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Effect of a Food Crop Development Project on Livelihood of Small-Scale Maize Farmers, Ghana

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Abstract: The Food Crop Development Project (FCDP) was introduced with the aim of improving farm incomes, household food security, nutrition and reducing poverty among small-scale farmers. This study sought to find answers to the questions of whether the project improved farmers' access to credit, improved maize output or whether small-scale maize farmers adopted the improved maize production practices and how it impacted on maize production. Descriptive survey was conducted and using multi-stage random sampling procedure a final sample of 130 farmers was selected. The results indicated that participation in FCDP had a positive and significant but moderate relationship with maize output. More participants reported having easy access to credit than non-participants with chi-square value of 17.29 being highly significant indicating the possible relationship between ease of access to credit and participation in FCDP. The OLS stepwise regression analysis showed that participation, farm size and ease of access to credit were the main predictors of maize output while participation, income and household size were also the main predictors of food security. Thus, FCDP helped to improve the livelihoods of maize farmers in the study area. The policy implication of these findings is that subsidized agricultural input projects like the FCDP, have the potential to improve food security and farm incomes of peasant households.

Keywords: Coping index, credit, food crop, food insecurity, income, output

INTRODUCTION

A significant number of the rural population in developing countries depends primarily upon small-scale, subsistence-oriented agriculture based on family labor. However, due to their limited access to resources, technology and alternative livelihood, they are engaged in the over-exploitation of natural resources, including marginal lands.

The Food Crop Development Project (FCDP) was one of several measures the Government of Ghana introduced to address the problems of low yields, low farm incomes as well as to address food insecurity in eight selected districts in the country. Ejura-Sekyedumase District was one of the beneficiary pilot districts. The project was aimed at improving household food security, nutrition, farm incomes and reducing poverty among small-scale farmers through increased production, storage and processing of cereals and legumes (MoFA, 2003). Six years after its implementation (2001-2005), was the project successful in achieving these goals? Was there been a positive improvement in output and income levels of participant farmers? Was there an improvement in food security situation (reduction in coping indices) among beneficiary farmers? The study sought to find answers to these questions.

The purpose of the study was to assess the impact of a food crop development project on farm incomes, maize output and food insecurity coping indices of maize farm households in the Ejura-Sekyedumase District of Ghana. The research raised the following questions:

- What are the demographic characteristics of maize farmers and their relationship with farmer's income levels?
- Are there any differences in socio-economic characteristics of farmers in the FCDP area in terms of scale of production (size of farm) and ease/difficulty of access to credit, savings behavior between participant and non-participant farmers?
- Are there any differences in the level of use of recommended agronomic practices by farmers in terms of use of improved maize seed, herbicides to control weeds and other cultural practices?

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- Are there any differences the level of living of participants and non-participant farmers in terms of income levels and distribution?
- What is the effect of the project on maize output and food insecurity coping index of households in the district?

METHODOLOGY

The study targeted all small-scale maize farming households in the study area. A descriptive survey design was used to assess the food security status of maize farming households. This involved collecting data through questionnaires and personal observation. In this study the situations of the two groups of farmers (participants and non-participants in FCDP) in terms of food security, maize output, farm incomes as well as total income were measured and compared. The non-participant farmers therefore served as the control in this 'with-and-without' study design. The 'with'-and-'without' approach enabled the researcher to take into account changes in the situation of farmers who did not take part in the project (Gittinger, 1974).

