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**IMPACT OF MEMBERSHIP OF FADAMA USERS' ASSOCIATIONS ON
RESOURCE USE, CROP YIELD AND FARM INCOME:
A CASE STUDY FROM TWO LOCAL GOVERNMENT AREAS IN NIGER STATE**

K.M. BABA and M.A. WANDO

Department of Agricultural Economics and Extension,
Usmanu Danfodiyo University, Sokoto.

ABSTRACT

This study evaluated the effect of fadama users' associations on resource use, crop yield and farm income in the Magama and Kontagora Local Government Areas of Niger State. Data were collected from 30 members of fadama users' associations and 30 non-members, all producing rice or tomato under irrigation. Descriptive statistics, farm budgeting, and multiple regression were employed in data analysis. Members used more improved inputs and obtained higher yields and incomes than non-members. Regression results further confirmed the positive impact of membership on farm income and identified the use of inorganic fertilizer as another important income determinant. Suggestions were made on how to further increase financial returns in irrigated farming in the area.

INTRODUCTION

Inadequate water supply is a major constraint to farming in Nigeria, particularly the northern parts where annual rainfall is typically restricted to less than six months. It is estimated that less than 50% of potential agricultural land in the country is presently cultivated due to inadequate water supply.

The problems posed by inadequate rainfall appear to have long been recognised by agricultural development planners in Nigeria. Thus, government involvement in irrigation development dates as far back as 1918 (Ehabor, 1982, 1991). Today, a number of small- and large-scale irrigation schemes have been established in different parts of the country and efforts are being made to establish more. One of the most recent strategies is small-scale *fadama* development for irrigation.

Fadama is a Hausa word for inland valley lands that are generally flat-floored, relatively shallow and seasonally water-logged (Turner, 1984, 1986; Adams and Carter, 1987). According to Kolawole and Scoones (1994), the word *fadama* means the seasonally flooded or floodable flood plains along the major savanna rivers and/or depressions on the adjacent terraces. The *fadama* soils usually have high moisture retention and are rich in plant nutrients (Singh and Bajajif, 1989, 1990). These characteristics make the *fadama* land a critical resource in the drylands of northern Nigeria.

It is probably in recognition of the potentials of the fadama lands that current efforts are being made to develop them for irrigated farming under the World Bank-assisted National Fadama Development Project (NFDP). The NFDP is being implemented through the Agricultural Development Projects (ADPs) in collaboration with the Federal Agricultural Coordinating Unit (Umar and Yem, 1984; Sangant, 1986). The Project plans to develop up to 3.1 million hectares in the northern and middle belt areas for small-scale irrigation (Awogbade, 1994).

The approach of the NFDP typically involves impounding flood water, building small earth dams, or developing ground water by sinking washbores and tubewells. It also involves the sale of small petrol water pumps and other requisite inputs to farmers. What was perceived as the major threat to this strategy were inability of individual farmers to afford the inputs and how to ensure the sustainability of the irrigation facilities. In an apparent move to circumvent these problems, the NFDP emphasises the formation of cooperative societies, popularly called fadama users' associations, through which the inputs are channelled to farmers. The associations, therefore, are expected to make improved inputs more accessible to the farmers by allowing them to pool their resources together. Use of the improved inputs in irrigated farming is then expected to increase aggregate agricultural output and farm incomes. The associations are also expected to facilitate the organization of farmers for group action particularly in the maintenance of the irrigation systems, so as to ensure their sustainability.

In Niger State, the State ADP has undertaken fadama development under the NFDP in a number of localities. Some of the areas receiving attention are located in Magama and Kontagora Local Government Areas where some fadama farmers have been organised into fadama users' associations. This study evaluated the extent to which such associations have facilitated the accessibility of farmers to irrigated farming inputs, and how they have affected crop yields and farm incomes in the area.

METHODOLOGY

The Study Area

The study was conducted in Magama and Kontagora Local Government Areas of Niger State which are located between latitudes $10^{\circ}24'N$ - $10^{\circ}30'N$ and longitudes $5^{\circ}9'E$ - $5^{\circ}29'E$. Annual rainfall in the area varies between 1016 mm and 1524 mm with a duration of seven to eight months (March to October). The remaining period of the year (November to February) is dry with little or no rainfall.

Farming is the major occupation in the area. Both upland and fadama cultivation are undertaken under raised and irrigated conditions, respectively. Maize, sorghum, millet, groundnut and cowpea are the major crops grown in the upland, while rice, tomato, egg plant and pepper are grown in the fadama. Fadama cultivation is done mainly in the valleys of Rivers Kontagora and Nasiki which flow through the area.

