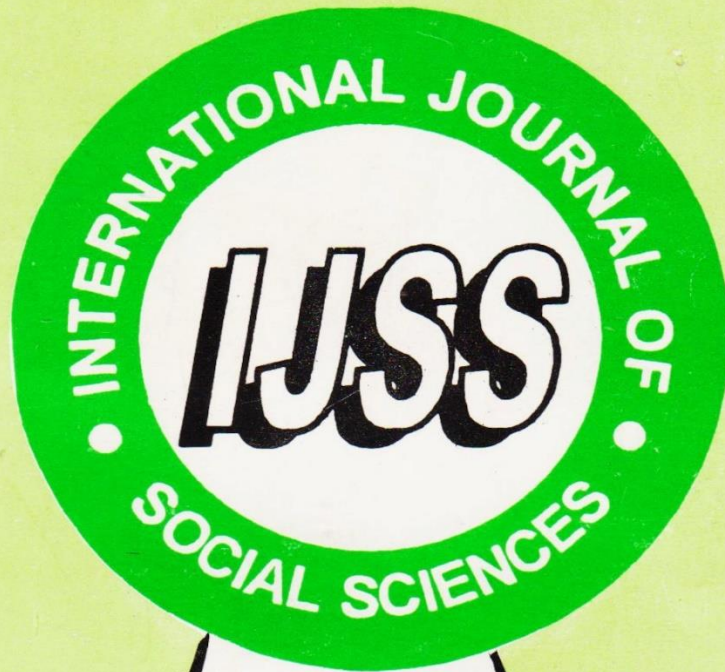


ISSN 1119 - 4898

International
JOURNAL
of
SOCIAL SCIENCES



FACULTY OF SOCIAL SCIENCES
UNIVERSITY OF UYO
UYO

Volume 2, Number 1, June 2000

The impact of new technology on agricultural production: The case of small farmers in Akwa Ibom State, Nigeria

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ABSTRACT - Technology is known to play significant role in the improvement of agricultural output/productivity. This role, however, depends on the extent to which the technology is adopted. This study attempts to assess the level of awareness and adoption of new technologies promoted by the Akwa Ibom Agricultural Development Project (AKADEP) and the impact of the new technologies on the farmers output. It is found that the farmers are receptive of these technologies but the level of awareness and adoption differ greatly among farmers. The study also shows that the adopted technologies play a very vital role in raising the food crop production. Its significance in the estimated equations and the views of the respondents attest to this fact.

1. INTRODUCTION

Nigeria is a country dominated by small farmers. It is estimated that over 90 per cent of Nigeria's total food production comes from these small farmers and at least 60 per cent of the country's population earn their living from these small farmers (Olayemi, 1980). One major characteristic of these small farmers is that they make use of largely traditional technology usually called the hoe-cutlass culture. Apart from the fact that these technologies are labour intensive, the irksomeness and/or druggery of labour can be very considerable. This, coupled with fragmentation of holdings and the long trekked distances between home and farms, considerably reduce the man hours utilized in any specific man-day farm.

One way of increasing production is the use of improved technology. In Nigeria, Agricultural Development Project (ADP) is the main organ for promoting these technologies among small farmers. In Akwa Ibom State, the technologies promoted by the Akwa Ibom Agricultural Development Project (AKADEP) include row planting crop arrangement/alternate row planting with yam/cassava/maize/cowpea, yam/cassava/maize/telfaira and

cassava/cocoyam/melon inter-crop. Others include late cassava/maize cowpea production, yam minisett production, high yielding crop varieties: ring method of fertilizer application, dry season vegetable gardening and upland rice production. Also promoted are cocoyam/plantain or banana inter-crop; rabbit/goat production and management, homestead fishpond, snail farming, crops/fish/livestock processing and utilization, alley farming/cropping as well as fadama.

The aim of this paper is to determine the impact of these technologies (especially alternate row planting yam/cassava/maize/cowpea and yam/cassava/maize/telfaira combinations; cassava/maize/melon intercrop, late cassava/maize/cowpea production, and the use of modern inputs-yam, cassava and fertilizer) on farmers output. The rest of the paper is organized as follows: in section two the conceptional framework and literature review are discussed. This is followed by methodology in section three and discussion of results in section four. The paper is concluded in section five.

2. CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Technology is generally defined as the application of scientific and technical knowledge to the production and utilization of goods and services. It includes not only capital goods (which may be an embodiment of technological progress) but also technical (the way inputs are combined), management, distributive and marketing activities of production as well as the socio-economic environment in which production takes place. It is the embodiment and result of systematic, disciplined, cumulative, non-accidental, and non-serendipitous research (Olayide, 1980). The emphasis here is on agricultural technology which is seen as the application of technology for the promotion and development of agriculture. In a broad sense it consists of the nature and types of available inputs (e.g. seed, fertilizer, chemicals, tools, machines, farm power, etc) and the ways in which these are combined (e.g. land-fertilizer ratio, labour-machine ratio, etc). Defined in this way, agricultural technology is viewed far beyond the existence of modern scientific inventions to include the aspects of natural inputs such as seeds, seedlings, manure, etc., and also the aspect of socio-cultural practices such as fallowing, mixed cropping, mixed farming, among others (Ayoola, 1990).

Usually, agricultural technology is promoted as a package: a new seed variety, a recommended fertilizer application and other recommended cultivation practices (Leathers and Smale, 1991) and often takes the form of "process innovation" which results in greater output of a specified product from a given quantity of inputs. These packages are typically developed by interdisciplinary teams of plant breeders, agronomists and soil scientists that

seek to maximize yield by capturing the biological and chemical interactions among its components. However, many farmers do not take advantage of these interactions but choose to adopt pieces of the package rather than the whole in a sequential fashion due mainly to profitability, riskiness, uncertainty, lumpiness of investment and institutional constraints.

In empirical studies, the impact of technology on agricultural output is often assessed using either technology augmented production or supply response models. The models are themselves related and in most cases, it is argued that, one is the dual of the other. Of these two models, the most widely used in empirical work is the supply response models which seek generally to examine the response of agricultural output to price changes. These price changes, it is argued, influence the farmers' decisions regarding the adoption of new technology and crop varieties, higher application of yield-enhancing inputs, better resource management and application of greater effort (Chibber, 1988). This supply response model which was developed by Nerlove (1958) has been used and possibly extended by many authors as reviewed by Askari and Cummings (1970), Chibber (1988), Nerlove (1979), Ogbu and Gbetibouo (1990) and Oyejide (1990).

However, the failure of price changes to account for all the variations in agricultural output has led to the consideration of other non-price factors such as labour, capital, technology and other inputs. Of all these non-price factors, it is technology that poses the greatest problem of measurement. What is done is to use proxies. In most time series and cross-sectoral or cross-country studies, time trend has been used (Oni, 1979; Bond, 1983; Lele *et al*, 1989; Binswanger, 1985). Others have suggested the use of unit cost of capital or yield per unit of capital (Akinyama and Trivedi, 1987); expenditure on research and development (R&D) and stock of schooling at the third level (Peterson, 1988). Also used as proxy for technology are extensive use of modern inputs such as chemical fertilizer, pesticides and high yielding varieties (Onyenwaku, 1994; 1997) and expenditure on modern inputs (Nerlove, Vosti and Basel, 1996) as measure of technology. What appears from the above review is that there is no single universally accepted measure of technology in either empirical models of production or supply response in relation to agriculture. The proxies used vary with the type of analysis (time series, cross-sectional, etc.) and the objectives of the study.

3.0. METHODOLOGY

3.1. The Study Area

The main study area is Akwa Ibom State located in the southeastern part of Nigeria. It lies between latitudes 4°31' and 5°31' North and Longitudes

7°35' and 8°25' East. It is bounded on the North by Abia and Cross River States, in the east by Cross River State, in the west by Abia and Rivers States and in the south by the Atlantic Ocean. The State occupies an area of approximately 7.081 sq km and is mostly inhabited by the Ibibio, Annang and Oron ethnic groups which together constitute about six million people living in the thirty-one (31) local government areas of the State. By its location, Akwa Ibom State is within the tropical region with two main seasons (the wet or rainy season and the dry season). The vegetation consists of the mangrove swamp forest along the coastal areas and rain forest in the hinterland. The soil is basically sandy loam, which favours the cultivation of a wide range of crops including oil palm, yam, cassava, maize, cocoyam, vegetables, etc. These crops are mostly grown in the rural areas by small farmers who constitute at least 90 per cent of the working population. The State as at 1997 was classified by AKADEP into six agricultural zones namely Abak, Etinan, Eket, Oron, Uyo and Ikot Ekpene.