Multi-stage sampling procedure was used because of logistic and organizational reasons and in order for the sample to be grouped together in a more limited number of geographical areas (Poate and Daplyn, 1993). In all, the district (Ejura-Sekyedumase District) was divided into nineteen operational areas, with each area managed by an Agricultural Extension Agent (AEA). To start with, two operational areas were randomly sampled. The second stage involved the selection of communities in the operational areas selected. This was done by compiling a list of all communities in each operational area and using simple random sampling, four communities were selected using the lottery method. With the help of the Agricultural Extension Agents (AEA's) the list of households of participants in the FCDP in each selected community was obtained. To obtain a sampling frame for the non-participant farming households, a snowball sampling technique was used. To be able to use probability statistical analysis, a sampling frame was compiled after which linear systematic sampling method was employed to obtain the final sample. It has been established that, for the purposes of analysis, linear systematic sampling can be treated just like simple random sampling, on condition that there is no intrinsic regularity/periodicity in the sampling frame (Poate and Daplyn, 1993; Sarantakos, 1998). A total of 130 heads of maize farming households (made up of 65 participants and 65 non-participants) were selected for the study.

The research instrument for households was a pre-tested structured interview schedule. The interview schedule was administered to the selected household heads by the researcher assisted by two trained extension staff from MoFA. Some relevant data; such as:

- Climatic information for the district from the Meteorological Services
- Background information and area maps from the District Planning Office (Ejura)
- Prices and output data from MoFA, Ejura

Food security model: Household food security was measured by using food insecurity Coping Index (CI), Hoddinott (1999):

$$CI = \sum_{i=1,6}^{I} \sum_{k=1,4}^{K} f_{j=1,3} S_{ik} \qquad (1)$$

CI = Coping index
f = Weight/severity of a strategy
S_i = Strategy i
S_k = Scale of strategy k

RESULTS AND DISCUSSION

Socio-economic and demographic characteristics of vegetable producing households in the Ejura-Sekyedumase district: The results of the study showed that the ages of the farmers ranged from 23 to 77 years. The mean age was about 42 years with a standard deviation of 10 and modal age of 41-50 years (Table 1). The study also revealed that younger people (between 31-50 years) are more involved in the maize production than the aged (that is above 50 years). The

Table 1: Age distribution of farmers

	Participants		Non-participants		Total	
Age range	F	(%)	F	(%)	F	(%)
≤30	2	3.00	8	12.3	10	7.70
31-40	20	30.8	22	33.8	42	32.3
41-50	23	35.4	21	32.3	44	33.9
51-60	16	24.6	12	18.5	28	21.5
>60	4	6.20	2	3.10	6	4.60
Total	65	100	65	100	130	100
Mean	44.98		41.98		43.48	
S.D.	9.49		10.34		10.00	

Field survey (2007); Youngest: 23; Oldest: 77

Table 2: Distribution of household size

	Participants		Non-participants		Total	
Household size	F	(%)	F	(%)	F	(%)
2	7	10.8	9	13.9	16	12.3
3	7	10.8	15	23.1	22	16.9
4	11	16.9	6	9.20	17	13.1
5	7	10.8	13	20.0	20	15.4
6	17	26.1	6	9.20	23	17.7
>6	16	24.6	16	24.6	32	24.6
Total	65	100	65	100	130	100
Mean	5.69		5.05		5.37	
S.D.	3.02		2.73		2.89	
Minimum	2		1		1	
Maximum	17		13		17	

Participants: 65; Non-participants: 65; Field survey (2007)

Table 3: Correlation coefficients of demographic and outcome variables

Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	1.0	-0.15	-0.200**	0.194**	0.285*	0.008	0.266**	0.170	0.157
X_2		1.00	-0.268**	0.013	0.577**	0.361**	0.241**	0.304**	0.252**
X_3			1.000	-0.450*	-0.233*	-0.229	-0.187*	0.195*	0.140
X_4				1.000	0.117	0.211*	0.064	0.101	0.194
X_5					1.000	0.493**	0.354**	0.238**	0.285**
X_6						1.000	0.377**	0.393**	0.395**
X_7							1.000	0.785**	0.763**
X_8								1.000	0.932**
X_9									1.000

**: Correlation is significant at 1% level (2-tailed); *: Correlation is significant at 5% level (2-tailed); X_1: Participation; X_2: Age, X_3: Sex; X_4: Level of education; X_5: Household size; X_6: Farm size (ha); X_7: Maize output; X_8: Income from maize; X_9: Total income; Field survey (2007)