Sampling and Data Collection

To achieve the objectives of the study, 80 fadama farmers, consisting of 30 members of fadama users' associations and 30 non-members, were selected and interviewed from four villages in the area through a stratified random sampling technique. The farmers were initially stratified into two groups consisting of members of fadama users'

association and non-members. Each group was again sub-divided on the basis of crops grown and 15 farmers each were selected out of those growing rice and tomato. The sample, therefore, consisted of 15 members growing rice and 15 growing tomato, and 15 non-members growing rice and 15 growing tomato. The emphasis on rice and tomato was because they were the most widely cultivated fadama crops in the two Local Government Areas.

The villages from which the farmers were sampled include Ibado, Nsako and Saka in Magama Local Government Area, and Maulafa, Inkontagora Local Government Area. Equal number of farmers (15) were sampled from each of the villages. From the sampled farmers, demographic, input-output, sales, and price data were collected in a cost-route survey conducted during the 1996/97 irrigation season using pre-tested questionnaire.

Data Analysis

The collected data were analysed using descriptive statistics, farm budgeting and multiple regression. The descriptive statistics were used mostly to analyse the sources and uses of the inputs while the farm budgeting was used to delineate the costs and returns in crop production. The farm budgeting model used was of the form:

$$NFI = GI - FC - VC \dots\dots\dots (1)$$

where:
 NFI = net farm income,
 GI = gross income,
 FC = fixed cost, and
 VC = variable cost.

The multiple regression model was used to quantify the effects of a number of variables on net farm income. The model was specified as follows:

$$NFI = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e \dots\dots\dots (2)$$

where:
 X_1 = farm size (ha),
 X_2 = labour input (man-hours/ha),
 X_3 = seed input (naira/ha),
 X_4 = fertilizer input (kg/ha),
 X_5 = dummy variable for membership of water users' association (1 = member, 0 = non-member),
 b_0 = intercept term,
 $b_1 \dots b_5$ = estimated regression coefficients, and
 e = random disturbance (error) term.

RESULTS AND DISCUSSION

Sources and Uses of Inputs

The study revealed that majority of the respondents (88.87% of members and 76.67% of non-members) acquired fadama lands through inheritance. The remaining either obtained them as gift (10% of members and 23.33% of non-members) or borrowed (3.63% of members only). None of the respondents purchased or hired fadama lands. This suggests that commercial transaction in fadama land is rare in the area. The

absence of commercial transaction and the preponderance of land tenure by inheritance could be an impediment to transfer of title on land. In addition, inheritance as a system of land tenure, often leads to fragmentation of land holdings which perhaps partly explains the small plot sizes in the area. Fragmented holdings, in turn, are not amenable to mechanization and may also prevent farmers from benefiting from scale economies.

Information on farm sizes in the area is presented in Table 1, which shows that the farm plots were generally small, with members cultivating an average of 1.92 ha and non-members cultivating 1.55 ha. This suggests an increase in farm size of 23.87% for members over non-members. Although the plot sizes recorded in the area were small, they exceeded the average of 0.55 ha estimated for inland valleys in Nigeria (Ashai et al., 1988).

Table 1: Resource use and crop yield

Variable	Members	Non-members	t-value
Farm size (ha)	1.92	1.55	0.934 **
Labour (man-hours/ha)	297.00	298.00	0.432 **
Fertilizer (kg/ha)	1,650.00	126.67	1.881 *
Rice yield (kg/ha)	1,850.00	1,400.00	2.432 **
Tomato yield (kg/ha)	9,360.00	7,553.30	1.745 *

** = significant at $P < 0.10$ and $P < 0.05$, respectively; * = not significant.

Source: Field survey, 1990/97

The level of labour use by the two categories of respondents is also presented in Table 1. Evidently, the two categories of farmers were almost at par in terms of average labour use, with members using about 297 man-hours/ha and non-members about 298 man-hours/ha. This finding is surprising because non-members, some of whom used shadof, were expected to use more labour than members, all of whom used motorised pumps. For instance, Baba (1993), working in Bauchi State, found that shadof users employed a significantly higher amount of labour than pump users which he attributed to the fact that the shadof is manually operated and required more labour.

Further analysis revealed that about 86% of members used both family and hired labour as compared with only 66% of non-members combining the labour sources. Family labour alone was used by 13% and 33% of members and non-members, respectively. More members used hired labour probably because they cultivated larger plots and required more hands for the timely accomplishment of the farm operations.

Table 1 also shows the level of fertilizer use by the farmers. The members used more fertilizer than non-members. While members used about 160 kg/ha of fertilizer, non-members used 126 kg/ha. This represents an increase of about 27% for members over non-members, an increase which is statistically significant ($P < 0.10$). Members used more fertilizer probably because the commodity was more easily accessible to them than non-members. Since the government is encouraging farmers to form associations, it usually gives priority attention to such associations when it comes to

fertilizer sales. Consequently, all the members were able to obtain fertilizer from their associations while 86% of the non-members had to struggle on their own to obtain the commodity from the Niger State Agricultural Supply Company, and the remaining 14% from the black market.

