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Full Length Research Paper

Barriers and Facilitators to Crop-Based Technology Adoption in Jenkwe Development Area, Nasarawa State, Nigeria

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The study focused on the factors influencing adoption of crop-based technologies among farmers in Jenkwe Development Area (JDA) of Nasarawa State of Nigeria. The research respondents consisted of 96 farmers from five districts of the development area selected through multi-stage sampling techniques. Primary data were obtained by means of a structured interview schedule administered on the respondents. The result was analysed using descriptive statistical tool in the form of frequency and percentage. Regression analysis using the Statistical Package of Social Sciences (SPSS) was used to determine relationship some variables. The results showed a significant negative relationship between adoption and number of farm plots (r = -229) and farm size (r = -198), positively significant correlation with years of farming experience (r = .190) and farm income (r = .172) at 5%. Also low level of education and advanced age of the respondents contributed to low level of technology adoption. Fertilizer application (87.50), spacing technique (82.29%); intercropping practice (71.88%); and storage measures (70.83%) were accorded varying levels of high adoption by respondents. This study recommends that technologies dissemination to farmers should be based on potential economic benefits, while requisite inputs should be made available and accessible to farmers on time and at affordable price.

Keywords: Crop-based Technologies, Jenkwe Development Area, Mode of Adoption, Inter-cropping, Fertilizer, Application and Spacing, Nasarawa Agricultural Development Programme.

INTRODUCTION

Jenkwe Development Area (JDA) of Nasarawa State of Nigeria is typical rural setting. Like most rural areas of developing countries, farmers in JDA depend mainly on agriculture for their livelihood. According to Onyenwaku (1991), income and standard of living are generally low in the rural areas. This is occasioned by incidence of poverty and low standard of living probably brought about by poor agricultural productivity. Utilization of agricultural technologies could provide avenue for improving the quality of live of rural communities. Oladele (2002) observed that the efficiency of technologies generated and disseminated depend on their effective utilization by

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farmers. Alao (1979) emphasizes that diffusion of innovation was based on model that examined the socio-demographic factors to explain differentials in adoption rates among farmers without regard to examining technologies themselves and the ability of the farmers to adopt them.

NAERLS (1997) reported existence of few fragmented studies on adoption of farm innovation before the introduction of Training and Visit extension system. However, despite the introduction of T and V system, in the state of central zone of Nigeria where JDA is located, the level of adoption of all recommended technologies was still low. Nasarawa Agricultural Development Programme (NADP) was established primarily to promote extension activities with the view to increasing farmers' productivity, crop production and incomes of small scale farmers. Programme's area of jurisdiction included Western, Central and Southern Zones with headquarters at Keffi, Akwanga and Obi respectively. All the three zones comprised 156 cells, 1248 sub-cell or circle scattered all over Nasarawa State for purpose of effective extension delivery.

Through the organizational set up of the NADP, relevant farming technologies were disseminated to farmers by the extension agents. Monthly Technical Review Meeting (MTRMs) took place with the scientists present to teach the Subject Matter Specialists (SMSs) current innovations. Jointly, they formulate production recommendations to be disseminated as messages to farmers with the assistance of village extension agents (VEAs).

NAERLS (1997) reported that most of the technologies disseminated in Nigeria including the study area were crop-based namely: crop varieties, land preparation, plant spacing, weeding, herbicides to save human labour in weeding, pesticides, fertilizer application and technologies related to woman-in-agriculture (WIA).

To ensure acceptability of the innovation, the NADP elicited for farmers' cooperation in the study area. On-farm testing were carried out to evaluate farmers' acceptability during which technical, socio-economic, cultural and institutional constraints were observed for necessary modification. Farmers selected as contact farmers for the trials by the extension agents were usually willing and active farming population of the study area. Agbamu (2006), believes that farmers' participation in the technology trials was essential for gathering indigenous knowledge for incorporating time-proven solutions into recommendations of improved technology suited to local farm circumstances. This situation depicted that farmer in JDAwere adequately aware and had knowledge of the improved technologies developed for their locality. Their involvement in the technologies evaluation would possibly lead to greater and more readily acceptance of the technologies available to them. This study was designed to examine those factors influencing adoption of crop-based technologies among farmers in JDA of Nasarawa State of Central Nigeria.