Table 4: Ease/difficulty of access to credit

			Category of farmer		
Credit source			Participant	Non-participant	Total
	Difficult	Count	34	49	83
		% within Banks	41.0%	59.0%	100.0%
		% within participation	52.3%	87.5%	68.6%
		% of total	28.1%	40.5%	68.6%
	Easy	Count	31	7	38
		% within banks	81.6%	18.4%	100.0%
		% within participation	47.7%	12.5%	31.4%
		% of total	25.6%	5.80%	31.4%
	Total	Count	65	56	121
		% within banks	53.7%	46.3%	100.0%
		% within participation	100.0%	100.0%	100.0%
Banks		% of total	53.7%	46.3%	100.0%

N: 130; Participants: 65; Non-Participants: 65; Field survey (2007)

situation is not surprising since maize farming is both a capital and labor intensive investment. This is an indication that food crop production has a bright future in the area.

Distribution of household size: From Table 2, household sizes ranged from 2 to 17 persons and showed a wide variation with mean of 5.37 persons per household and standard deviation of 2.89 persons per household in the sample of farmers covered in the study area. The large standard deviation shows that household size varied and was not consistent among farm households. However, a few households (16% participants and 24.6% for the total sample of farmers) contained more than 6 persons. This shows that less than 25% of households are still relatively large.

Research question 1:

Relationship between demographic characteristics and income levels farmers: Table 3 shows the correlation coefficients between some socio-economic variables and the outcome/response variables in the study. It could be observed that participation in the project had a statistically significant and moderate correlation with maize output ($r = 0.266$, $p \leq 0.01$). However, participation did not result in a significant correlation with incomes though the relationship was positive. This could be explained by the fact that other factors such as price of maize, incomes from other crops, livestock as well as non-farm incomes might have influenced the statistical significance of the relationship between participation and total income. Some participants also reported that the short term nature of their loans always compelled them to sell their maize early to avoid paying high interests. This might have had some influence on maize income. Indeed, gross margin calculations using on-farm trial data have shown that even in relatively favorable climatic conditions, growing maize is barely profitable due to the very low relative price of maize and high cost of fertilizer (Benson, 1997).

In addition, household size correlated positively and significantly with farm size, total output of maize as well as income from maize, at 1% level. The significant relationship between household size and farm size confirms the assertion that, larger households have larger labor reserve due to contribution of family members compared to smaller household all other things being equal. Thus, the large farm size might have resulted in increased output and subsequently increased income. This is because farm size correlated positively and significantly with maize output ($r = 0.377$, $p \leq 0.01$). The correlation coefficient between farm size and maize output confirms the observation in the State of the Ghanaian Economy 2003 that, output of major Ghanaian crops continues to depend heavily on the area cultivated as the use of fertilizers and certified seeds remains very low (ISSER, 2004).

Table 5: Chi-square tests: participation and ease of access to credit

	Value	df	Asymp. Sig. (2-sided)
Pearson chi-square	17.29 (b)	1	0.000
Continuity correction (a)	15.700	1	0.000
Likelihood ratio	18.428	1	0.000
Linear-by-linear association	17.152	1	0.000
Phi coeff (φ)	0.378	1	0.000
N of valid cases	121		

A: Computed only for a 2×2 table; b: 0 cells (.0%) have expected count less than 5; The minimum expected count is 17.59; Field survey (2007)

Table 6: Chi-square tests of savings behaviour and participation in FCDP

	Value	df	Asymp. Sig. (2-sided)
Pearson chi-square	14.444	1	0.000
Likelihood ratio	14.805	1	0.000
Linear-by-linear association	14.333	1	0.000
Phi-coefficient (φ)	0.3300		0.000
N of valid cases	130		

$p \leq 0.01$; Field survey (2007)

Level of education also had a significant and positive relationship with farm size and total income, though the correlation coefficients ranged from low ($r = 0.211$, $p \leq 0.01$) to moderate ($r = 0.395$, $p \leq 0.01$). This could be explained by the fact that education might have influenced farmers' chances of engaging in non-farm jobs/employment. Thus, total income correlated significantly and positively with education while income from maize showed no statistical significance.