Generally, the level of fertilizer use in the study area was low. For instance, the rates for both categories of farmers were far lower than the recommended 500 kg/ha for vegetables grown in the Fadama lands of northern Nigeria (AERLS, 1985).

Table 2: Prices of some inputs/services in the study area

Input/service	Members	Non-members
Fertilizer (N/kg)	3	10
Pump (N/set)	15,000	28,000
Rice seed- Faro 43 (N/kg)	100	100
Rice seed- CP rice (N/kg)	100	100
Rice seed- Hajj Kusa (N/kg)	100	100
Tractor services (N/ha)	500	1,800

Source: Field survey, 1996/97

The results show that three varieties of rice and two of tomato were planted by the respondents. The rice varieties include CR rice, Faro 43 and Hajj Kusa. The CP rice is an improved, dwarf, early-maturing (90 days) and high-yielding variety which requires relatively high fertilizer rates. It is the most preferred variety of those who have fairly easy access to fertilizer and was planted by all the members and by 20% of non-members. The remaining non-members planted Faro 43 (73%) and Hajj Kusa (7%). The Faro 43 is also an improved variety, but tall and late-maturing. Although it is high-yielding, it is subject to lodging and the yield is variable depending on the wind condition. The Hajj Kusa is a local, early maturing and dwarf variety with low yield. Its low yield potential probably accounts for its low popularity in the area.

The two varieties of tomato grown were *Dan aka* and *Maitaya* both of which are improved. All the members and 46% of the non-members planted *Dan aka*, while the remaining 54% of non-members planted *Maitaya*. *Dan aka* is preferred because it is high-yielding and produces medium-sized fruits which do not rot easily. This is in contrast with *Maitaya* which has lower yield and produces large highly perishable fruits.

All members obtained rice seeds through their associations while some of the non-members bought from Niger State Agricultural Supply Company or from the open market. As can be seen in Table 2, there was no difference in the price of rice seeds obtained either through the association or from the open market. But seeds obtained through the association are likely to be more authentic than those bought from the market. The tomato seeds were obtained by both categories of farmers from the open market. The results in Table 3 show that non-members spent more on seeds, notwithstanding that prices paid were fairly uniform.

All members owned motorised pumps for lifting water either from the river or from tubewells. Only 60% of non-members owned pumps, the remaining 40% combined

hiring of pumps with the use of shadof. All of the members owned pumps because they were able to purchase them through their associations at lower prices than non-members who purchased from the open market (see Table 2). Ownership of pump guarantees better control over the timing and quantity of water application than hiring. It is probably due to the uncertainties surrounding the pump hiring that each of the farmers who hired pumps also owned shadof which was used whenever the farmer could not obtain pump for hiring. It has, however, been pointed out that the need for manual operation of shadof places a premium on the sizes of fadama lands that farmers could effectively irrigate (Iwua, 1981; Ertabor, 1982; Babba, 1993). This perhaps explains why non-members, some of whom used shadof, cultivated smaller plots than members, all of whom owned and used pumps.

Table 3: Cost structure in rice and tomato production (N/ha)

Item	Members		Non-members	
	Cost	% of total	Cost	% of total
Labour	3,748	34.08	3,771	27.58
Fuel	3,825	34.76	2885	21.10
Repairs	325	2.95	190	1.38
Fertilizer	480	4.36	1,286	9.26
Seeds	887	8.08	1,067	7.80
Empty sacks	473	4.30	582	4.26
Tractor hiring	500	4.54	1,800	13.16
Pump hiring	-	-	533	3.80
Depreciation on pump/shadof	540	4.91	897	6.49
Depreciation on implements	215	1.96	263	1.92
Depreciation on shadof	-	-	425	3.11
Registration fee	11	0.10	-	-
Others	-	-	4	0.03
Total	11,005	100	13,573	100

Source: Field survey, 1996/97

The results show that all members obtained credit for fadama farming from their associations while only 60% of non-members obtained credit from the Nigerian Agricultural and Cooperative Bank. The remaining 40% of non-members relied entirely on their own savings. It appears, therefore, that membership of associations has increased accessibility even to credit.

Yield and income

Information on rice and tomato yields obtained by the respondents is also presented in Table 1 which shows that members recorded higher yields of both crops than non-members. The average yield of rice was 1,850 kg/ha for members and 1,400 kg/ha for non-members. This represents a yield difference of 32.14% which was statistically significant ($P < 0.05$). The average yields of tomato for members and non-members were 9,380 kg/ha and 7,553 kg/ha, respectively. This represents a significant tomato yield increase of 23.92% for members over non-members. The yields of both crops

were higher for members than non-members probably because members used more improved inputs, particularly fertilizer and rice seed, than non-members. In addition, all members owned pumps while 40% of non-members hired pumps or used shadoof for irrigation. Obviously, members were likely to have had a better control over the timing and quantity of water applied. This might have also contributed to the observed yield differences between the two groups of farmers.

