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Full Length Research Paper

Farmers' adoption of improved vegetable production practices under the National Fadama Phase One Development Project in Anambra State of Nigeria

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The study was undertaken to evaluate the Fadama phase one vegetable production project in Anambra State. Data for the study were colleted from 160 vegetable growers (80 project farmers and 80 non-project farmers), through the use of a set of structured interview schedule. Percentages, mean scores and gross margin analysis technique were used in the data analysis. The result of the study indicates that majority (70.0%) of the project farmers (PFs) were males, while the majority (25.5%) of the non-project farmers (NPFs) were females. The vegetable growers had relatively large household size and long Fadama farming experience. The mean hectarage of Fadama vegetable farm size of PFs and NPFs were 0.87 and 0.63 ha, respectively. The Fadama vegetable production contributed 30.5 and 25.8% to the annual income of the PFs and NPFs, respectively. Telfaria and Okro production were the most preferred vegetables during dry and wet seasons, respectively, mainly due to high income generating capacity, high market demand, high yielding capacity, usefulness and availability to the family. Only improved vegetable seed, manure application and harvesting method were adopted. The study also revealed that the vegetables under study were profitable to the PFs, especially, during the project life.

Key words: Adoption, improved vegetable, production practices, farmers and national fadama development project.

INTRODUCTION

The increase in agricultural production achieved through the enclave Agricultural Development Projects (ADPs), compared with the situation before the adoption of the ADP approach, encouraged the Nigerian Government to establish the ADPs on a nation-wide basis in all the states of the Federation with the focus on small-scale farmers (Aja, 1981; Unamma et al., 1999). The ADPs thus became the extension arms of the state ministries of agriculture. Consequently, the Training and Visit (T&V) system of agricultural extension (Benor and Baxter, 1984) was chosen and adopted (Amalu, 1998). Gradually Unified Extension Approach was introduced whereby each extension agent was expected to deal with the transfer of technology on all the agricultural sub-sectors; viz: arable crops, livestock, agro forestry and land management, fisheries, and post harvest (especially, WIA). The Unified Agricultural Extension System (UAES) is an amalgamation of the Farming Systems Research and the Training and Visit Extension System to generate and disseminate location specific agricultural technologies to farmers through a single field worker (Benor and Harison, 1977; Unamma et al., 1989; Olukosi et al., 1991). The Women-In-Agriculture (WIA) component of the ADPs was established nationwide in 1989/90 activity year to address the peculiar extension needs of women farmers, particularly in gender specific issues (Amalu, 1998; Ajayi, 1999).

Technology transfer under the UAES ensures that contact farmers and/or contact groups initially receive the technologies first-hand from the extension agents. Other farmers are then expected to copy the innovations from

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the contact farmers. Proven technologies are demonstrated to the farmers through the Small Plot Adoption Techniques (SPATs) (Chukwunta and Uzoechi, 2001). In the process, the farmers are able to compare the small plots with equivalent plots of their traditional/local practices (Nkematu, 2003). In order to effectively back-up the re-organized extension service with relevant technologies, the agricultural research institutes were re-organized and precise responsibilities were allocated to each (Anuebunwa, 1993; Amalu, 1998). Relevant arable-crop based institutes were mandated to conduct farming systems research in defined agro ecological zones of the country in order to provide appropriate technologies for the utilization of relevant ADPs (F.M.A.W.R.R.D., 1989; F.M.A.N.R., 1997).

To facilitate smooth and quick flow of appropriate technologies generated at the research institutes to the farmers level, a linkage group had to be formed in the form of On-Farm Research (OFR) Team/core Team of Monthly Technology Review Meeting (MTRM), Resource Research Scientists and Subject Matter Specialists (SM Ss) (Iwueke, 1994). The Extension Agents (EAs) are expected to cover a circle delineated into 6 - 8 sub-circles within a fortnight. In this process, the EAs are expected to visit small groups on official contact farmers' fields and other farmers' fields at least once a fortnight to teach them up to 3-4 carefully chosen production recommendations on "impact points"; on what to do over the next two weeks (Amalu, 1998; Obiechina, 1999; Chukwunta and Uzoechi, 2001). The EAs are made to attend Block Meetings (BM) and Fortnightly Training (FNT) sessions. The Block Extension Supervisors (BES s), in addition to attending training sessions are expected to spend at least; eight days, every two weeks in the field, in supervising the EAs (Unamma et al., 1989). In the whole process, a technology package or small components of it are either accepted, modified or rejected by the contact/project farmers depending on farmers' assessment of the package. If accepted, the technology is passed on to the rest of the farmers in the recommendation domain through the appropriate ADP extension channels. If rejected, the technology is returned to the Research Institute or scientists through the BM, FNT, and MTRM for a further research, refinement and adaptation (Chukwunta and Uzoechi, 2001).

