Resource Management Practices and Challenges of *Fadama* Users in Federal Capital Territory, Abuja, Nigeria

[1]Amusa, T. A and [2]Isiwu, E. C

[1]Department of Agricultural Economics,
Michael Okpara University of Agriculture, Umudike, Nigeria

[2]Department of Agricultural/Home Economics Education,
Michael Okpara University of Agriculture, Umudike, Nigeria

Corresponding Author: hamfeeq@yahoo.com; +2348036185143

Abstract

This study investigated resource management practices and challenges of Fadama users in the Federal Capital Territory, Abuja, Nigeria. Data obtained from 387 Fadama users with the aid of a structured close-ended questionnaire were analyzed using descriptive statistics and factor analysis. The study found that resource management practices utilized by the Fadama users included mulching, inorganic fertilizer use, multiple cropping, rain water harvesting and fallowing among others. Resource management practices not utilized by the Fadama users included organic manure application, cover cropping, soil fallowing, soil liming, construction of bonds, construction of terraces, drainage, afforestation, controlled logging and agroforestry practices among others. The result of the factors analysis identified three challenging factors facing Fadama farmers in resource management as: institutional/cultural factors(lack of extension visits to the farmers (0.537), poor control of farmlands by most of the farmers (0.427), insufficient knowledge of sources of credit to support farming (0.614) and lack of collateral security required to secure loans (0.647)), cost factor(low financial capacity of the farmers (0.682), lack of access to supporting facilities (0.437), low levels of farming experience (0.409), high costs of labour for resource management (0.466) and subsistence scale nature of production by farmers (0.570)), and input factors(high costs of farm inputs for resource management (-0.509), inadequate farm labour resource management (0.675) and poor technical know-how of the Fadama farmers (0.563). The study recommended that education and training of Fadama users be done for sustainability of Fadama resource (soil, water and vegetation) management.

Keywords: *Fadama*, soil, water, vegetation, challenges, factor analysis, FCT, Abuja

Introduction

The Nigerian agricultural sector is dominated by small-scale farmers who produce the bulk of food requirements of the country with their associated low productivity. In order to ensure that the laudable objective of self-sufficiency in food production is sustainably achieved in the country, the Federal Government of Nigeria developed and implemented *Fadama* Development Projects across the country.

Fadama is a Hausa word for low-lying flood plains, usually water-logged or with easily accessible shallow ground water; an irrigable land underlined by shallow aquifers and found along Nigeria's river system. According to Ibrahim and Omotesho (2011), *Fadama* is a wetland

or the seasonally flooded or floodable plains along major savannah rivers and/or depressions on the adjacent low terraces. *Fadama* areas are typically waterlogged during the rainy season but retain moisture during the dry season for food production. In affirmation, Ajayi and Nwalieji (2010) stated that implementation of *Fadama* projects ensures that agricultural production is carried on during the rainy and dry seasons. *Fadama* areas are composed of deposited alluvial sediments, and contain exploitable aquifers. *Fadama* farming therefore involves preparation of low-lying areas and flood plains for food crops, agroforestry and livestock production (Nwadukwe, 2000).

The objectives of the National *Fadama* Development Project (Umar and Tyem, 1995) include:

(i) installation of 50,000 shallow tube wells in the *Fadama* lands for small scale irrigation;
(ii) simplification of drilling technology for the tubewells;
(iii) construction of *Fadama* infrastructure;
(iv) organization of farmers for irrigation services;
(v) carrying out aquifer studies;
(vi) monitoring and upgrading irrigation technologies, and
(vii) completion of a full assessment of the environmental and social impacts of *Fadama* development.

Effective management of *Fadama* resources is central to the achievement of these objectives. *Fadama* resources, according to World Bank (2003), include soil, water and vegetation which constitute an ecosystem upon which the existence and welfare of a majority of the rural poor depend. *Fadama* soils tend to deteriorate under continuous cultivation and irrigation. World Bank (2001) observed that Nigeria is confronted with a number of serious environmental problems, and that the rate of deforestation in Nigeria was 2.6% in 2000. Hence, considerable fertilizer input and organic manure application is necessary to achieve optimum crop yields. Ballayan (2000) highlighted three components of estimating the cost of soil degradation as: (i) cost of replacing nutrients through additional inputs to maintain level of productivity, (ii) cost of replacing soil organic matter by allotting part of the land to a green manure crop and (iii) cost of replacing the eroded soil for increased agricultural production.