3.2 Methods of Data Collection and Type of Data Collected

The study is based on primary data which were obtained through oral interview and administration of structured questionnaires. The oral interview was used on the Chief Agricultural Extension Officer and the Chief Planning Monitoring and Evaluation Officer of the Akwa Ibom State Agricultural Development Project (AKADEP). The essence was to know the type and sources of agricultural technology known to AKADEP, those they have been pushing to the farmers and the procedure or process of extending these technologies to farmers.

The structured questionnaires were administered on small farmers who have been exposed to the various technologies pushed by AKADEP. These farmers are predominantly food crop growers since improved agricultural technologies promoted by AKADEP are food crop-based. In administering the questionnaires, three of the six agricultural zones (Eket, Uyo and Ikot Ekpene) were randomly selected. These zones grow basically the same food crops except Ikot Ekpene zone where rice is grown in Ini and Ikono Local Government Areas (LGA). In each of the selected zones, one hundred (100) farmers were randomly selected and interviewed. Trained interviewers who actually asked the farmers the questions from the questionnaire and recorded their responses administered the questionnaires. The data were collected between January and April, 1997. In all, three hundred farmers were interviewed out of which two hundred and fifty were selected on grounds of information supplied.

The relevant data collected from the farmers include the major sources of information on the various technologies, and the level of awareness, adoption and period of adoption of the identified technologies. Others include labour usage and average wage per day from which the man-day of labour, was computed; the capital input and unit cost which enabled us compute expenditures on modern inputs (chemical fertilizer, pesticides, improved cassava cuttings, yam seeds, improved maize seeds) and other inputs (matchet/cutlass, hoe, basin, basket, traditional seeds, etc). Data on the crops cultivated, hectares cultivated, output (in kilograms) as well as the unit price of output were also collected.

3.3 Methods of Data Analysis

Both descriptive and econometric techniques have been used in the analysis of the data. The descriptive technique is used in the discussion of the type of technology, sources of information on the technology and the level of adoption of the technology by farmers. The discussion are facilitated by the use of tables and simple ratios and percentages for easy comparison.

The econometric technique is used to establish the impact of agricultural technology on agricultural output. Here a production function is specified and estimated. The general model is given thus:

$$Q_i = a_0 + a_1 HEC_i + a_2 LAB_i + a_3 INP_i + a_4 OIN_i + a_5 DUM_i + V_i$$

Where

Q_i = Output of crop/crop combination i produced in kilograms ($i = 1$: cassava only; 2 : cassava and maize; 3 : cassava and yam; 4 : cassava, yam and maize; 5 : cassava maize and cocoyam; and 6 : cassava, maize, yam and cocoyam).

HEC_i = Hectare of land under cultivation of crop/crop combination i ($i = 1, 2, \dots, 6$).

LAB_i = Labour (in mandays) used in crop/crop combination i 's production.

INP_i = Expenditure on modern inputs used in crop/crop combination i 's production ($i=1,2,\dots,6$).

OIN_i = Expenditure on fixed capital and traditional inputs used in crop/crop combination i 's production ($i=1,2,\dots,6$).

DUM_j = Dummy variables representing crop combination j technology package adopted. ($j = 1$: yam/cassava/maize/cowpea; 2 : yam/cassava/maize/telfaira; 3 : cassava/maize/egusi intercrop and 4 : late cassava/maize/cowpea production).

V_i = Error term,

a_{is} = Regression coefficient of inputs

A positive relationship is expected between the identified factors and the output of the i^{th} crop/crop combination produced. However, since we are using the cost of modern inputs and fixed capital/traditional inputs and man-days of labour, we might expect a negative sign which means that the high cost of these inputs and small man-days of labour may be detrimental to increased output by the farmers.

In estimating the model, two different measures of output were used namely physical output in kilogram (kg) and output (yield) per hectare expressed also in kilogram (kg). Generally, the capital input of the farmers consists of machet/cutlass, hoe, basin, basket, seeds, seedling, cassava cuttings, fertilizer and pesticides. This was broken into fixed/traditional inputs (machet/cutlass, hoe, basin, basket and traditional crop varieties) and modern inputs (improved cassava variety, yam seeds and fertilizer). However, because of the heterogenous unit of measurement of these capital goods, total expenditure (cost) on these inputs were used. Again, in computing the cost of these capital inputs the current market price was used. The cost of fixed capital could not be adjusted for depreciation because there was no information on when they were purchased and the cost at that time.

