial logit regression analysis of the socio-economic factors that influenced the type of irrigation techniques practiced by the dry season vegetable farmers in the study area. The explanatory power of the factors as reflected by the pseudo R^2 (71%) seems high. However, the overall goodness of fit as reflected by prob > chi was good (0.0000). In terms of consistency with a priori expectations on the relationship between the dependent and the explanatory variables, the model appears to have performed well.

Table 2. Output from multinomial logit regression analysis

Variables	Traditional (1)	Small Pumps (2)
Sources of funds (dummy)	7.8832**	3.6401***
	(2.78)	(3.50)
Farm size (ha)	-5.9419	-6.9966
	(-2.01)	(-2.10)
Farming Experience (years)	-0.0189	0.8245**
	(-0.09)	(2.57)
Education (years of Schooling)	-0.3869	-0.2964
	(-1.53)	(-1.19)
Age (Number)	-0.1521	-0.7573**
	(-1.11)	(-2.75)
Income (naira)	-0.0000	-0.0000**
	(-1.69)	(-2.73)
Intercept	11.773**	27.9128**
	(1.69)	(2.67)

Source: Field survey, 2012.

Statistics: chi^2 = 101.20, prop > ch^2 = 0.0000; Pseudo - R^2 = 0.7114; number of observation= 70. Note: (3) Motorized (large scale) irrigation system is the comparison category. The figures in parenthesis are Z- ratios. ***p ≤ 0.01;0.01 < p ≤ 0.05.**

The probability that a farmer practiced small pumps (private) and traditional (bucket) irrigation system as opposed to motorized system was positively and highly significantly related to the farmers' sources of fund. This is to be expected because most farmers use personal savings as their major source of funds and may not have accessed formal credit facilities which could assist them afford capital intensive irrigation techniques.

In comparison with motorized irrigation system, the probability that a farmer practiced small pumps irrigation system was positively and significantly related to farming experience. In other words, the more experience a farmer is, the higher the odds, that the farmer will practice large scale irrigation technique. This is to be expected because more experienced farmers, given opportunity, would choose to practice large scale irrigation technique which could lead to high productivity, hence improving their wellbeing. The probability that a farmer practiced bucket irrigation system in comparison with motorized system was negatively and highly significantly related to the farmer's age. In other words, the older the farmer, the lower the odds of practicing bucket irrigation system. This is not surprising because bucket irrigation system is labor intensive, and older farmers may be not be energetic to carry on with the rigors of its operation.

In comparison with the motorized irrigation system, the probability that a farmer practiced bucket (traditional) and small scale irrigation system was negatively and highly significantly related to the farmers' income. In other words, the higher the income, the lower the odds of the farmer practicing bucket and small scale irrigation system. This is to be expected because farmers with higher income would normally practice irrigation techniques that are capital intensive.

Constraints to Dry Season vegetable production in the study area

During the field work component of this study, the dry season vegetable farmers were requested, for each possible constraint, to tick whichever is applicable from among the options: SA= strongly agree, A= agree, SD= strongly disagree and D= disagree. The responses of the farmers to this question show that 100% of them noted lack of access to credit facilities as a constraint to dry season vegetable farming in the area. Lack of credit facilities could also be limitation to the type of irrigation system practice by the respondents. Scarcity of land was also adjudged a constraint by 65% of the respondents. This is an indication that land was not a major problem in the study area. This could be because most of the respondent had access to communal land. Although the average area of land (0.49ha) cultivated by the respondents indicated that they were mostly small scale farmers. This could be because the farmers are undercapitalized. Furthermore, 59% and 54% of the respondents indicated inadequate visits by extension agents and poor transport facilities. Extension personnel are usually poorly mobilized, both in terms of wages and logistics, in Nigeria and hence they are also usually poorly committed to their jobs. The problem of high cost of planting material could also be connected with that of lack of credit access, because the farmers may not have been sufficiently empowered, financially, to adequately contain the cost of planting material. The problem of pests/diseases and low productivity were each reported by 56% of the farmers while the problem of theft was reported by 39% of them.

CONCLUSION

Irrigation is an important concept in dry season farming; it improves productivity as well as reduces the incidence of food insecurity. Identified in this study are the socio-economic factors influencing the type of irrigation techniques practiced by dry season vegetable farmers in Anambra agricultural zone of Anambra State, Nigeria using multinomial logit model. Socio-economic characteristics show that farmers mean age was 41 years, an indication that they were in their most productive age. Majority of the farmers were females with average farming experience of about 13 years and household size of about 7 persons. Also, dry season irrigation system in the study area was positively and significantly influenced by sources of fund and income. Experience in dry season farming and age of the farmer had a positive and significant influence on the type of irrigation system practiced. The study call for policies aimed at provicion of irrigation technologies and facilities in the study area. Lack of access to credit was a major constraint to dry season vegetable production. The study also recommends that credit facilities be provided to the dry season farmers in the study area.

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