Research question 2:

Ease of access to credit and savings: Table 4 show the cross tabulation between participation in FCDP and farmers perception about ease or difficulty of access to credit. It was observed that 83 (68.6%) of respondents perceived access to credit from banks as difficult. It was further observed that of these, 34 were participants (41% of the total that perceived access to be difficult) and 49 were non-participants (59.0% of the total that perceived access to be difficult).

In all 38 respondents (31.4%) of the total reported having easy access to credit and of those that reported easy access, 31were participants (81.6%) and only 7 non-participants (18.4% of the total). Thus, though a lot of banks are now prepared to offer micro-credit to farmers, small-scale food crop farmers still perceive this as being far from reality. A study by Nuryartono *et al*. (2003), in Central Indonesia on credit access by farm households showed that under certain conditions, only 18.1% of the households were not credit constrained. Most small-scale farm households are credit constrained due to a lack of collateral.

To ascertain whether these differences between participants and non-participants were significant a chi-square statistic was determined as shown in Table 5. The chi-square statistic (17.29) was observed to be highly significant ($p \leq 0.01$). Consequently, the hypothesis that there is no significant difference between participants and non-participant in their ease or difficulty of access to credit has been rejected.

The Phi statistic of 0.378 out of a maximum value of 1 indicates a moderate association between ease of access to credit and participation in FCDP. This value is highly significant ($p \leq 0.01$) indicating that participation influenced farmers' perception of having easy access to credit from banks. To indicate whether there was any link between participation in FCDP and savings behavior, chi-square (χ^2) statistic was determined as shown in Table 6. The chi-square (χ^2) value of 14.44 was found to be statistically significant ($p \leq 0.01$) indicating the possible relationship between participation and saving in a financial institution. The value of Phi statistic also indicates a significant and moderate relationship ($\varphi = 0.33$, $p \leq 0.01$) between participation in FCDP and savings.

Research question 3:

Adoption and use of improved maize technologies: Table 7 shows the use of various maize production technologies as indicated by farmers in the study area. Only a quarter (24.6%) farmers reported the use of improved maize varieties. Out of this, 22 participants representing 33.8% and 11 non-participants (16.9%) used at least one improved maize variety (Mamaba or Obaatanpa) the previous season. However, most farmers who used improved variety preferred Obaatanpa to Mamaba. A greater number of farmers still preferred using seed from their own farms as opposed to the use of certified improved varieties. From Table 3, eighty percent (80%) of farmers continue to use their own seed. This included those who recycled improved seed. This consisted of 75.4% participants and 84.6% non-participants.

Meanwhile other practices such as zero tillage and recommended spacing were being practiced by farmers. A survey about labor saving technologies in Western Kenya by the Food and Agriculture Organization (2002) revealed that one common response by households to minimize their farm power requirements was to adopt minimum or zero tillage systems and use cover crops and mulches to suppress weeds. In contrast 49 (37.7%) farmers made up of 46.2% participants and 29.2% non-participants reported that they still prefer to use improved variety but currently not necessarily using it for various reasons.

Impact of maize production technologies on time spent on cultural activities: Table 8 indicates farmers' perceptions about the project on the time spent on some cultural activities in maize production. Majority of farmers (76.9% of participants and 69.2% of non-participants) saw a reduction in the time spent on land preparation since they started using weedicides.

