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ASSESSMENT OF CASSAVA FARMERS FACTORS OF FARMLAND MANAGEMENT SUSTAINABILITY IN OYO STATE NIGERIA

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ABSTRACT

Various factors affect crop farmers' production capability in one way or the other which enhance or reduce farmers' potentials optimum levels of production sustainability. The study examined smallholder cassava farmers' farm specific and factors of farmland management sustainability in Oyo State Nigeria. Multistage sampling was used to collect primary data from three hundred and thirty farmers through well-structured questionnaire; data was analyzed using descriptive and tobit regression analysis. The result shows that 52.8% of the farmers sources of credit was through cooperative society, 35.5% source their farmland through inheritance, mean years of farming experience was 13 years, 66.1% used manual means of cultivation, 17.9% used mechanized irrigation, 30.6% harvested between 21-30 of cassava per hectare and 69.7% earned income between ₦101,000 and ₦500,000. The tobit regression revealed that the coefficient of farmers years of farming experience and farm size are positive and significant (p<0.05), farmers mean of cultivation was negatively signed and significant (p<0.05), organic manure application, fertilizer and pesticide application, organic matter presence in the soil, residue cover and farmers profit per hectare are significant (p<0.01) to *farmland management sustainability. The sigma pseudo R^2 was 0.7973, with the Chi^2 being significant (p<0.01) which shows that there is a possibility of increasing farmers sustainable farmland management with an increase in application of these variable indices. It was therefore concluded that farmer's combination of these variables and the sustainability effects will increase farmer's decision in the continuous usage of some certain farmland management practices in the study.*

Keywords: *Marginal Effect. Tobit, Sustainable, Farmland, Management, Oyo, Nigeria.*

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1. INTRODUCTION

Farmers have traditionally evolved their own soil conservation and farmland management strategies over time. Farmers have been able to sustain their produce for millennia by using these strategies (Heyi, 2012). The consequences of resource exploitation have become pervasive, and there is a rising understanding that productive lands are becoming scarce, that land resources are not infinite, and that the land that is presently in use requires greater care. As the world's population grows, other non-agricultural activities compete for land space, resulting in a progressive loss of area for food production. Simultaneously, demand for food and other agricultural goods is increasing, necessitating the use of more land, which is not available because the earth's land area is limited.

The implications are numerous; for example, extreme pressure on land will affect farmer management practices, resulting in a reduction of fallow periods of traditional shifting cultivation from as much as 10-15 years to less than 3 years, which may capture the extent of degradation the land may have suffered (Oloyede et al., 2014). Farming activities are exposing marginal regions such as slopes and gravelly soils that should normally be kept hidden. In the humid and sub-humid tropics, the conventional farming practice of shifting cultivation was acceptable many years ago in terms of soil conservation. Due to the low population, tiny plots of land were necessary for cultivation in order to achieve food production equilibrium (Is-haq, 2008). Presently, the population is increasing and this necessitates sustainable farmland management practices in other to enhance crop yield.

Given that these resources are the foundation of Nigerian agriculture's productivity and are essential to many rural and urban households' lives, management issues cannot be taken for granted (Oyekale, 2012). The understanding of the quality use and management interaction of land as well as socio-economic factors and farmers' attitudes towards land management is also a key indicator of the sustainability of the resource.

The soil's nutrients have also been seriously overused and depleted due to weak incentives for resource conservation, among other socioeconomic issues. However, studies which had been conducted by various authors such as Rahji (2005), Adeola (2010), Raufu and Adetunji (2012), Ikechukwu et al., (2013), Oladeebo et al., (2013), Adedokun and Ogunyemi (2013), Amao et al., (2013) Ademola and Olujide (2014) and Akinola et al., (2015) on land management, soil conservation, adoption, degradation, awareness and sustainable agricultural practices had not examined the issue of farm level indicators indices, hence necessitating this study with the following objectives which ate to: examine the farmers farm specifics and socioeconomics characteristics and factors of farmland management sustainability.

2. REVIEW OF LITERATURE

2.1 Factors of farmland Management

Land in Nigeria, similar to other places, faces a number of environmental issues, particularly those brought on by human activity, such as land destruction from agricultural practices unsuited to the climate, slope, and soil, extinction of animal and plant species from hunting, fishing, and habitat disturbance, and obstruction of forest regeneration from haphazard deforestation practices (Oyewo, 2018).

According to Bagigboye and Kuponiyi (2013), land management is a crucial component of all efforts made by stakeholders (such as local farmers, governments, and non-governmental organizations (NGO's)) to ensure the preservation of land and facilitate the restoration of the condition of the soil's nutrients. Specifically, to avoid soil being harmed, lost, or destroyed. This will improve effective land usage for beneficial purposes.