The specific objectives were to:

(i) identify the socio-economic characteristics of farmers in the study area.
(ii) determine the effect of some variables on the adoption of crop-based technologies in the study area.
(iii) determine the most frequently adopted technology available by farmers in the study area.

METHODOLOGY

The study was conducted in Jenkwe Development Area (JDA) of the middle Belt zone region of central Nigeria. JDA lies between latitudes 7^0 North and longitudes 7^0 East. Its vegetation is characterized by both flood plain complexes of savannah and mixed leguminous, wooded savannah mixed with formation of trees, shrubs, grasses and oil palms. It covers an area of 550 km^2 (NADP, 2010) with estimated 70 percent of the people engaged in rain-fed subsistence agriculture within the rural setting. Most of the farmers in JDA grow food crops such as yams, millet, beans, groundnuts, beniseed, cassava, guinea and melon seed. A large proportion of the population keep livestock like goats, sheep, pigs, poultry and cattle. JDA has a climate typical of the tropical zone. It has a maximum temperature of 81.7^0 F and minimum temperature of 61.7^0 F. Rainfall varies from 121.73cm in some places to 145cm in others (MOI, 2010). The months of December, January and February are cold due to harmattan winds blowing across the State from North-East. The Development Area is characterized by two distinct seasons: dry and wet. The dry season spans from November to February while wet or rainy season lasts between the month of March to October. The rural economy of the study area is characterized by subsistence (small scale and fragmented) land holdings. Farmers in JDA largely rely on traditional method of cultivation by hoe and cutlasses and crop protection are mostly carried out by way of subsistence orientation.

The population of JDA was put at 325.500 (NPC, 2006). The administrative set up of JDA is made up of five districts: Duduguru, Musha, Gidinye, Agwade and Agyaragu Town (JDA, 1999). The entire five districts were selected for the study because the districts belong to the same ecological zone and the ethnic groups that make up the development area have cultural linkages with long record of harmonious co-existence with one another as informed by their historical past.

Sampling Technique, Sample Size and Data Collection

Farmers in the study area comprised 10,000 farm families who have been residing in the five districts of the study area for a very long time (NADP, 2010). Multi-stage

Table 1. Distribution of Respondents in The Nasarawa Agricultural Development Programme

Zone	Area	Block	Cell	Sub-Cell	Non-Contact Farmers
Southern Zone (Obi)	Doma	Lafia	Wakwa	2	16
			Lafia	2	16
Central Zone (Akwanga)	Garaku	N/Eggon	Mada Station	2	16
			*N/Eggon	2	16
Western Zone (Keffi)	Nasarawa	Karu	Karu	2	16
			Asopada	2	16
Total	**3**	**3**	**6**	**12**	**96**

Source: Field Survey, 2011
* NasarawaEggon

sampling technique (Table 1) was used to select the respondents for the study. Three out the six area offices of the NADP were randomly selected. An area is made up of five blocks. Out of 26 blocks of the three zones of the NADP three were randomly selected. A block is made up of six cells. A total of six cells were randomly selected out the three blocks. A cell is made up of eight sub-cells. A total of twelve (12) sub-cells out of which eight farmers from each were randomly selected to give a total of 96 farmers as respondents for the study.

Developed questionnaire schedule was validated by professionals in the Department of Agricultural Economics and Extension of the Nasarawa State UniversityKeffi,

Faculty of Agriculture Shabu - Lafia Campus. The questionnaire schedule was pre-tested at week's intervals in each of the districts selected for the study and ten (10) enumerators who understood the local languages were used to assist in administering the questionnaire on the respondents.