Table 7: Pattern on use of recommended practices

	Participants		Non-participants		Total	
Practice	F	(%)	F	(%)	F	(%)
Use of improved varieties	21	33.8	11	16.9	32	24.6
Zero tillage	51	78.5	48	73.5	99	76.1
Use of recommended spacing	63	96.9	55	84.6	118	90.8
Timely execution of cultural practices (fertilizer application and weeding)	64	98.5	55	84.6	119	91.5
Use of mamaba	1	1.50	0	0	1	0.10
Use of obaatampa	21	33.8	10	15.4	31	23.8
Use of farmer's own seed	49	75.4	55	84.6	104	80.0
Still prefer to use improved variety	30	46.2	19	29.2	49	37.7

Field survey (2007)

Table 8: Perceptions of farmers on the time spent on cultural practices

	Participants						Non-Participants					
	Decreased		Same		Increased		Decreased		Same		Increased	
Activity	F	(%)	F	(%)	F	(%)	F	(%)	F	(%)	F	(%)
Land preparation	50	76.9	9	13.8	6	9.20	45	69.2	11	16.9	9	13.8
Planting	6	13.8	12	18.5	44	67.7	7	10.8	20	30.8	37	56.9
Weed control	53	81.5	6	9.20	6	9.20	47	72.3	9	13.8	9	13.8
Fertilizer application	27	41.5	10	15.4	28	43.1	19	29.2	18	27.7	28	43.1
Harvesting	22	33.8	8	12.3	35	53.8	14	21.5	21	32.3	30	46.1

Participants: 65; Non-participants: 65; Field survey (2007)

Table 9: Annual income structure of respondents

Category	Income source	F	Min GH¢	Max GH¢	Mean GH ¢	S.D.
Participant	Income from maize	65	40.00	1000.00	458.83	213.93
	Income (other crops)	48	37.50	1400.00	332.00	304.89
	Income (livestock)	26	25.00	400.000	125.92	105.61
	Non-farm income	18	20.00	350.000	107.50	97.500
	Total	65	40.00	3400.00	793.10	498.28
Non-participant	Income from maize	65	75.00	1125.00	356.38	271.80
	Income (other crops)	48	28.00	1470.00	395.17	396.01
	Income (livestock)	35	9.000	370.000	93.870	127.25
	Non-farm income	15	21.00	400.000	110.00	75.300
	Total	65	75.00	2957.00	760.53	569.15

Field survey (2007)

In addition, 81.5% of participants and 72.3% of non-participants said the time spent on weed control also reduced. However, time required to plant maize increased. From Table 8, 67.7% of participants and 56.9% of non-participants indicated an increase in the time required to plant maize. This is because, in order to achieve the recommended plant population per hectare, closer spacing is required and planting should be done in rows using garden lines.

Research question 4:

Annual income structure of respondents: Table 9 shows the annual mean income structure of the respondents. Incomes were computed by using crop outputs and their corresponding market prices. Non-farm or other incomes were estimated from the respondents' remittances or other sources. It could be observed that mean income from maize output among participants exceeded that of non-participants, the minimum and maximum incomes from maize indicated that some non-participant farmers really had more income from the maize than participants. This situation could be attributed to the fact that some participants reported that they had to sell their maize earlier to be able to pay off their loans. Mean income from other crops among non-participants however, exceeded that of participants. This observation could be attributed to concentration of resources by participants in maize production activities as compared to their non-participant counterparts.

Food insecurity coping indices of participants and non-participants: The results in Table 10 indicated the mean coping indices of households in the face of insecurity. The coping index was used as a proxy in determining the food security situation of households. Higher values indicated the use of severer coping measures, implying the presence of food insecurity (Hoddinott, 1999).

The results in Table 10 showed that participant households rarely used sever coping measures, with an index of 8.51 compared to 18.5 for non-participants. The mean values of 1.42 (0.23) showed that participants never or rarely used sever coping measures. Also, the value of 3.08 (1.09) indicated that, from time to time non-participant households reported using severer strategies. The high standard deviation of 1.09 indicated households were not consistent in their responses.