Nigerian farmers embarked upon various farming activities at farm level in other to keep up their farmland for long time use. Such farming activities include fertilizer application, addition of organic manure, mulching, land fallowing, pesticide, herbicides, vigour of crop growth and are known as farm indicator.

According to Aimee et al., (2009), indicators measuring farmer production practices (requiring means-based indicators like water use or nitrogen use) and emissions and wastes released into the environment (requiring effect-based indicators) are examples of indicators at various levels of the system related to environmental impacts.

Farming activities are now exposing marginal lands, such as slopes and gravelly soils, which under normal conditions should be left under cover. The traditional agricultural method in the humid and sub-humid tropics, shifting cultivation, was sufficient decades ago in terms of soil conservation. Due to the low population, farming on small plots of land was necessary to maintain equilibrium in the production of food (Is-haq, 2008). Presently, the population is increasing and this necessitates sustainable land management practices in other to enhance crop yield.

Actions to halt and reverse degradation, or at least to lessen the negative effects of earlier misuse, are becoming more and more crucial in uplands and watersheds, where resident population pressure is intense and where the destructive effects of upland degradation are felt "downstream" in regions that are much more densely populated.

According to a study by Kayode (2017), there are many variables that affect a farmer's propensity to apply certain conservation methods, including age, educational background, household size, and farm size. Despite the many benefits that land has for humanity, Maureen (2011) asserted that cultural, social, and socioeconomic factors contribute to the bias of policies regarding land access and tenure that favor one gender over another. In addition, Kayode (2013) noted that for agricultural expansion to reach its full potential and for both genders to play important roles in the agricultural sector, conservation and management techniques of natural resources, such as land, must be emphasized. Another important aspect of agricultural and land management practices is the manner in which farmers acquire land and the land management techniques they use, regardless of gender.

2.2 Soil Conservation

An essential resource for agricultural production systems is soil. In addition to serving as a medium for agricultural growth, it also serves to maintain environmental quality, provide for plants and animals, and preserve crop output. In order to ensure both cash and industrial crop output as well as food security, soil is also a fixed asset (Anjichi *et al*., 2007). A collection of management techniques known as soil conservation work to stop soil from washing away from the surface of the earth or from changing chemically due to overuse, salinization, acidification, or other chemical of soil contamination (Wikipedia, 2018). The Food and Agricultural Organization of the United Nations (2016) states that the production of cash crops for export is put in jeopardy due to diminishing soil productivity in the absence of effective soil conservation strategies.

Nigerian soils are known for their low productivity because of their poor ability to retain moisture and their lack of organic matter. Government and non-government organizations in Nigeria have widely disseminated a variety of soil conservation technologies to farmers. The Oyo State Agricultural

Development Programme (OYSADEP) and research organizations like the International Institute of Tropical Agriculture (IITA), Forestry Research Institute of Nigeria, and Institute of Agricultural Research and Training (IAR&T) have provided farmers in Oyo State with various methods for conserving soil and managing farmland. The development of multipurpose tree hedgerows, contour vegetative hedges of votives, minimal tillage, double cropping, the establishment of cover crops, the use of mineral fertilizers, and the planting of trees were a few of these strategies. Despite the use of participatory techniques to promote these measures, such as the creation of Small Plot Adoption Techniques (SPATs) and demonstration plots, adoption of soil conservation measures has not been particularly high (Adeola, 2010).

2.3 Agricultural Productivity

According to the statement, sustainable land management is thought to produce both private and public advantages, potentially leading to significant "win-win" solutions to problems including environmental difficulties, food insecurity, and poverty.

Privately, it can result in more production consistency, lower costs, and increased productivity for farmers. However, it can also significantly contribute to the production of public environmental goods including enhanced watersheds, the preservation of biodiversity, and climate change mitigation (Kebede *et al.*, 2017). Improving agricultural output while adhering to sustainable development principles is one method of tackling poverty and food insecurity.

3. METHODOLOGY

3.1 The Study Area

This research was conducted in Oyo State, Nigeria. The state is situated in the country's southwest. Oyo State is divided into thirty-three (33) local government units, which are divided into four (4) agricultural zones: Ibadan-Ibarapa, Oyo, Saki, and Ogbomoso Zones. Oyo State has a total land area of around 27,249,000 Km2 and a population of approximately 5.6 million people (National Population Commission, 2006). Oyo State's population currently stands at 7,840, 864 million, according to the most recent demographic projections given by the National Bureau of Statistics in 2017 (Oyewo *et al*., 2020). The state is located between Latitude 7o N and 19o N and Longitude 2.5oE and 5oE of the meridian and is bordered in the south by Ogun State, in the north by Kwara State, in the west by Ogun State and partly by the Republic of Benin, and in the east by Osun State.