On *Fadama* water resources, there is a localized potential risk of river bed and bank contamination due to build-up of pesticides thereby posing a threat to crops and livestock. In much smaller water bodies such as lakes, ponds and reservoirs, water quality degradation is more common due to biological activity and increased concentration resulting from high moisture evaporation (Singh *et al*, 1996). The undisturbed natural ecosystem and vegetative cover provide a natural shelter for aquatic life and other animals, while the water regime brings in nutrients which stimulate rapid growth of micro-organism and invertebrates within the natural ecosystem. Unfortunately, a greater percentage of Nigeria's vegetation cover has been removed. Nigeria lost about 1,214 square metres of forest cover between 1990 and 1995, resulting in severe exposure of the soil to agents of soil degradation and consequently loss of soil productivity (World Bank, 2003).

The present state of *Fadama* soil, water and vegetation management is counter-productive. This trend has considerably undermined the productivity of farmers under the *Fadama* system. Supporting this fact, Ibrahim and Omotesho (2009) emphasised that the current system of food production under *Fadama* in north-central Nigeria is not sustainable. This is because, substantial amount of deforestation has taken place in the country over the last few decades

(Alkali and Shettima, 2011). In confirmation, FAO (2005) reported that the rate of deforestation and degradation of soils in tropical countries was estimated to be about 1% per year.

On water availability, Ahaneku (2010) stated that the quantity of water required for maximizing crop production in most regions of the country was fast becoming inadequate. Surface water quality is deteriorating, and groundwater is polluted and irreversibly damaged by the intrusion of salt water along the coast.

Poor water control also contributes to erosion especially in hilly and highland regions experiencing deforestation due to logging and agricultural expansion, and to soil nutrient leaching in wetter areas (Barrett *et al.*, 2002).This has resulted from poor natural resource management culture among farmers who constitute the major actors in agriculture and food production. Some of the resultant effects of poor management of natural resources include environmental degradation, low level of economic development and lack of good agricultural practices which directly affect the livelihood of people. Junge *et al.* (2007) observed that some of the farming system practices aimed at managing soil, water and vegetation have widespread acknowledgement but with low usage among farmers. They observed further that most of the projects on resource management were carried out on research farms and in only a few other farms with low participation of farmers.

Despite the obvious poor resource management practices among farmers, no study seems to have identified resource management practices by farmers, the degree of usage of the practices and the challenges facing *Fadama* users in carrying out resource management practices to ensure sustainability of Nigerian agriculture. Therefore, effort to embark on a study that will address these pertinent questions would provide baseline information for governments, National *Fadama* Development Project and farmers on practices utilized in managing *Fadama* resources, and the challenges facing farmers. This study therefore investigated *Fadama* resource management practices and their associated challenges among *Fadama* users in Nigeria's Federal Capital Territory, Abuja.

Material and Methods

The Study Area

The study was carried out in Nigeria's Federal Capital Territory (FCT), Abuja. The FCT covers a land area of about 8000km^2 with a total population of 1,405,201 (National Population Commission, 2006). It is bounded in the north by Kaduna State, in the west by Niger State, in the east and southeast by Nasarawa State and in the southwest by Kogi State. The FCT is naturally endowed with rolling hills and isolated highlands. The savannah grassland of the North and middle belt, the richness of tropical rainforest of the South and an equable climate make the FCT rich in good agricultural soils.

The FCT is one of the areas covered by the National *Fadama* Development Project (*Fadama* II) (Dauda *et al*., 2009). The project is operated in the *Fadama* resource-rich areas of the FCT. These areas are demarcated into 10 *Fadama* development areas (FDAs). They are: Abaji, Gwagwalada, Kuje, Municipal, Wako-Ashara, Bwari, Karshi, Kwali, Rubochi and Yaba.