Adoption was measured by the number of technologies utilized by farmers. The data from the study area were subjected to regression analysis using the statistical package for social science (SPSS) to satisfy objective Two. The model was specified as follows:

$Y = a + bx_1 + bx_2 + bx_3 + bx_4$
$+bx_5$ Where
Y = adoption score
X_1 = age (years)
X_2 = education (years)
X_3 = no. of plots (No)
X_4 = farm size (ha)
X_5 = income (Naira)

RESULTS AND DISCUSSION

Socio-economic characteristics of Respondents

Data in Table 2 revealed the average age of the respondents was 44.51 years. About 41.01 percent of the farmers were between the age brackets of 40 – 49 years; 24.21 percent fell between 50 – 59 years, while 22.10 percent were between 30 – 39 years. Results of the study farther revealed that farmers were of middle age which made adoption of improved technologies generally difficult as "aged" people are less likely to bear the risk of trial associated with adoption of new technologies. Table 2 also showed that 27.25 and 25.25 percent of the farmers obtained primary and secondary school education respectively. Conversely, 38.38 percent of the farmers had no education at all suggesting they were illiterate. Low level of education as attained by farmers in the study area inferred that farmers were less likely to understand the scientific basis of agriculture. The findings agreed with the work of Imoh and Essian (2005) who reported that farmers' level of education influenced adoption of technology positively. Most (83.70%) of the respondents had above 10 years of farming experience. Years of experience in farming were important because management skills of farmers improved with experience. This depicted good signal for adoption of improved technologies as experienced farmers tended to understand the importance of technologies in farming (Idrisa et al. 2006). About 59.34 percent of the respondents owned above three farm plots, while 30.77 percent had two plots each. Results showed that mean farm plots of land owned by a farmer was 2.46.

Table 2. Socio-Economic Characteristics of Respondents

Variable	Percentage	Central Tendency
Age (year)		
Up to 30	6.32	
30–39	22.10	
40–49	41.05	mean = 44.51
50–59	24.21	Std. Dev. = 8.881
Education level		
No education	38.38	
Adult education	5.10	
Primary	27.25	
Secondary	25.25	
Tertiary	4.04	
Experience (year)		
5 – 9	16.30	mean = 9.59
10 and above	83.70	Std. Dev. = 0.71
No. of farm plot		
1	9.89	
2	30.77	mean = 2.46
3 and above	59.34	Std. Dev. = 0.71
Farm size (ha)		
Up to 2	14.13	
3 – 5	38.04	mean = 5. 45
6 – 8	30.44	Std. Dev. = 2.79
9–11	13.04	
12 and above	4.35	
Income level (₦'000)		
Up to 10,000	1.04	
30,000 – 40,000	20.83	
50,000 – 60,000	33.33	mean =₦ 61151.85
70,000 – 80,000	15.63	Std. Dev.₦ 22886.49
90,000 – 100,000		
100,000 and above		

Source: Filed Survey, 2011

This was in consonance with the findings of Olayide (1982) that majority of Nigerian farmers were usually Small Scale farmers. The generally low farm size resulted in wide use of family labour by respondents, which made cultivation on large scale difficult. The problem was further compounded by the use of hand tools by most respondents. The data also revealed that average income of respondents was N6115.85 per year. Quantum value of income realized by farmers in the study area suggested the major reason of undertaking farming operation was economic interest as this had great correlation with income and implied adequate enough income to provide household security from their operations.

Relationship between some Socio-Economic Variables and Adoption of Crop-based Technologies

Table 3 shows the correlation and regression analyses results between socio-economic variables and adoption of the technologies. The results indicated that at $p< 0.05$ level of significance, adoption had positive and significant relationship with farming experience ($r = 0.190$), farm size ($r = 0.198$) and income ($r = 0.172$). Conversely, number of plots ($r = -0.229$) had negative but significant relation with adoption.