The state is well-drained, with rivers flowing north-south from the uplands. The climate in Oyo State is tropical, with dry and wet seasons and generally high humidity. The dry season runs from November to March, whereas the wet season is from April to October. Almost all year, average daily temperatures range between 25 °C (77.0 °F) and 35 °C (95.0 °F). Oyo State's vegetation pattern is rainforest in the south and guinea savannah in the north. Crops such as maize, yam, cassava, millet, rice, plantain, cocoa tree, oil palm, and cashew thrive in the climate. The vast majority of residents are civil servants. (www.oyostate.gov.ng).

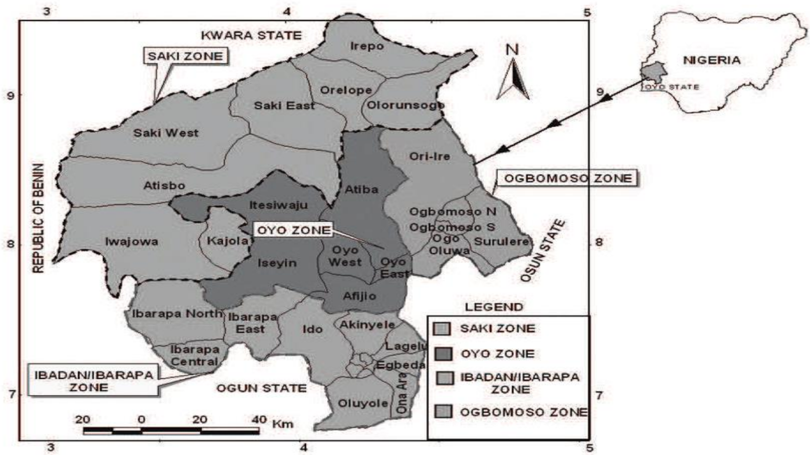

Figure 1. Map of Oyo State Showing Agricultural Zones

3.2 Sampling Technique and Sample Size

The study's population sample consists of registered cassava farmers from Oyo State's cassava growers' association from the four agricultural zones. 330 cassava farmers were interviewed using a multi-stage sample technique.

The four agricultural zones, namely Ibadan-Ibarapa, Oyo, Saki, and Ogbomoso, were purposefully chosen for the study due to their proximity and availability of cassava farmers. Ibadan-Ibarapa (14), Oyo (5), Ogbomoso (5), and Saki (9) villages were the agricultural zones. The first stage was the deliberate selection of two Local Government Areas, namely Ibarapa East and Egbeda from Ibadan-Ibarapa zone, Atiba and Itesiwaju from Oyo zone; Ogbomoso North and Ogo-oluwa from Ogbomoso zone; Atisbo and Iwajowa from Saki agricultural zone making a total of eight (8) Local Governments' Areas because they have the highest number of cassava farmers. Each Local Government Council area represents an agricultural block of the Agricultural Development programme (ADP). The next stage involved the selection of 60% of the population which was 348 cassava farmers out of 580 farmers from the study. The list of farmers in these areas was sought from the Federal Department of Agriculture (FDA) Moor Plantation Ibadan, Oyo State. The farmers for the study comprise of 83, 94, 71 and 99 from Saki, Oyo, Ogbomoso, Ibadan-Ibarapa agricultural zones respectively, making a total of 348 respondents. However, only a total number of 80, 90, 70 and 90 questionnaires were retrieved from each of the agricultural zones making three hundred and thirty (330) respondents to make the sample size of the population under study.

3.3 Data analysis

The objectives of the study were examined using descriptive statistics such as frequency, table means, percentage were employed to analyse the farmers farm specifics and tobit model was employed to analyse the factors of SFLM used

3.4 Tobit Model

Tobit model was employed to analyze the factors of farmland use management indices for cassava production in the study. This is because of the dependent variable's characteristics, because the variable of interest (FLMI) falls under the limited dependent variable and is characterize by both continuous positive values and zero values (discrete categorical variables and continuous categorical variables) which are regarded as a

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censored dependent variable. The model was selected based on Oloyede *et al*., (2014) and Agboola *et al*., (2015)

3.5 The Dependent Variable

Farmland management indices (SFLMI) that range from 0 and 1 were generated by the formula, $X_{ij} = (C-c_i)/(C-1)$ --------- (1)

Where $1 < c_i < C$ according to Oyekale (2012) using fuzzy logic analysis (fuzzy set theory).

3.6 The Independent Variables

These includes age of farmer (years), income (Naira), gender (dummy), farm size (hectares), farming experience (years), organic manure (index), fertilizer application (index), pesticide application (index), mode of cultivation (dummy), profit per hectare (actual value), educational level (dummy).