Sampling and Data Collection

There are 1,127 *Fadama* users engaged in crop production, livestock rearing, fishery and agro-processing enterprises in the FCT, Abuja (National Fadama Development Project, 2014). A

random sampling technique was used to select 400 *Fadama* users across the 10 FDAs in FCT. Abuja. In determining the sample size, the Yamane (1967) method was adopted since the actual population of *Fadama* users in FCT can be ascertained. Yamane (1967) provides a simplified formula for calculating sample size. A 95% confidence level and level of maximum variability (p = 0.05) were assumed. This formula was used to calculate the sample size for this study as shown below:

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = Sample size required

N = Total population

e = allowance error (0.05)

By substituting the parameters;

$$n = \frac{1,127}{1 + 1,127(0.05)^2}$$

n = 399.65 which is approximately 400 *Fadama* users

After the computation of the sample size by substituting the numbers into the Yamane formula, the obtained sample was 399.65 *Fadama* users. The researchers approximated the sample size to 400 *Fadama* users that constituted the respondents for the study. A simple random sampling was used to select 40 *Fadama* users from each of the 10 FDAs in FCT Abuja totalling 400 *Fadama* users from which data for the study were collected. The data for this study were obtained from primary source through the use of a structured questionnaire with close-ended questions. The questionnaire focused mainly on socio-economic characteristics of the *Fadama* users, soil, water and vegetation management practices utilized and challenges facing them in resource management in the area. The data for the study were collected in November - December, 2015 with the help of ten extension agents in the study area.Out of the 400 copies of the questionnaire administered and retrieved, 387 copies were considered valid for use for the study.

Estimation Procedure

The data collected were analyzed using arithmetic means and factor analysis as detailed below:

To determine the practices utilized by farmers in *Fadama* resource management in FCT Abuja, a 4-point rating scale technique was used. The 4-point rating scale of the degree of soil management practices was graded as: Highly Utilized, (HU) = 4, Moderately Utilized (MU) = 3, Less Utilized (LU) = 2 and Not Utilized (NU) = 1. The mean ratings of the respondents based on the 4-point rating scale were graded using boundary limit as stated below:

Response Categories	***Ordinal values***	***Boundary limits***
Highly Utilized (HU)	= 4	3.50 – 4.00
Moderately Utilized (MU)	= 3	2.50 – 3.49
Less Utilized (LU)	= 2	1.50 – 2.49
Not Utilized (NU)	= 1	1.00 – 1.49

Factor Analysis

An exploratory factor analysis procedure was employed to identify major challenges facing farmers in the *Fadama* system of the FCT. The challenges noted by the farmers were grouped into three factors using principalcomponent factor analysis with iteration and varimax rotation and factor loading of 0.40. The model was represented as:

$$Y_1 = a_{11}X_1 + a_{12}X_2 + * * *+ a_{1n}X_n$$
$$Y_2 = a_{21}X_1 + a_{22}X_2 + * * * + a_{2n}X_n$$
$$Y_3 = a_{31}X_1 + a_{32}X_2 + * * * + a_{3n}X_n$$
$$* = *$$
$$* = *$$
$$Y_n = a_{n1}X_1 + a_{n2}X_2 + * * * + a_{nn}X_n$$

Where:

$Y_1, Y_2 \ldots Y_n$= observed variables/challenges to farmers in resource management practices.

$a_1 - a_n$ = factor loadings or correlation coefficients.

$X_1, X_2, \ldots X_n$ = unobserved underlying challenging factors facing farmers in resource management.

Results and Discussion

Soil Management Practices by Farmers in the Fadama System

The result presented in Table 1shows some of the major soilmanagement practices and the extent to which they are being utilized by farmers under the FCT's *Fadama* system. From the result, mulching (3.67), use of inorganic fertilizer (3.51) and multiple cropping (3.50) were highly utilized by farmers for soil management. Intercropping (3.00), crop rotation (2.98), minimum tillage (2.86) and construction of waterways (2.68) were moderately utilized by the farmers for soil management. This finding is in conformity with that of Ogbonna *et al*. (2007) on adoption of soil management and management technologies in Nsukka area of Enugu State where the authors, among others, found that farmers utilized manure application, mulching and improved cropping such as multiple cropping and crop rotation as soil management and management practices. The result on soil management practices in the Table further shows that application of organic manure (2.33), cover cropping (2.42), soil fallowing (2.13), soil liming (1.95), no/zero tillage (2.02), construction of bonds (2.43), construction of terraces (2.00) and construction of contours with stones as barrier (2.32) were less utilized by the farmers for soil management. The report of World Bank (1999) affirmed that soil management efforts by most farmers in Nigeria is still very low, resulting in the recorded high rate of soil degradation in the country.Soil degradation affects about 50 million people in Nigeria and leads to the greatest loss of the nation's GNP (US $3000 million per year) relative to other environmental problems.