However, in 1992, the reappraisals of the ADP's dwindling resources and sustainability issues jointly led to the concentration of ADPs' activities to two distinct projects of National Fadama Development Project (NFDP) and National Agricultural Technology Support Project (NATSP). The two are being operated simultaneously by the ADPs. The NFDP was initiated for small-scale irrigation development, to increase the productivity of the farming system during the dry and wet seasons (F.M.A.N.R, 1997; Agu, 2002).

The Anambra State ADP (ASADEP) embarked on the NFDP Phase I in 1996 by carrying out a study of both the surface and shallow underground water resources in the state as part of its programme to increase dry season crop production and other farming activities in the state. The study showed that small-scale Fadama (irrigation) was feasible in Anambra State, using simple low cost technologies to harness both the surface and shallow underground water resources (Nwadukwe, 2000). About 30,000 hectares of land in the state was then identified as having the capability to support fadama development. About 66.67% (20,000ha) of the land could be irrigated by the provision of tube wells / wash bores, while 33.33% (10,000ha) could be irrigated by direct pumping/ diversion from surface water (Obiechina, 2000). River Niger is the most prominent river in the state. Others include Anambra, Mamu and Ulasi. These together with the numerous tributaries and streams are capable of providing enormous low land and basins for Fadama development in the state (ASADEP, 1995a; Nwadukwe, 2000).

Since the NFDP Phase-1 covered many areas of agricultural production, which will be impossible to examine under this particular study, the study is therefore, limited to vegetable production. Vegetables are among the major dietary intake in our everyday life. They are succulent herbaceous plants that are eaten in part, whole, raw or cooked as a part of our main dish or in salad. They are characterized by high moisture content being of the order of 75% moisture or more and 25% or less dry matter (Uzo, 1989).

Vegetables usually augment nutritive value of most of our staple food, which are deficient in vitamins, proteins and minerals. A remarkable change in nutritional requirements of an individual is bound to influence his health, skill and productivity. Now that the rural dwellers are finding it difficult to consume enough animal proteins, their dietary needs could be to some appreciable extent, met from the consumption of vegetables (Ellah, 2004). A judicious mixture of different vegetable proteins is enough to meet our daily protein requirements. Vegetables are also a good source of oils, carbohydrates, minerals and vitamins. Despite the nutritional value of vegetable they are not accorded their appropriate uses in the diet of the West African peoples partly because of ignorance of nutritive value of these foods and largely due to cost, difficulty of storage and distribution (Asiegbu, 1983). The NFDP phase-I which implementation lasted for a period of six years came to an end in December 2002 and the phase-2 is yet to take-off as of the time of this research in 2004/2005 cropping season. Within the period of six years, the NFDP was expected to have achieved its predetermined objectives especially, with respect to improved vegetable production. The question now relates to the level of adoption of the improved vegetable production practices under Fadama phase-1 project of the Anambra State. What is the level of adoption of the improved vegetable production practices?

Table 1: Study population and sampling procedure summary.

Zone	Block	Circle	PFs		NPFs		Sample total
			P	S	P	S	
Anambra	Anambra East	Aguleri Uno	30	10	20	10	20
		Enugu Otu	45	10	20	10	20
	Anambra West	Nzam	15	10	20	10	20
		Ifite-Anam	75	10	20	10	20
Onitsha	Ogbaru	Odekpe	45	10	20	10	20
		Atani	60	10	20	10	20
	Idemili South	Nnobi	30	10	20	10	20
		Alor	60	10	20	10	20
Total	4	8	360	80	160	80	160

P = Population; S = Sample.

Purpose of the study

This study was designed to determine the level of adoption of improved vegetable production practices under Fadama phase 1 project in Anambra State, Nigeria. Specifically, the study was designed to

describe the socio-economic characteristics of the vegetable growers;
determine the vegetable production preference of the growers;
determine the levels of adoption of improved vegetable production practices introduced by NFDP; and
determine the profitability of Fadama vegetable production among project-farmers.

METHODOLOGY

The study area

The study took place in Anambra State of Nigeria. The state comprises 21 Local Government Areas (LGAs) and four Agricultural Zones (AZs) - Aguata, Anambra, Awka and Onitsha. There are 6 blocks in Aguata AZ, 4 blocks in Anambra AZ, 5 blocks in Awka AZ and 6 blocks in Onitsha AZ. The climate is typically equatorial with two main seasons, the dry and the rainy seasons. 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).

Study population and sampling procedure

All vegetable producers in the 4 AZs of Anambra State formed the population of the study. Out of the 4 AZs in the state, two (Anambra and Onitsha) zones were purposively selected because of the high activities of Fadama vegetable production project and active participation of the vegetable farmers. Also, based on the same reasons, two blocks (Anambra East and Anambra West) were purposively selected from the Anambra AZ, while another two blocks (Ogbaru and Idemili South) were also purposively selected from the Onitsha AZ. This implies that a total of 4 blocks were purposively included in the study. From each of the 4 blocks, 2 circles that were actively involved in the activities of Fadama vegetable project were selected, using simple random sampling technique. This indicates that a total of 8 circles were involved in the study (Table 1).