As regards labour, we found that three types of labour were used - children, men and women. Based on the information collected on the number of each category used and the number of hours of work per day (usually 8 hours), for the different farm operations (land clearing, tillage/ridging, planting, weeding, fertilization, harvesting, etc), it was not difficult computing the total man-days utilized by the farmers.

Perhaps the most difficult thing to measure is technology. As already mentioned in section two (2), several proxies have been used. In this case, technology was measured in two ways. First, following Nerlove, Vosti and Basel (1996), expenditure on modern inputs was used as a measure of technology. This measure takes care of improved varieties of crops (yam miniset and cassava) and fertilizer use. Secondly, a dummy variable representing the technology packages of alternate row planting (yam/cassava/maize/cowpea and yam/cassava/maize/telfaira), cassava/maize/melon inter-crop and late cassava/maize/cowpea production was used.

The model was estimated using the econometric method of Ordinary Least Squares (OLS). The software used is Statistical Package for Social Sciences (SPSS) for Windows version 6.0. In the estimation process different functional forms were experimented namely linear, double logarithmic function, semi logarithmic (exponential) function and interaction models. The model that yields the best result is the double logarithmic function. The estimated models were also subjected to various tests such as the overall

significance of the model using F statistics and coefficient of determination as well as t-ratios for the significance of individual explanatory variables.

4. DISCUSSION OF RESULTS

4.1 Type, Sources and Adoption of Technology by Farmers

Generally, the farmers surveyed make use of both the traditional and modern agricultural technologies in their farming operations. The traditional technology is based on the hoe-cutlass culture which is not only irksome but also largely labour intensive. The main capital goods include machete, hoes, basins and baskets that serve other purposes apart from farming. Because of the small size (less than 1 hectare) and fragmented nature of their farms, it is difficult to use tractors and other modern capital goods that could assist in land preparation and planting. Thus the technologies of land preparation and planting are still largely traditional. It is in these areas that labour requirement is highest and most of the labour is hired. In fact it is a common belief that the hectareage under cultivation by farmers depends largely on labour (family and hired) availability. Other areas in which traditional technology is widely used are harvesting, on-farm haulage, processing and storage. The only exception is in the processing of cassava where farmers are increasingly using locally fabricated machine (garri grater).

Among the farmers surveyed, modern technologies are found in the area of seed and seedlings and management of farming practices (fertilizer application and mixed-cropping). The surveyed farmers reflect the technology of seeds and seedlings in the use of high-yielding varieties. This is very common among cassava and yam growers. For cassava, the improved varieties commonly planted include TM30572, 30555 and 4(2) 1425. These varieties have higher yield and shorter maturity period than the traditional varieties. The alternate row planting technology explicitly recognises the mixed-cropping nature of the small farmers and, therefore, seeks to improve such farming practices through better crop combinations and spacing. Two major types of these crop combinations are generally used namely: yam/cassava/maize/cowpea, and yam/cassava/maize/telfaira. Other crop combination packages are cassava/maize/melon inter-crop, and late cassava/maize/cowpea production. In addition, there is yam minisett technology and the application of fertilizer. Thus in assessing the impact of improved agricultural technology on agricultural productivity, attention is given to alternate row planting, cassava/maize/melon inter-crop, late cassava/maize cowpea production, yam minisett, improved cassava varieties and fertilizer application.

In terms of the sources of these technologies, the survey reveals three major sources: AKADEP through its Extension Agents and AKADEP Radio Farmer (a sponsored radio programme), other radio and television programmes and other farmers who have adopted the technologies. About 43.2 per cent of the surveyed farmers got information about these technologies from AKADEP. Another 2 per cent of the farmers became aware of these technologies through other radio and television programmes while only 6 per cent got theirs through other farmers. For lot more farmers, a combination of these sources were very important. For instance about 15.2 per cent of the farmers were introduced to these technologies through AKADEP Radio farmer and other radio and television programmes while 11.6 per cent received theirs from AKADEP and other farmers. It was also found that 20.4 per cent of the farmers got introduced to these technologies through a combination of AKADEP, other radio and television programmes and other farmers. The use of farmers that have already adopted the technologies is very important. This is because most of the small farmers, especially the rural ones, are risk averse and would be willing to adopt new technologies only if fellow farmers demonstrate the success of such technologies. This probably explains the use of contact farmers by AKADEP under its Small Plot Adoption Technique (SPAT) in promoting the new technologies to farmers.