Table 1: Mean Ratings of the Farmers on Soil Management Practices Utilized in the *Fadama* System (N = 387)

SN	Soil Management Practices	$\bar{X}$	SD
1	Mulching	3.67***	0.53
2	Organic manure application	2.33*	0.89
3	Inorganic fertilizer application	3.51***	0.56
4	Cover cropping	2.42*	0.87
5	Soil fallowing	2.13*	1.04
6	Multiple cropping	3.50***	0.65
7	Intercropping	3.00**	0.66
8	Crop rotation	2.98**	0.78
9	Soil liming	1.95*	1.08
10	Minimum tillage	2.86**	0.76
11	No/zero tillage	2.02*	1.03
12	Construction of bonds	2.43*	0.88
13	Construction of terraces	2.00*	1.04
14	Construction of water ways	2.68**	0.84
15	Construction of contour with stones as barrier	2.32*	0.96

Note: **** Highly Utilized; ** Moderately Utilized; * Less Utilized (LU)*
Source: Field Survey, 2015.

Water Resources Management

The result presented in Table 2 on water resources management showed that only rain water harvesting (3.53) was highly utilized while use of watering cans for watering farmlands (3.15), and digging of well or borehole (2.85) were moderately utilized. Flood irrigation (1.88), furrow irrigation (2.31), sprinkler irrigation (1.51), drip or trickle irrigation (1.50), management of water shed (2.48) and drainage (2.26) were less utilized for water resource management in the *Fadama* system. The foregoing findings revealed generally poor water management practices by the farmers. Igbokwe (1996) reported that high labour intensity, time-consuming, regular inspection and the large amount of construction materials required in water management are some of the problems that discourage farmers from installing or maintaining water management practices. In addition, Junge *et al.* (2007) shared a similar report that soil and water management practices are less utilized by farmers due to some limiting factors such as high cost of installation and maintenance of management structures.

Vegetation Resource Management

The result of the mean ratings of the utilization of vegetation management practices by farmers is presented in Table 3. From the result, fallowing (2.52) was moderately utilized while reduced bush burning (1.67), afforestation (1.99), controlled logging (2.06), controlled hunting for balanced ecosystem (1.54), erosion control (2.09) and agroforestry practices (2.46) were less utilized for vegetation management by farmers under the *Fadama* system.

Challenges of Farmers in Fadama Resource Management

Table 4 presents the varimax-rotated factors of the challenges facing *Fadama* farmers in resource management. Only variables with factor loadings of 0.40 and above, were used in

naming the challenging factors. Variables that had factor loading of less than 0.40 and those that loaded in more than one factors were not used (Madukwe, 2004).

Table 3: Mean Ratings of the Farmers on Vegetation Management Practices Utilized in the *Fadama* System (N = 387)

SN	Vegetation Management Practices	$\bar{X}$	SD
1	Reduced bush burning	1.67*	1.04
2	Afforestation	1.99*	1.02
3	Fallowing	2.52**	0.75
4	Controlled logging	2.06*	0.89
5	Controlled hunting for balanced ecosystem	1.54*	1.06
6	Erosion control practices	2.09*	0.73
7	Agroforestry practices	2.46*	0.76

*Note: ** Moderately Utilized; * Less Utilized (LU)*
Source: Field Survey, 2015.