The target populations for the study were the project farmers and the non-project farmers from the blocks/circles. The list of the 8 circles and registered Fadama users associations (FUAs) were obtained from the headquarters of ASADEP. For the Fadama project farmers (PFs), a total number of 80 respondents (10 respondents from each of the 8 circles) were selected through simple random technique from the registered FUAs list. For the non-Fadama project farmers, from each of the 8 circles, a list of 20 vegetable farmers was drawn. From the list, a total of 10 vegetable farmers were selected, using simple random sampling technique. This implies that a total of 80 non-Fadama farmers were involved in the study. Therefore, a total of 160 farmers formed the sample size of the study (Table 1).

Instrument for data collection

The primary data to fulfill objectives 1-4 were collected by developing a set of structured interview schedule for the project and non-project farmers. Copies of the interview schedule were administered by the researcher and three trained enumerators during the months of August, September, October and November 2004.

Measurement of the variables

Objective 1: This objective aims at describing the personal and socio-economic characteristics of vegetable growers under the Fadama phase one project. To achieve this objective, the following were examined: age (years); sex; marital status; level of education;

household size, farming and Fadama experience (years); nature of Fadama practice (part-time or full-time); sources of Fadama vegetable land and credit; Fadama vegetable farm size (hectarage) and Fadama vegetable contribution to annual income.

Objective 2: The aim of this objective was to determine the vegetable production preference of the farmers. Here, the farmers were asked to indicate the vegetable they prefer to grow most during dry season with reasons.

Objective 3: Here adoption levels of the improved vegetable production innovations introduced by the project were determined. The farmers were asked to indicate their adoption level on a 5 – point adoption scale. Their response categories and the corresponding weighted values were as follows: Aware (AW) = 1; Interest (IN) = 2; Evaluation (EV) = 3; Trial (TR) = 4; Adoption (AD) = 5. The adoption levels were determined through the following steps: (1) the total adoption score per innovation was computed; (2) the adoption mean ($\overline{X}$) score per innovation was computed by dividing the total adoption score by the number of the respondents involved and (3) the grand mean ($\overline{X}$) adoption score was calculated by adding all the mean adoption scores and then divided by the number of the innovation considered.

Objective 4: This objective aims at determining the profitability of Fadama vegetable production. To fulfill this objective, the variable cost of vegetable production per 0.25 ha and revenue from 0.25 ha of each vegetable crop of the project farmers, were ascertained. Objective 4 was achieved by using Gross Margin (GM) analysis. The G M analysis was carried out as follows:

GM = TR – TVC

Where GM = Vegetable Enterprises Gross Margin, TR = Total Revenue from sale of each vegetable produce in naira, and TVC = Total Variable Cost of the average operating inputs and labour in naira.

Also, percentage margin was given by

%GM = (GM/TVC) X 100

The assumption held in the use of the GM model was that the farmer did not incur any fixed cost. This was because fixed costs under the situation in which the study was carried out were regarded as common costs, which were shared by many enterprises and therefore, were not taken into consideration during the study. More so, fixed cost components such as depreciation, insurance, repairs, taxes and interest on borrowed capital (DIRTI – 5) do not have significant effects on costs of production in the traditional farming systems (Nworie and Agbaraevor, 1997). Also the revenue/0.25 ha of each vegetable was treated as separate enterprise with assumption that they are being grown as sole crops in different portion of land assumed to be 0.25 ha (minimum standard farm size). However all the vegetables under study enjoyed an equal or common variable cost.

Data analysis

Objectives 1 and 4 were analyzed by using percentage, mean scores and gross margin analysis technique.

RESULTS AND DISCUSSION

Socio-economic characteristics of the vegetable growers

Age (years)

Table 2 shows that majority (50.0%) of the project farmers (PFs) were between 40 and 49 years of age, while 30.0% were within the age range of 50-59 years. Those that were between the age of 30 and 39 years accounted for 10.0%. The remaining 10.0% of them fell within the age range of 60-69 years. Their mean ($\overline{X}$) age was 48.50 years. The table also shows that majority (45.0%) of the non-project farmers (NPFs) were between the age of 50 and 59 years, while 37.5 and 12.5% of them were within the age range of 40 - 49 years and 30-39 years, respectively. About 3% of them were between 20 and 29 years, while the remaining 2.5% fell within the age range of 60-69 years. Their mean age was 47.60 years. The implication of this finding is that most of the respondents were at their middle age. At this age, they are likely to be more responsive to vegetable production improvement programmes in the study area.