The coefficient of determination (r^2) explains the degree of variation in adoption score (Y) attributable to farming

Table 3. Correlation and Multiplication Analysis Results Showing The Relationship and Some Socio-Economic Variables of Farmers on Adoption

Variable	Correlation Coefficient (r)	Coefficient of determination (r^2)	Regression Coefficient	t = Value H^0
Age	-.0.19	.361 10^{-3}	-.102	-.875
Education	-.075	.0563 x 10^{-2}	.028	-.249
Experience	.190*	0.361	.44	1.337
No. of farm plots	-.229*	.0524	-242	-2.298*
Farm size	-.198*	.0392	.231	2.225*
Income	.172*	.0296	.185	1.552

Source: Field Survey, 2011

Number of independent variables = 6
Number of respondents = 96
r is significant at P< 0.05 level
t is not significant at P< 0.05 level
R-square (R^2) = 0.129
Adjusted (R^2) = 0.059

experience (19.10%), farm size (19.8%) income (17.2%) and number of plots (22.9%) respectively. The inference to this was that 78.9 percent of the variation in Y was attributable to all the significant variables.

Table 3 further shows the regression analysis used to determinate the magnitude of change in adoption score (Y) by all significant variables (X). R-square (R^2) showed the total percentage of variations in Y variables (adoption score) explained by the joint contribution of X variables attributed to age (t = -0.875), education (t = -0.249), experience (t -1.439), number of farm plots (t = -2.2980, farm size (t = 2.225) and income (t = 1.552). The inference to this was that 16.5 percent of the variations in adoption score (Y) was attributed to all significant variables.

The findings of the study area at Table 3 showed years of experience, farm size, income and number of plots were all significant variables and accounted for 78.9 percent of the variability in the level of technology adoption.

The number of plots had negative coefficient suggesting that farmers in the study area were at subsistence level and relied on use of family labour, the situation which made cultivation on large scale difficult. This problem was compounded by the use of hand tools (low technology) by most respondents. Implication of this was that the farmers in the study area were risk-aversed. Equally, farm size showed negative relation of coefficient possibly because the more the farm size was the less the farmers were worried about adoption of new technologies since they possibly believed they could still meet their family demand for sustenance.

The non-significance of the coefficient for age and education was probably because the availability of subsidized fertilizers and improved seeds would serve as the basic motivating factor for technology adoption. The positive relationship between years of experience and adoption implied that adoption of improved technologies tended to be accepted by experienced farmers because they understood the importance of technologies in farming. Similarly, the positive relationship between income and adoption implied that availability of income enhancedfarmers' ability to purchase the inputs embodied in the new technology and paid for hired labour needed for the use of these inputs and improved management practices for greater productivity.

Mode of Adoption of Technologies by Farmers

Data in Table 4 revealed that most of the crop-based technologies introduced to the farmers were highly adopted: spacing (82.29%), weeding (60.42%); fertilizer application (87.50%), pest/diseases control measure (67.71%); storage (70.83%) sole cropping (29.17%) and inter-cropping (71.88%).

Intercropping technique of farming had consistently been acceptable by 71.88%of the resource-poor-farmers in the study area possibly because it ensured high yields and higher returns to their farming operations. Being resource poor farmers, they possibly found the practice of inter-cropping an effective means of utilizing their environmental resources (water, light, nutrients) and labour. The practice of inter-cropping by implication might have provided them with effective means of pests and diseases control; served as insurance against crop failures thereby assuring total subsistence neededfor the farm families.

Table 4. PERCENTAGE DISTRIBUTION OF RESPONDENTS ACCORDING TO MODE OF ADOPTION OF INPUT TECHNOLOGIES

Variable	Percentage Adoption by Respondents
Fertilizer Application	87.50
Spacing Technique	82.29
Inter-Cropping Practice	71.88
Storage Measures	70.83
Pest/Disease Measures	67.71
Weeding Technique	60.71
Sole Cropping Practice	29.17

Multiple respondents recorded
Source: Field Survey, 2011

Furthermore, farmers' attitude seemed to infer that embarking on inter-cropping practice was to provide effective coverage for the soil erosion and exposure to solar-radiation. Inter-cropping practice among the resource poor farmers in the study area were carried out as means of suppression weeds. In this regard, resource-poor farmers in the study area might have chosen to accord very high adoption technique for inter-cropping.

Storage measure was accorded high level of adoption by large proportion (70.83%) of the respondents. This showed considerable priority by farmers in the study area who were peasants farmers characterized by small holdings. Storage technique adopted was clear reflections of their pre-dominant subsistence level of farming where farmers had little to store, usually for consumption, and planting and occasionally a little to sell.