The rice yields obtained in this study compare well with the national averages between 1971 and 1974 which ranged from 1,486 kg/ha to 1,942 kg/ha (Adeniyi, 1988). They were, however, much lower than the 3,770 kg/ha reported for Adakeliki in erstwhile Anambra State (Nwagbo and Ormuchekeva, 1988). Njoku (1988) also obtained 1,706 kg/ha and 2,290 kg/ha for swamp and upland rice in the Ohaozara area in Imo State.

Table 3 presents the production cost structure for the two groups of farmers. The members produced at an average total cost of N11,005.17/ha as against N13,673.70/ha for non-members. This implies that members produced at a lower cost than non-members. This is not unexpected considering the fact that members obtained their inputs (particularly fertilizer and pump sets) at relatively low prices as against non-members some of whom purchased the inputs at relatively high prices from the open market (see Table 2).

The distribution of respondents according to net farm income per hectare is presented in Tables 4 and 5 for rice and tomato, respectively. As presented in Table 4, the rice growing members earned more profit than non-members. For instance, 93.33% of members earned a profit of N15,001/ha or more while only 26.67% of non-members earned that much. The average net farm incomes of rice growing members and non-members were N17,421.13/ha and N13,818.07/ha, respectively.

Table 4: Distribution of rice farmers according to net farm income (N/ha)

Net Farm Income (N)	Members		Non-members	
	Freq.	%	Freq.	%
1 - 5,000	0	0.00	0	0.00
5,001 - 10,000	0	0.00	1	8.87
10,001 - 15,000	1	6.67	10	66.67
15,001 - 20,000	12	80.00	4	26.67
20,001 - 25,000	2	13.33	0	0.00
Total	15	100	15	100

Mean: members = N17,421.13; non-members = N13,818.07

Chi-square = 14.36; significant at P<0.05

It can be seen from Table 5 that members producing tomato also earned more profit than non-members. Majorly (86.67%) of members earned between N15,001 and N20,000/ha profit in tomato production, while only 20% of non-members were in this income group. A major proportion of non-members earned below N15,000/ha. The average net income of members in tomato production was N15,845.8/ha, while that of

The results of the regression analysis with respect to tomato in Table 7 show that fertilizer and membership had positive relationships with net income while labour, seed and farm size had negative relationships with net income. This implies that, given the present circumstances of the farmers, increasing the use of the last three inputs would only decrease profits from tomato. The coefficients with respect to labour, farm size and membership were significant.

Table 7: Regression results for factors affecting net farm income from tomato

Variable	Parameter estimate	t-value
Intercept	24549.00	5.44**
Farm size	-4738.74	-2.66*
Labour	-22.12	-2.13*
Seed	-4.79	-0.72**
Fertilizer	16.10	0.97**
Membership	3281.65	3.31**

R² = 49.22; F-value = 4.46**

** = significant at P<0.05 and P<0.01, respectively; ns = not significant

For the two crops, it appears that fertilizer and membership of associations were the most important determinants of net farm income. The positive effect of fertilizer on net farm income might have resulted from its effect on the yields of the two crops. Membership also positively affected net farm income probably because it made improved inputs, including fertilizer and pumps, more readily available, thereby increasing crop yields. In addition, membership allowed farmers to obtain the production inputs at lower prices which lowered the total cost of production of members, thereby increasing their income.

CONCLUSION

The study has shown that membership of fadama users' associations has enhanced accessibility of fadama farmers to improved inputs. Consequently, members of associations were found to use more improved inputs, especially fertilizer, rice seeds and pumps, than non-members. This probably contributed to the higher crop yields obtained by members over non-members. It, however, appears that opportunities still exist for increasing yields by increasing fertilizer use because the rates used by the two categories of farmers were lower than the recommended rates.

Members also earned more net income than non-members. The regression analysis showed that fertilizer and membership were the most important determinants of income. It would be beneficial, therefore, to make more fertilizer available to the farmers and encourage more membership of associations. To further enhance income, the associations should also assist members in marketing their produce. One of the major constraints identified by respondents was low prices of produce. Better prices could be obtained through collective bargaining by the associations on behalf of members in the disposal of produce.

Furthermore, it appears that the associations could prove highly valuable for extension teaching especially where group action is necessary. Organizations concerned with extension teaching in the area should, therefore, work with the associations in trying to reach the farmers.

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