Table 10: Food insecurity coping indices of participants and non-participants

Strategy (S)	Weight (f)	Participants Sk	Participants Sf	Non-participants Sk	Non-participants Sf
		Mean		Mean	
Has the household consumed less preferred foods?	1	1.88 (0.86)	1.88	3.12 (1.12)	3.12
Have you reduced the quantity of food served to men in this household	1	1.32 (0.73)	1.32	3.34 (1.18)	3.34
Have you reduced your own consumption of food?	1	1.28 (0.67)	1.28	3.30 (1.10)	3.11
Have you reduced the quantity of food served to children in this household the last seven days?	1	1.26 (0.92)	1.26	2.02 (0.96)	2.02
Have members from these household skipped meals in the last seven days?	2	1.42 (0.81)	2.84	3.09 (1.10)	6.18
Have members of these household skipped meals for a whole day?	3	1.35 (0.86)	4.05	3.63 (1.07)	10.89
Coping Index (CI)		8.51*		18.5*	
Mean		1.42 (0.23)		3.08 (1.09)	5.96
S.D.					

Scale (k): 1 = Never, 2 = rarely, 3 = from time to time, 4 = often; Weight (f) = 1 for strategy one to four, 2 for strategy five and 3 for strategy six; Figures in parenthesis refer to standard deviations; *: Calculated from equation 1; Field survey (2007)

Table 11: Household maize output in tones per between 2000 and 2006

Category of household	Year	F	Min (t/ha)	Max (t/ha)	Mean (t/ha)	S.D.	Change in yield (%)
Participants	2000	53	0.38	2.33	1.18	0.58	-
	2001	50	0.83	2.67	1.76	0.51	+49.15
	2002	55	0.94	3.33	1.83	0.53	+4.000
	2003	61	0.71	3.88	1.33	0.66	-27.32
	2004	62	0.58	2.75	1.76	0.52	+32.33
	2005	60	0.75	3.00	1.84	0.50	+4.550
	2006	65	0.54	3.13	1.97	0.59	+7.100
Non-participant	2000	64	0.35	2.31	1.10	0.71	-
	2001	29	0.50	2.50	1.24	0.48	+12.72
	2002	47	0.25	2.83	1.32	0.55	+4.830
	2003	60	0.31	3.08	1.18	0.90	-10.61
	2004	62	0.33	3.00	1.44	0.49	+22.03
	2005	63	0.21	3.00	1.56	0.50	+8.330
	2006	65	0.21	2.88	1.50	0.60	-3.850

Participants: 65; Non-participants: 65; t/ha: tonnes per hectare; Field survey (2007)

Table 12: Effect on maize output

Predictor variable	Step entry	β	R^2	Adjust- R^2	R^2-change	S.E.E.	F. reg.	F. Sig.
Constant	1	15.048				4.701		0.002
X_3	1	0.6460	0.417	0.412	0.417	6.420	91.50***	0.000
X_5	2	0.2050	0.459	0.451	0.042	6.210	53.88***	0.000
X_4	3	0.1760	0.485	0.473	0.026	6.080	39.63***	0.000

***: Significant at 0.01 level; Maize output (Q_h) = 15.048 + 0. 646X_3 +0.176X_4+0.204X_5…3; X_3: Farm size (ha); X_4: Ease/difficulty of access to credit; X_5: Dummy variable indicating participation in FCDP (1 = participation and 0 = non-participation)

Effect on maize output: Table 11 shows the per hectare maize yield in tonnes between 2000 and 2006. The result showed an increase in average maize yield from 1.18 tonnes/ha to about 2.0 tonnes/ha among participant households. This observed increase in per-ha maize output among the participants could be attributed to the use of improved agronomic practices farmers acquired through participation in FCDP. The relatively high standard deviations (between 0.50 and 0.65 tonnes/ha) indicate that the reported average yields were not consistent among participant households over the period. For instance, in 2003 some participant households reported close to 4 tonnes/ha of maize. In 2003 for instance, a general poor rainfall pattern in the area, resulted in more than a quarter (27.32%) drop in average yield of maize among participants and about 10.61% reduction among non-participant households.