Sex

Table 2 shows that majority (70.0%) of the PFs were males, while the remaining 30.0% were females. On the other hand, 52.5% of the NPFs were females while 47.5% were males. This implies that PFs were predominantly males, while NPFs were dominated by females.

Marital status

It is evident from Table 2 that majority (92.5%) of the PFs were married, while 7.5% were still single. On the other hand, 89.0% of the NPFs were married, 7.5% were single, while 3.5% were widows. The implication is that the farm labour required by the married vegetable farmers could be supplied by their households, thereby reducing cost of production (Igben, 1988).

Educational level

Entries in Table 2 also indicate that majority (35.0%) of the PFs had no formal education, while 25.0, 17.5 and 22.5% had primary, secondary and tertiary education, respectively. On the part of the NPFs, 47.5% did not go to school at all, while 30.0% had primary education. About 18% had secondary education, while the remaining 5.0% had tertiary education. Education has been shown

Table 2. Percentage distribution of the respondents by socio-economic characteristics.

Variable	PF (n = 80)		NPF (n = 80)	
	(%)	($\overline{X}$)	(%)	($\overline{X}$)
Age (years)				
20 – 29	0.0		2.5	
30 – 39	10.0		12.5	
40 – 49	50.0	48.50	37.5	47.60
50 – 59	30.0		45.0	
60 – 69	10.0		2.5	
Sex				
Male	70.0		47.5	
Female	30.0		52.5	
Marital status				
Single	7.5		7.5	
Married	92.5		89.0	
Widowed	0.0		3.5	
Level of education				
No formal education	35.0		47.5	
Primary education	25.0		30.0	
Secondary education	17.5		17.5	
Tertiary	22.5		5.0	
Household size				
1 – 5	22.5		27.5	
6 – 10	55.0	8.00	37.5	
11 – 15	22.5		32.5	9.00
16 – 20	0.0		2.5	
Farming experience (years)				
11 – 20	22.5		32.5	
21 – 30	47.5	27.00	30.0	26.75
31 – 40	22.5		30.0	
41 – 50	7.5		7.5	
Fadama farming experience (years)				
1 – 10	5.0		7.5	
11 – 20	30.0		50.0	
21 – 30	45.0	23.50	30.0	20.25
31 – 40	12.5		12.5	
Nature of Fadama vegetable practice				
Part-time	25.0		52.5	
Full-time	75.0		47.5	
Fadama vegetable farm size (hectares)				
– 0.5	26.3	0.87	50.0	0.63
– 1.0	45.0		37.5	
1.1 – 1.5	17.5		8.8	
1.6 – 2.0	11.3		3.8	
Source of Fadama vegetable farm land				
Family land	57.5		55.0	
Rented/Hired	30.0		32.0	
Inherited the Land	12.5		13.0	

Table 2. contd.

Source of credit/finance*				
Friends/relative	22.5		22.5	
Personal/savings	100.0		77.5	
Esusu Club	42.0		17.5	
Fadama vegetable prod. contribution to annual income				
About 10 - 19%	15.0		22.0	
20 - 29%	30.0		48.0	
30 - 39%	35.0	30.50	25.0	25.80
40 - 49%	20.0		5.0	

*Multiple responses.

to be a factor in the adoption of modern farm practices. It is generally considered an important variable that could enhance farmers' adoption of new technology (Obinne, 1991).

Household size

Table 2 shows that majority (55.0%) of the PFs had a household size of 6-10, while 22.5% had a household size of 1-5. The remaining 22.5% had a household size of 11-15. Their mean household size was 8.0. On the other hand, 37.5% of the NPFs had a household size of 6-10, while 27.5% had a household size of 1-5. Those that had a household size of 11-15 and 16-20 accounted for 32.5 and 2.5% respectively. Their mean household size was 9.0. The implication of this finding is that more family labour for Fadama vegetable production would be readily available since relatively large household size is an obvious advantage in terms of farm labour supply (Igben, 1988).

Farming experience

A greater proportion (47.5%) of the PFs had 21-30 years of farming experience (Table 2). About 23% of them had 11-20 years of farming experience, while 22.5 and 7.5% had 31-40 years and 41-50 years of farming experience, respectively. Their mean farming experience was 27.0 years. It is also evident from the table that 32.5, 30.0, 30.0, and 7.5% of the NPFs had 11-20 years, 21-30 years, 31-40 years and 41-50 years of farming experience, respectively. Their mean farming experience was 26.8 years. These findings imply that most of the respondents had been into farming for quite a long period of time. Long farming experience is an advantage for increase in farm productivity since it encourages rapid adoption of farm innovations (Obinne, 1991).