However, the level of awareness and adoption of these technologies by the surveyed farmers differ greatly. Beginning with the alternate row planting technology, the survey reveals that 55 per cent of the farmers were aware of the yam/cassava/maize/cowpea crop combination while only 34 per cent adopted it. Whereas 79 per cent were aware of the yam/cassava/maize/telfaira combination only 58 per cent adopted it. Again it is found that while 78 per cent of the farmers were introduced to the cassava/maize/melon combination only 65 per cent ever adopted it. Also of the 62 per cent who had knowledge of the late cassava/maize/cowpea combination only 48 per cent have adopted it. It is obvious from this analysis that the most popular crop combination under the alternate row planting technology/inter-crop is cassava/maize/melon. This is followed by yam/cassava/maize/telfaira. In view of the fact that cocoyam is a very popular crop among the farmers, some of them have included it in the various crop combinations. That is why in the 1997 farming programme of AKADEP, the cassava/cocoyam/maize/telfaira was given top most priority under the row planting crop arrangement. Yam is not as popular as cassava and maize among the farmers. This is reflected in the adoption of yam minisett technology. Of the 49 per cent of the farmers, who had knowledge of this technology, only 23 per cent adopted it. This represents the lowest adoption level. As regards improved cassava varieties, 87 per-

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cent of the farmers were aware and also adopted it. Again 86 per cent of the farmers had knowledge of fertilizer application but only 83 per cent had applied it in their farms. Table 1 shows the details.

Table 1: Levels of Awareness and Adoption of New Agricultural Technology by Farmers (Percentages)

No.	Technology	Level of Awareness			Level of Adoption		
		Aware	Not Aware	Total	Adopted	Not Adopted	Total
A.	Alternate Row Planting						
	Yam/Cassava/Maize/Cowpea	55.0	45.0	100	34.0	66.0	100
	Yam/Cassava/Maize/Telfaira	79.0	21.0	100	58.0	42.0	100
B.	Cassava/Maize/Melon intercrop	78.0	22.0	100	65.0	35.0	100
C.	Late Cassava/Maize/Cowpea production	61.5	38.5	100	48.0	52.0	100
D.	Yam Minisett production	49.0	51.0	100	23.0	77.0	100
E.	Improved Cassava Varieties	87.0	16.7	100	87.0	13.0	100
F.	Fertilizer Application	86.0	14.0	100	83.0	17.0	100

Source: Field Survey.

There are also differences in period of adoption of these technologies by farmers. The general picture is that majority of the farmers (between 66 and 96 per cent) have adopted these technologies for a period not exceeding three years. Between 4 and 17 per cent had adopted them for 4 - 6 years while only 3 to 19 per cent have used them for over 6 years. However, the average adoption period is three years with between 31 and 69 per cent of the farmers. Table 2 provides details of this period of adoption. What emerges from the above discussion is the fact that farmers generally are not opposed to new agricultural technologies despite their socio-cultural environment. However, the adoption rate of these technologies depends on the level of farmers' exposure to them and the successes/failures achieved by early adopters.

Table 2: Period of Adoption of New Agricultural Technology by Farmers (percentages)

No.	Technology	1 year	2 years	3 years	1 - 3 years	4 - 6 years	over 6 years
A.	Alternate Row Planting						
	Yam/Cassava/Maize/Cowpea	10	17	69	96	4	1
	Yam/Cassava/Maize/Telfaira	2	18	51	71	17	2
B.	Cassava/Maize/Melon intercrop	7	28	38	73	17	10
C.	Late Cassava/Maize/Cowpea production	18	26	36	80	14	6
D.	Yam Minisett production	31	19	31	81	16	3
E.	Improved Cassava Varieties	12	20	34	66	15	19
F.	Fertilizer Application	12	10	51	73	14	13

Source: Field Survey.