Table 4: Varimax Rotated Factors of Challenges Facing Farmers in *Fadama* Resource Management in the Study Area (N = 387)

S/N	Challenging Variables Against the Farmers in *Fadama* Resource Management	Institutional/ cultural Factor = 1	Cost Factor = 2	Input Factor = 3
1	Illiteracy of the farmers	0.309	0.385	0.137
2	Lack of extension visits to the farmers.	**0.537**	-0.209	0.203
3	Poor access to resource management information.	0.125	0.339	**0.440**
4	Tedious nature of resource management practices.	0.180	-0.224	0.341
5	Low financial capacity of the farmers.	0.038	**0.682**	0.313
6	Lack of access to supporting facilities	0.354	**0.437**	0.221
7	High cost of farm inputs for resource management	0.388	0.342	**-0.509**
8	Rough topography of the farm land	0.304	0.366	0.234
9	Poor control of farm land by most of the farmers.	**0.427**	0.095	0.272
10	Low level of farming experience.	0.179	**0.409**	0.356
11	Inadequate farm labour resource management.	0.281	0.142	**0.675**
12	**Continuous cultivation of the farm lands	**0.615**	0.129	**0.544**
13	Insufficient knowledge of credit source to support farming.	**0.614**	0.082	0.306
14	High cost of labour for resource management.	0.215	**0.466**	-0.238
15	Subsistence scale nature of production by farmers.	0.268	**0.570**	0.101
16	Inadequate institutional support from government	0.344	0.351	0.221
17	Lack of collateral security required to secure loan	**0.647**	0.328	0.088
18	Poor technical know-how of the *Fadama* farmers	0.357	0.351	**0.563**
19	Limited government responsiveness to resource management practices by farmers.	**0.448**	**0.520**	0.267
20	Lack of access to credit support groups, e.g cooperatives	0.178	**0.645**	0.209

Note: Factor loading of **0.40** is used at 10% overlapping variance.
Variables with factor loadings of less than **0.40** were not used.
**Variables that loaded in more than one factor were discarded

Source: **Field Survey, 2015.**

The communalities ranged between 0.415 and 0.743, which represented the squared multiple correlation between each of the variables and all other variables. The communalities are positive, indicating strong direct relationships among the observed variables. Each of the three factors in this study were named according to the set of variables or characteristics it was composed of. Three factors, socio-cultural, cost and input, were extracted based on the responses of the farmers.

Under institutional/cultural factor, the variables that loaded with their respective factor loadings included: lack of extension visits to the farmers (0.537), poor control of farmland by most of the farmers (0.427), insufficient knowledge of credit sources to support farming (0.614), lack of collateral security required to secure loans (0.647) and limited government responsiveness to resource management practices by farmers (0.448). Cost factor variables that loaded with their corresponding factor loadings included: low financial capacity of the farmers (0.682), lack of access to supporting facilities (0.437), low levels of farming experience (0.409), high costs of labour for resource management (0.466), subsistence scale of production by farmers (0.570) and lack of access to credit support groups such as cooperatives (0.645).

Oni (2015) found that high costs of fertilizers, land and other inputs constitute a part of the major challenges facing farmers in agroforestry tree planting for conservation. Enete (2003) also reported that financial institutions in developing countries do not usually lend to farmers, not only because farmers lack the basic collateral as a result of poverty, but also because farming is considered very risky. This constitutes a major challenge by making the farmers unable to bear the cost of farm inputs and operations.

The variables that loaded under input factor with their corresponding factor loading were: high costs of farm inputs for resource management (-0.509), inadequate farm labour resource management (0.675), poor technical know-how of the *Fadama* farmers (0.563) and poor access to resource management information (0.440). The findings of this study agreed with that of Amusa *et al*. (2011) who found that high costs of farm inputs and inadequate access to inputs constitute major challenges to farmers.

Conclusion and Recommendation

The Federal Government of Nigeria, in attempt to overcome the challenge of food shortage in the country, has developed several programmes such as ADP and *Fadama* programme among others. In order to achieve the laudable objective of self-sufficiency in food production through the *Fadama* system, resource (soil, water and vegetation) management practices under the *Fadama* system deserve proper attention.It was discovered, from thisstudy, that resource management practices utilized by the *Fadama* users in Nigeria's Federal Capital Territory (FCT) included: mulching, inorganic fertilizer application, multiple cropping, rain water harvesting and fallowing among others. Resource management practices not utilized by the *Fadama* users were: organic manure application, cover cropping, soil fallowing, soil liming, construction of bonds, construction of terraces, drainage, afforestation, controlled logging and agroforestry practices among others. The result of the factors analysis identified three challenging factors facing *Fadama* farmers in resource management which were institutional/cultural, cost and input factors. Based on these findings, the study recommends education and training of *Fadama* users for sustainability of *Fadama* resources (soil, water and vegetation) management.

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