Fadama farming experience

Data in Table 2 also reveal that majority (45.0%) of the PFs had 21-30 years of Fadama farming experience, while 30.0% had 11-20 years of Fadama farming experience. Only 5.0% of them had 1-10 years of Fadama farming experience, while 20.0% had 31-40 years of Fadama farming experience. Their mean Fadama farming experience was 23.5 years. On the other hand, a greater proportion (50.0%) of the NPFs had 11-20 years of Fadama farming experience. Those that had 21-30 years and 31-40 years of Fadama farming experience accounted for 30.0 and 12.5%, respectively. The remaining 7.5% had 1-10 years of Fadama farming experience. Their mean Fadama farming experience was 20.3 years. These findings imply that majority of the respondents had been raising dry season vegetables before the introduction of the Fadama project in 1996. The long Fadama farming experience would be expected to be an added advantage in the area of adoption of Fadama vegetable production innovations since long farming experience promotes specialization, improved knowledge, skills and aspiration (Igben, 1988).

Nature of Fadama vegetable practice

Entries in Table 2 show that 75.0% of the PFs were practicing Fadama vegetable farming on full-time basis, while 25.0% were practicing Fadama vegetable farming on part-time basis. In case of the NPFs, 52.5% were practicing Fadama vegetable farming on part-time basis, while 47.5% practiced Fadama vegetable farming on full-time basis. A full-time Fadama vegetable farmer is defined as one who spends at least 75% of his working hours in Fadama vegetable production. Full-time Fadama vegetable farming would ensure increase in vegetable production of the farmers.

Fadama vegetable farm size (ha)

It is evident from Table 2 that majority (45.0%) of the PFs had a total Fadama vegetable farm size of 0.6-1.0 ha, while 26.3% had a Fadama farm vegetable size of 0.1-0.5ha. Only 17.5% had a Fadama vegetable farm size of

1.1-1.5ha, while 11.3% had a Fadama vegetable farm size of 1.6-2.0ha. Their mean Fadama vegetable farm size was 0.87ha. Majority (50.0%) of the NPFs had a total Fadama vegetable farm size of 0.1-0.5ha. About 38% of them had a Fadama vegetable farm size of 0.6-1.0ha, while 8.8 and 3.8% had a Fadama vegetable farm size of 1.1-1.5 ha and 1.6-2.0 ha, respectively. Their mean Fadama farm size was 0.63ha. This implies that Fadama vegetable production in the area is still at subsistence level, possibly due to nature of land tenure system in the area. This finding corroborated the finding of Obinne and Anyanwu (1991). In their study, they found out that most farmers (especially, in Delta State), were small-scale operators, with less than 2 hectares of farm size. Relatively small Fadama vegetable farm size could constitute a major constraint to increased vegetable production in the area.

Source of Fadama vegetable farm land

Table 2 also indicates that the primary source of Fadama vegetable farm land to the PFs (57.5%) was family land, while the source of Fadama vegetable farm land to 30.0% of them was rented/hired land. The remaining 12.5% had inherited land as their source of Fadama vegetable farm land. The major source of Fadama vegetable farm land to a greater proportion (55.0%) of the NPFs was family land. Rented/hired land also served as a source of Fadama vegetable farm land to 32.0%, while inherited land was used mainly by 13.0%.The implications of this finding are that land acquisition cost will be less and at the same time, there will be less land acrimony.

Source of credit/finance

It is evident from Table 2 that all (100.0%) of the PFs had personal/savings as their main source of credit/finance for the take-off, while 22.5% had their source of credit/finance from friends/relatives. Forty-two percent had source of credit/finance from Esusu Clubs. On the other hand, majority (77.5%) of the NPFs regarded personal/savings as their main source of credit/finance for the take-off. About 23 and 18% of them sourced their credit/finance from friends/relatives and Esusu clubs, respectively.

Mean percentage annual income generated from Fadama vegetable production

According to Table 2, 15.0% of the PFs agreed that Fadama vegetable production contributed 10-19% to their total annual income. Those that were of the opinion that Fadama vegetable production had been contributing 20-29%, 30-39% and 40-49% to their total annual incomes accounted for 30.0, 35.0 and 20.0%, respectively. Their mean percentage annual income from Fadama vegetable production was 30.5%. Majority (48.0%) of the NPFs were of the opinion that Fadama vegetable production had been contributing 20-29% to their total annual income, while 25.0% agreed that Fadama vegetable production had been contributing 40-49% to their total annual income. 22% also accepted that Fadama vegetable production had been contributing 10-19% to their total annual income, while the only 5.0% accepted that Fadama vegetable production had been contributing 40-49% to their total annual income. Their mean contribution to annual income was 25.8%. The implication is that Fadama vegetable production had contributed significantly to the annual incomes of the vegetable growers in the area.