According to Morris *et al*. (2001), average grain yields of maize are modest when expressed in per unit land area, averaging less than 2 tonnes/ha. A similar observation was reported by ISSER (2004), in the State of the Ghanaian Economy in 2003. Reports from field trials conducted by MoFA (2003) indicated that yields of up to 5 tonnes/ha are possible with the use of improved varieties and recommended practices.

Table 12 shows the OLS regression on maize output as the dependent variable. Three variables namely, farm size (X_3), participation (X_5) and ease of access to credit (X_4) were observed as the best predictors of maize output. From the R-square values it could be said that about 2.6% of the change in maize output was attributed to change in the households' perception about ease of access to credit. Also, 4.2 and 41.7%, respectively of the changes in maize output observed could be attributed to participation in FCDP and farm size respectively. An observation made by ISSER (2004) indicated that increases in output in most Ghanaian farms were due to expansion in farm size. According to World Bank (2003, 2006), national maize output grew 2.5 times and most of the production increases came from area expansions.

Table 13: Effect on food security

Predictor	Step entry	β	R^2	Adjust- R^2	R^2-change	S.E.E.	F. reg.	F. Sig.
Constant	1	2.240				1.980		0.031
X_2		0.201	0.590	0.520	0.520	0.111	7.96***	0.006
X_5	2	-0.265	0.871	0.810	0.291	0.026	6.92***	0.001
X_y	3	-0.285	0.882	0.880	0.070	0.221	9.35**	0.002

***: Significant at 0.001 level; N: 130; CI: $2.240 + 0.201X_2 - 0.265X_5 - 0.285X_y$ …4; CI: Coping index; X_2: Household size; X_5: Participation in FCDP; X_y: Household income; Field survey (2007)

Effect on food security: The results shown in Table 13 indicate that three variables namely, household size, participation in FCDP and total income of the household were the best predictors of the coping index which was used as a proxy measure of food security. While household size had a positive effect on the coping index as indicated by the beta value (0.201, that is high food insecurity), participation in FCDP (X_5) and total income of the household (X_y) had negative beta values (-0.265 and -0.285 respectively. The R^2-values suggest that 52.0, 29.1 and 7.0%, respectively of the changes in the dependent variable (Coping Index, CI) could respectively be attributed to changes in the household size, participation and household income.

According to Food and Agriculture Organization (2000), it is when the household's overall income is sufficiently high to afford non-staple foods that the household truly enjoys food security and adequate nutritional status. The negative beta values of the variables X_5 and X_y suggested that both participation and household income had decreasing effects on the coping index of the household and therefore positively influence food security.

CONCLUSION

- Participation in FCDP had a positive and significant but moderate relationship with maize output.
- The findings also revealed that despite the fact that both groups perceived access to credit as difficult, a chi-square test showed that there was a significant relationship between participation and households' perception of ease of credit access. In addition, there was a statistically significant difference between participants and non-participants with respect to savings behavior.
- With the implementation of the Food Crop Development Project, a greater proportion of sampled farmers in the study area reported they use zero tillage mainly the use of weedicides, to prepare the land and to control weeds in maize which helps to save labor and reduced time spent on weeding.
- Contrary to the expectation that most farmers will adopt improved maize varieties to increase yield, the survey revealed that, majority of farmers still prefer local maize varieties due to high cost of seeds and fertilizers. More participants than non-participants were observed to use improved varieties.
- The main findings of the empirical analysis indicated that participation, farm size and ease of access to credit were the main predictors of maize output. It was also observed that participation and household income had a negative effect on food insecurity coping index which implied that, participants felt more secured in terms of food security compared to non-participant. However, larger households felt more food insecure than smaller households since household size had a positive effect on the coping index of the households.

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