Pests/diseases control technique was inevitably adopted by 67.71% of the respondents due to the fact that in JDA, the devastating effect of pests/diseases on crops was considerable. Monu(1983), noted that in Nigeria and indeed the study area the control of pests and diseases could not be over-emphasized as 40 – 80 percent crop was lost yearly due to pests and diseases. This situation suggested that farmers who were able to control the menaces of pests/diseases could realize higher productivity and better economic return in their farming operations. In this regard adoption of pests/diseases control measures was expected because ability to control pests/diseases enhanced technology adoption.

Weeding technique was adopted by large number (60.2%) of the respondents into their farming operation. This implied that low-resource farmers in the study area regarded weed management technique as suitable for effective control of undesirable grasses in their farming operations. Weed control involving hand weeding is labour intensive, uneconomical and more difficult to handle. Adoption of the technology of weed control by the resource poor in the study area inferred farmers' realization of the fact that delayed weeding encroaches into the critical period of weed interferences. By implication, they understood timely weeding could ensure higher economic returns to their farming operations. Furthermore, farmers had possibly became convinced that modern weed control such as the use of herbicides, was not only more convenient but more effective than the traditional hoeing.

Spacing technique adopted by most (82.29%) of the respondents suggested that the recommendation did not require much financial outlay, but the economic benefit was enormous. In Nigeria and indeed in the study area spacing as part of the technology package was among the critical extension messages disseminated to farmers by extension agents. High level percentage of the respondent's adoption of technology inferred intensity to extension delivery to farmers. In Nigeria, extension agents constitute the main source of farmers' information on improved agricultural technologies. They were, also, responsible for educating farmers on the use of improved technologies. The higher the adoption level the greater intensity of extension contact made by farmers (Njoku, 1991).

Fertilizer application technology was accorded highest (87.5%) priority by most respondents. This implied possible defects in the soil nutrients of the study area. Agbede and Kalu (1991) reported low levels of nutrients in most soils in the Savannah will not support good crops unless supplied with micro nutrients particular N. P. and K. and in some cases lime. According to them, due to undulating to hilly nature of land scope in most part of the state (Nasarawa State and JDA) the soil were prone to serious erosion problems. The study area comprised mostly, subsistence farmers, as such would not allow soil degradation in their customary area of abode to interfere with their food security. Consequently, considerable attention by the farmers in adopting fertilizer as an important technology to be incorporated into their farming operation became imperative. Since investment in fertilizer was a critical technological input needed for their farming operations, subsistence farmers such as the ones

in the study area were likely to adopt more of the improved fertilizer technology to safeguard their food security.

Sole-cropping technology was accorded low (29.17%) acceptance by most respondents – due to the fact that Nigerian farmers and indeed farmers in the study area were conceived mono-cropping was a source of harm or damage to their welfare. Igbozuruike(1983) described mono-cropping culture as inimical to natural order, deleterious to ecopheric safety and lethal to man's long-term interest. At Okitipupa in Nigeria's Ondo State, farmers rejected growing oil palm in monoculture by putting several other crops, and even refused growing oil palm if not coaxed to intercrop. There was no always good correlation between performance of cultivars in sole-cropping and intercropping (Okigbo, 1979).

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

Years of experience and farm income were positively correlated to adoption of crop-based technologies while farm size and number of plots were negatively correlated to technology adoption in the study area. Age and low level of education of the respondents contributednegatively to adoption of technologies while fertilizer application was accorded highest adoption followed by spacing technique.

RECOMMENDATIONS

Based on the foregoing conclusions:

(i) Technology dissemination to farmers should be based on potential economic benefits and should be simple and suited to the educational/technological level of the farmers.

(ii) Such technologies should be as much as possible fit into the prevailing farming system of the respondents.

(iii) Inputs relevant to recommended technologies should be made available to farmers in good time and at affordable prices so as to minimize discontinuations of adoption.

(iv) Participation of youth in agricultural development schemes, due to their high level of adoption potentials of innovation-compared with their other contemporaries should be encouraged.

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