Vegetable production preference among project and non-project farmers

Dry season

Entries in Table 2 indicate that during dry season, telferia was the most preferred vegetable by the PFs (70.0%). This was followed by okra (55.0%), amaranthus (27.6%), pepper (22.6%), tomatoes (15.0%) and garden eggs (10.0%). In the same vein, the most preferred vegetable by the NPFs (62.6%) was telferia. This was also followed by Okra (40.0%), amaranthus (30.0%), tomatoes (25.0 %), pepper (22.6%) and garden eggs (20.0%). It implies from these findings that the generality of the farmers (PFs and NPFs) had preference for telferia, okra and amaranthus. However, telferia was the most preferred vegetable by the two groups of farmers. According to Ogungbaigbe (2001), *Telferia* spp. is the most prominent vegetable in the Southeastern zone of Nigeria but currently, is gradually becoming a vegetable of national reckoning.

Wet season

Table 3 also reveals that during wet season, majority (57.6%) of the PFs preferred growing more of okra than any other vegetable. This was followed by telferia (55.0 %), pepper (50.0%), amaranthus (22.6%), garden eggs (7.6%) and tomatoes (7.6%). On the part of the NPFs, the most preferred vegetable was also Okro (50.0%), while telferia (47.6%) was preferred to pepper (35.05), amaranthus (32.6%), tomatoes (22.6%) and garden eggs (12.6%). It implies from these findings that the PFs and NPFs had preference for Okra, telferia and peppers. However, okra was the most preferred vegetable by the two groups of farmers. This finding agrees with the find-

Table 3. Percentage distribution of respondents by their vegetable production Preference.

Type of vegetable	Production preference (%)*			
	Dry season		Wet season	
	PFs (n = 80)	NPFs (n = 80)	PFs (n = 80)	NPFs (n = 80)
Telferia	70.0	62.6	55.0	47.6
Okra	55.0	40.0	57.6	50.0
Amaranthus spp	27.6	30.0	22.6	32.6
Garden eggs	10.0	20.0	7.6	12.6
Pepper	22.6	22.6	50.0	35.0
Tomatoes	15.0	25.0	7.6	22.6

*More than one vegetable was preferred.

ing of Ogungbaigbe et al. (1997). In their study, they found out that okra production under Fadama farming, especially, during wet season ranked very high among the farmers.

Adoption levels of the improved vegetable production innovations introduced by NFDP

Improved vegetable seeds

Entries in Table 4 show that telferia ($\overline{X}$ = 5.0), amaranthus ($\overline{X}$ = 5.0), garden eggs ($\overline{X}$ = 5.0) and pepper ($\overline{X}$ = 5.0) were at the adoption level on the 5 – point adoption scale, while okra ($\overline{X}$ = 4.0) was at the trial level on the 5-point adoption scale. The grand mean adoption score of the PFs for the six improved vegetable seeds studied was 5.0 out of a maximum of 5- points. The fact that the mean adoption score of okra was 4.0 implies that some of the respondents were still making use of their local okra seed variety. The implication of these findings is that there would be increase in vegetable productivity in the area in the near future since improved seeds had been widely adopted by the growers.

Field preparation innovations

Table 4 shows that the mean adoption score for check basin was 3.0, while the mean adoption score for sunken bed was 5.0. The grand mean adoption score of the PFs for the two field preparation innovations studied was 4.0 out of a maximum of 5- points. These findings imply that check basin was still at the evaluation level on the adoption scale, while sunken bed was already adopted. On the whole, the field preparation innovations were still at the trial level on the adoption scale. The implication of these findings is that, the fadama infrastructure such as water pump and tubewell which are meant for carrying out check basin field preparation might not have been acquired by the majority of the respondents; hence old methods of field preparation were still being used.

Planting distance

It is also evident from Table 4 that the mean adoption score of the recommended planting distance for telfaria was 4.0, while those of okra, amaranthus, garden eggs, pepper and tomatoes were 3.0, 3.0, 3.0, 4.0 and 3.0, respectively. The grand mean adoption score of the PFs for the six vegetable varieties studied was 3.0 out of a maximum of 5 points. This implies that majority of the PFs were still at the evaluation level of adopting the improved planting distances of many of the vegetable varieties.

Water management

Table 4 also shows that the mean adoption score for the use of water pump was 2.0, while the mean adoption score for the use of tubewell or washbore was 2.0. The grand mean adoption score of the PFs for the two improved water management practices studied was 2.0 out of a maximum of 5 points. This implies that a greater proportion of the PFs were still at the interest level on the adoption scale with respect to the improved water management practices introduced to them by the NFDP. The observed low levels of adoption of the water management innovations could be attributed to the initial high cost of procuring them by the farmers.

Staking

Table 4 further reveals that the mean adoption score for staking of vegetables (e.g. telferia) was 3.0. The grand mean adoption score of the PFs for the practice was 3.0. This shows that the adoption process of staking of vege-

Table 4. Adoption levels of some of the vegetable production innovations introduced by NFDP - 1 (n = 80).