4.2. Impact of Technology on Agricultural Production

The results of the above production function estimated to assess the impact of the adopted technologies on farmers output are presented in tables 3, 4 and 5. In table 3, it is seen that all the explanatory variables explain at least 81 per cent variation in the total or aggregate output of all the crops combined suggesting that the equations are good. The joint overall significance of the explanatory variables as shown by the F-statistics is quite high. In terms of the explanatory variables it is seen that hectare under cultivation (HEC), labour (LAB) and technology measured by the expenditure on modern inputs (INP) are not only rightly signed but are also significant in all the equations. Their coefficients are significantly different from zero at 1 per cent in all the equations. Expenditure on other inputs (OIN) is negatively associated with aggregate output and significant at 1 per cent level. The hectare of land under cultivation is, however, the most important variable affecting the level of aggregate output. It explains about 69 per cent of the

Table 3: Estimated Production Functions under Different Technology Packages

Variables	1	2	3	4	5
Intercept	7.543 (17.783)	7.885 (16.599)	7.674 (17.869)	7.610 (17.607)	7.494 (15.888)
Hec.	0.882*** (16.420)	0.899*** (16.459)	0.893*** (16.571)	0.886*** (16.417)	0.879*** (15.895)
INP	0.181*** (4.650)	0.180*** (4.643)	0.181*** (4.658)	0.177*** (4.526)	0.182*** (4.645)
LAB	0.327*** (5.012)	0.281*** (3.942)	0.314*** (4.573)	0.326*** (4.991)	0.329*** (4.986)
OIN	-0.158*** (-4.117)	-0.180*** (-4.421)	-0.169*** (-4.356)	-0.167*** (-4.187)	-0.153*** (-3.460)
DUM1	-	0.117** (1.583)	-	-	-
DUM2	-	-	0.106** (1.708)	-	-
DUM3	-	-	-	0.055 (0.831)	-
DUM4	-	-	-	-	-0.017 (-0.238)
R ²	.810	.816	.816	0.814	.814
F	267.5	215.8	216.3	213.9	213.2
N	250	250	250	250	250

Note: t-ratio in parentheses *** P < 0.01; ** P < 0.10
N = Number of observation

variation in the level of output. This is evidenced in tables 4 and 5 when the dependent variable is replaced by yield (output) per hectare and the hectare under cultivation is excluded as an explanatory variable. Of all the technology packages adopted by farmers only the alternate row planting crop combinations of yam/cassava/maize/telfaira and yam/cassava/maize/cowpea are significant even at 10 per cent level. The cassava/maize/melon inter-crop, which is the most widely adopted technology by farmers, is not significant at all. The late cassava/maize/cowpea production does not only exert negative influence on output but it is also statistically insignificant. This notwithstanding, the general picture points to the fact that technology measured either by the expenditure on modern inputs or dummy variable representing adoption of technology package positively affects crop production of farmers in Akwa Ibom State. The result of the expenditure on modern inputs which is the second most important variable in all the equations is not surprising given the fact that at least 83 per cent of the farmers adopted modern inputs of improved cassava varieties and fertilizer application.

Table 4: Estimated Per Hectare Production Functions under Different Technology Packages

Variables	1	2	3	4	5
Intercept	8.032 (22.121)	8.366 (20.989)	8.131 (22.298)	8.095 (21.982)	8.072 (20.539)
INP	0.160*** (4.205)	0.162*** (4.301)	0.161 (4.274)	0.156*** (4.095)	0.159*** (4.189)
LAB	0.253*** (4.500)	0.209*** (3.488)	0.234 (4.127)	0.255*** (4.530)	0.252*** (4.484)
OTN	-0.153*** (-3.948)	-0.180*** (-4.407)	-0.165 (-4.242)	-0.164*** (-4.077)	-0.158*** (-3.561)
DUM1	-	0.143 (1.975)**	-	-	-
DUM2	-	-	0.121* (1.941)	-	-
DUM3	-	-	-	0.067 (1.020)	-
DUM4	-	-	-	-	0.019 (0.269)
Multiple R	.546	.556	.555	.549	.533
R ²	.298	.309	.309	.301	.298
F	34.88	27.4	27.3	26.62	26.0
n	250	250	250	250	250

Note: t-ratio in parentheses * P < 0.10 ** P < 0.05 *** P < 0.01

N = number of observation

In the case of individual crops, Table 5 shows that the relative importance of the explanatory variables differs. For cassava, the hectare under cultivation (HEC) and expenditure on modern inputs (INP) are the only significant variables. Their coefficients are significantly different from zero at 1 per cent level. In the case of maize, hectares of land under cultivation and labour are the most significant (each at 1 per cent level). Expenditure on modern input is only significant at 10 per cent level. For yam all the variables

Table 5: Estimated Production and per hectare Production Functions for the Different Crops.