Vegetable production innovations	Adoption levels					Total adoption score	Mean ($\overline{X}$) adoption score (adoption score)	Grand mean ($\overline{X}$) Adoption score (adoption level)
	AW (1)	IN (2)	EV (3)	TR (4)	ADOP (5)			
Improved vegetable seeds								
Telfaria	4	8	-	8	350	370	5.0	
Okra	5	10	24	-	310	349	4.0	
Amarathus	6	4	6	8	340	364	5.0	5.0
Garden egg	5	8	-	20	330	363	5.0	
Pepper	1	12	-	24	335	372	5.0	
Tomatoes	2	8	-	40	320	370	5.0	
Field preparation								
check basin	44	-	12	8	150	214	3.0	
sunken bed	4	8	12	-	340	364	5.0	4.0
Planting distance								
Telfaria (50 x 50 cm)	28	-	-	32	220	280	4.0	
Okro (60 x 60 cm)	48	-	6	8	140	202	3.0	
Amaranthus (50 x 30 cm)	36	12	12	64	90	214	3.0	
Garden egg (50 x 50 cm)	32	16	12	40	130	230	3.0	3.0
Pepper (50 x 50 cm)	22	4	-	56	210	292	4.0	
Tomatoes (50 x 30 cm)	28	12	18	40	150	248	3.0	
Water management								
Use of water pump	54	20	6	-	70	150	2.0	2.0
Use of tube-well/washbore	64	12	-	-	50	126	2.0	
Stacking (esp. Telfaria)	47	4	-	24	125	200	3.0	3.0
Fert./organic manure appl								
Organic fertilizer (compost + Poultry droppings)	6	-	6	48	300	360	5.0	5.0
Inorganic fertilizer (N.P.K.)	-	-	6	32	350	388	5.0	
Pesticides								
Herbicide: Round-up	18	12	-	24	250	304	4.0	
Insecticides: Karate	22	8	12	48	190	280	4.0	
Vetox 85	32	8	6	64	130	240	3.0	4.0
Furadan	2	4	12	40	310	368	5.0	
Harvesting								
Done in the morning/evening	-	-	-	-	400	400	5.0	
Harvest at physiological maturity	8	-	-	16	340	364	5.0	5.0
Storage procedure								
sorting out diseased & bruised produce	-	-	-	16	380	396	5.0	
Use of well-ventilated containers such as smooth baskets	2	-	-	8	380	390	5.0	
Storage in bulk at ambient temperature (Bunching-up method)	40	4	3	72	90	212	3.0	4.0

Table 4. contd.

-Storage in evaporative coolant structure such as pot-in-pot, Tin-in-pot and use of constructed leafy vegetable basket	60	6	3	16	60	1.54	2.0	

tables was still at the evaluation level. According to the majority of the respondents, staking of telferia vegetable for example is unnecessary unless if and when it is being produced for pods production.

Fertilizers utilization

Table 4 also indicates that the mean adoption scores for the use of organic fertilizers (compost + poultry droppings) and use of in-organic fertilizers (for example, NPK) were 5.0 and 5.0, respectively. The grand mean adoption score of the PFs for the two practices studied was 5.0. The adoption process of both organic and in-organic fertilizers had reached the adoption level on the scale. A wide adoption of fertilizers by the PFs would be expected to boost production.

Pesticides (herbicides and insecticides)

Table 4 indicates that the mean adoption score for herbicide (round-up) was 4.0, while the mean adoption scores for insecticides- karate, vetox 85 and furadan were 4.0, 3.0 and 5.0, respectively. The grand mean adoption score of the PFs for the four pesticides studied was 4.0. This implies that pesticides utilization was still at the trial level on the scale.

Storage procedure

Table 4 also show that the mean adoption scores for sorting, use of smooth-ventilation materials, bunching-up and storing in evaporative coolant structures were 5.0, 5.0, 3.0 and 2.0, respectively. The grand mean adoption score of the PFs for the four storage procedure studied was 4.0. This implies that storage procedure was still at the trial level on the scale.

Table 5a shows variable and revenue structure of vegetable production per 0.25 ha of the project farmers, while table 5b shows the gross margin analysis per 0.25 ha of vegetable crops of the project farmers.

Variable cost

Table 5a shows an equal or common total variable cost of ₦15, 120.00, before and ₦24,698.00, after 1996, per 0.25 hectare of each of the six vegetable crops studied. The variables considered were the average operating inputs and labour.

Revenue

Table 5a also shows that the revenues from each of the vegetable crops per 0.25ha before and after were as follow: Telfaria (₦24, 300 and ₦56, 287); Okra (₦2394 and ₦55250); Tomatoes (₦19637.50 and ₦ 36800); Amaranthus (₦21708 and ₦44880); Garden egg (₦20700 and ₦37800) and Pepper (₦20,880 and ₦43,680).

Gross margin

As a result of variable cost-revenue interactions in Table 5a, the outcome in Table 5b shows a profit margin of 60.7 and 127.9%, before and after, respectively, for telfaria; 58.3 and 123.7% for okra; 29.9 and 49.0% for tomatoes; 43.6 and 81.7% for amaranthus; 36.9 and 53.0% for garden egg; and 38.1 and 76.9% for pepper. These results imply that the six vegetable crops yielded positive returns or profits of which telfaria gave the highest. This was followed by Okra, amaranthus and pepper. The results agreed with those of Nworie and Agbaraevor (1997), who concluded that dry-season vegetable production was profitable. Also, it could be observed that profit made in respect of each of the vegetable enterprises by the project farmers, after 1996 (1996-2002) was much greater than the profit made before 1996. This implies that the vegetables under study were profitable to the PFs, especially, during the project life. It could then be concluded that the project might have made meaningful positive impact on vegetable production and socio-economic life of the PFs.

Conclusion

Based on the findings of the study, the following conclusions were made:

The socio-economic characteristics of the vegetable

Table 5a. Variable cost and revenue of vegetable production per 0.25 (1/4) hectares of a project farmer.

Item/Operation	Unit	Before 1996		After 1996 (1996 – 2002)			
		($\overline{X}$) Qty	($\overline{X}$) Unit cost /price (₦)	Total (N)	($\overline{X}$) Qty	($\overline{X}$) Unit cost/ price (₦)	Total (₦)
Variable cost							
Planting material	No/kg	3.0	250.00	750.00	2.0	606.50	1213.00
Rent on land	Ha	¼	1200.00	300.00	¼	2000.00	500.00
Fertilizer (NPK) applied	Kg	50.0	30.00	1500.00	100.0	40.50	4050.00
Manure (compost) applied	Tipper	½	1200.00	600.00	½	1400.00	700.00
Herbicide (round-up) applied	Litre	1.0	700.00	700.00	1.0	1000.00	1000.00
Insecticides applied	Litre	1.0	600.00	600.00	1.0	850.00	850.00
Nursery preparation	Manday	1.0	350.00	350.00	1.0	500.00	500.00
Field cultivation	Manday	8.0	330.00	2640.00	8.0	450.00	3600.00
Transplanting/sowing	Manday	8.6	150.00	1280.00	8.0	200.00	1600.00
Irrigation water application	Manday	120.0	20.00	2400.00	120.00	35.00	4200.00
Weeding	Manday	8.0	120.00	960.00	8.0	200.00	1600.00
Insecticide application	Manday	1.0	100.00	100.00	1.0	200.00	200.00
Fertilizer/manure application	Manday	1.5	300.00	450.00	1.5	350.00	525.00
Harvesting	Manday	16.0	105.00	1680.00	16.0	180.00	2880.00
Handling and transportation	Manday	16.0	105.00	1680.00	16.0	180.00	2880.00
Total variable cost revenue/0.25 ha				15,120.00			24,698.00
Telfraia	Bundle	120.0	202.50	24300.00	154.0	365.50	56287.00
Okra	50 kg basket	57.0	420.00	23940.00	65.0	850.00	55250.00
Tomatoes	50 kg basket	25.0	785.50	19637.50	32.0	1150.00	36800.00
Amaranthus	Bundle	108.0	201.00	21708.00	136.0	3330.00	44880.00
Garden Egg	50 kg basket	24.0	862.50	20700.00	35.0	1080.00	37800.00
Pepper	50 kg basket	18.0	1160.00	20880.00	26.0	1680.00	43680.00

Table 5b. Gross margin per 0.25ha of vegetable crops.

Vegetable	Before 1996				After 1996 (1996 – 2002)			
	Total revenue (₦)	Total cost (₦)	GM (₦)	Margin (%)	Total revenue (₦)	Total cost (₦)	GM(₦)	Margin (%)
Telfaria	24300	15120	9180	60.7	56287	24698	31589	127.9
Okra	23940	15120	8820	58.3	55250	24698	30552	123.7
Tomatoes	19638	15120	4518	29.9	36800	24698	12102	49.0
Amaranthus	21708	15120	6588	43.6	44880	24698	20182	81.7
Garden egg	20700	15120	5580	36.9	37800	24698	13102	53.0
Pepper	20880	15120	5760	38.1	43680	24698	18982	76.9

growers indicated that the majority of the project farmers were males; that the growers have relatively large household size and long Fadama farming experience.

Telfaria and okra were most preferred vegetables cultivated during dry and wet seasons, respectively, mainly due to their high income generating capacity, high market demand and high yielding capacity.

Only improved vegetable seeds, manure application and harvesting method among some of the vegetable production innovations introduced by NFDP, were on adoption level on a 5-point adoption scale.

The vegetables under study were profitable to the

project farmers, especially, during the project life

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