Variables	Output of				Yield Per Hectare of			
	Cassava	Maize	Yam	Cocoyam	Cassava	Maize	Yam	Cocoyam
Intercept	7.508 (18.519)	3.091 (3.315)	6.465 (8.238)	6.167 (4.240)	7.665 (23.084)	3.884 (5.066)	8.442 (13.168)	5.841 (4.923)
HEC	0.963*** (17.537)	0.812*** (6.405)	0.527*** (4.411)	1.084*** (5.065)	-	-	-	-
INP	0.152*** (3.861)	0.154* (1.840)	0.216*** (3.259)	-0.179 (-1.220)	0.145*** (3.817)	0.114 (1.439)	0.096 (1.542)	-0.153 (-1.174)
LAB	0.011 (0.168)	0.472*** (3.162)	0.791*** (7.038)	0.932*** (4.155)	-0.012 (-0.215)	0.360*** (2.788)	0.559*** (5.505)	0.973*** (4.950)
OIN	0.009 (0.230)	0.036 (0.381)	-0.497*** (-5.730)	-0.203 (-1.231)	0.011 (0.277)	0.045 (0.471)	-0.477*** (-5.207)	-0.215 (-1.329)
Multiple R	.872	.759	.854	.754	.289	0.371	0.581	.479
R ²	.760	.575	.730	.568	0.084	0.138	0.337	.230
F	194.12	55.91	80.90	29.95	7.48	8.84	20.504	9.138
n	250	250	250	250	250	250	250	250

Note: t-ratio in parenthesis * P < 0.10 *** P < 0.01
N = Number of observations.

are significant at 1 per cent. Expenditure on other inputs coefficient is, however, negative as in the aggregate output equation. Hectare of land under cultivation and labour are both significant at 1 per cent level in the cocoyam equation. Expenditures on modern inputs and other inputs are not only negatively signed but also insignificant. The yield per hectare equations of table 5 show rather poor fit. Apart from expenditure on modern inputs and labour which are significant for cassava and maize respectively, all other variables are insignificant. In the case of yam the only significant variables are labour and expenditure on other (traditional) inputs while labour is the only significant variable for cocoyam. All these variables are significant at one (1) per cent level. Despite the poor fit of these equations, the F-statistic show that all the variables jointly explain the variation in the yield per hectare of the individual crops.

These results corroborate the farmers' response when they were asked the impact they thought the adopted technology had on their output compared

to the time they used the traditional method. About 81 per cent of the farmers surveyed indicated positive influence of the adopted technologies on their output. Another 7 per cent reported negative influence while 12 per cent could not say with certainty whether there was positive or negative influence.

5. CONCLUSION

What emerges from the study so far is the fact that technology plays a very important role in raising food crop production. Its significance in the estimated equations and the views of the respondents attest to this fact. It is also clear from the study that farmers are generally not opposed to the new technologies especially those that improve farm management practises. However, the level of adoption of these technologies depend, to a large extent, on the level of farmers' exposure to them i.e. source of information on new technologies. This means that if agricultural production is to be enhanced through improved technology, adequate and appropriate technology that could easily be understood by the farmers should be discovered and promoted. Given the importance of AKADEP as a source of information in influencing the level of technology adoption it stands to reason that there should be a significant improvement in the Training and Visit method of promoting the technologies by AKADEP. The small holder farmers should be the target since they produce greater proportion of the food crop. Increased use of extension agents to demonstrate these technologies to farmers right at their farm is necessary. That is why the modification of the small plot adoption technique (SPAT) especially in the choice of contact farmers used by AKADEP is highly recommended. The ineffectiveness of the contact farmers in extending the knowledge on existing technology to non-contract farmers has been identified by Madukwe and Ayichi (1997). Even if the farmers are exposed to these technologies, the level of adoption will still be low unless there is adequate and timely provision of the technology-related inputs at affordable price or cost.

In conclusion, therefore, it could be said that there is great potential in the currently promoted technology by AKADEP in increasing food crop production in Akwa Ibom State. This potential will be realised if the new technologies are properly promoted and adopted by the farmers and the various impediments to the adoption of the new technologies are adequately taken care of.

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