The model was stated as:

$$FLMIi = A + \beta i \sum_{j=1}^{14} Zi + \mu \ldots\ldots\ldots\ldots \text{(2)}$$

$$FLMIi = (\beta o + \beta 1Z1 + \beta 2Z2 + \beta 3Z3 + \beta 4Z4 + \beta 5Z5 \ldots\ldots + \beta 14Z14 + \mu) \ldots\ldots\ldots \text{(3)}$$

Where; FLMI = (Farmland management indices (index)).

Z_1= Age of farmers (in years)

Z_2 = Farmers experience (in years)

Z_3 = Income (₦)

Z_4 = Farm size (ha)

Z_5 = Manure application (index)

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Z_6 = Fertilizer application (index)

Z_7 = Continuous cropping (index)

Z_8 = Erosion runoff (dummy)

Z_9 = Pesticide application (index)

Z_{10} = Organic matter (index)

Z_{11} = Mode of cultivation (dummy)

Z_{12} = Educational level (dummy)

Z_{13} = Residue cover (index)

Z_{14} = Profit per hectare (actual)

μ = error term

β = coefficient

A= Constant

4. RESULTS AND DISCUSSION

4.1 Framers Farm Specific

Table 1 revealed that more over half (52.8%) of the farmers had access to financing through cooperatives, 3.9% through friends, 16.7% through personal saving while 2.1% was through government agencies this was not in line with findings of Akinola *et al*., (2015) that says majority of the farmer source their credit through personal savings. Thus, this implies that little amount can be realized from friends, so it might have a little effect on the production and farmers adoption of SFLM. This also supported by (Apatal *et al*., 2016). Cooperative association have the ability to give huge amounts of credit on a long- or short-term basis with little interest than friends or individual that will give small amounts. 1.8% of the farmers had access to the land through government, 3.0% through community, 26.1% rented / leased the land while 33.6% and 35.5% purchased and inherited their farm land respectively. This implies that farmers that have land right possess it through purchasing and inheritance which may allow the farmers to embark on long term farming activities and farmland management programmes and could enhance productivity with the available bundle of right to the farmer, this corresponds to the findings of (Oyewo *et al*., 2020). 3.9% of the farmers had 31 years or more of cassava farming experience, 38.2% had 11-20 years of cassava farming experience, and 49.1% had 1-10 years of agricultural methods experience. The average number of years of farming experience was 13.0. As a result, the vast majority of responders had extensive experience in cassava farming. which could assist the farmers in making good decision in the production process and improve farmers' ability to manage their farm land properly in order to maintain productivity, which is in consistent with the findings of Olarinde (2008) and Oladeebo *et al.* (2022). The Table further revealed that 82.1% of the farmers source their water through rainfall while 17.9% source their water through artificial irrigation. This implies that majority of the farmer practiced rain fed agriculture which is in line with expectation in the study area. 14.2% of the farmers' practiced mechanical technology for their mode of cultivation while majority 85.8% practice manual means of cultivation. Majority 83.9% of the farmers had farm sizes of less than 5.0 hectares, 14.6% had farm sizes between 5.1-10 hectares while

1.5% had between 10.1-15 hectares with mean farm size of 3.0 hectares. This means that the vast majority of farmers were engaged in small-scale farming. According to Dorward *et al*., (2005) and Okunade and Williams (2014) The size distribution of these holdings has been documented in the literature as small-scale farms ranging from 0.10 to 4.99 hectares, medium scale farms ranging from 5.0-9.99 hectares, and large-scale farms ranging from 10 hectares and upward. It was also discovered that 41.2% utilized 1-10 hectares of land and 42.8% used 11-20 hectares of land for 1-10 years and 11-20 years while 10.8% stayed on the same hectare of land for 21-30 years, with a mean of 13.9 years. This means that continuing to agriculture on the same piece of land may result in soil nutrient loss, deterioration, and low yield. It was further revealed that 8.2% of the farmer' had between N10,000 - N100,000 level of income while majority (69.7%) had between N101, 000 - N500, 000 levels of income and 4.5% of the respondent had income of N1000001 and above while average gross farm income was N486, 619.40k. This implies that cassava production was a lucrative agribusiness in the study but considering other inputs and duration of farming season, the income level may not inspire the farmer to implement a comprehensive agricultural management system, which may result in a bumper harvest and sustaining production because the farmers may not be able to plough back the credit available to them into the farming system due to other domestic activities. Though, this is at variance to the work of Ikechukwu and Nwakwo (2013) that increasing revenue will provide farmers with additional funds for possible adoption of farmland management measures and also conform to the statement of

Agboola *et al*., (2015) that large farmers earn more revenue, which gives a higher capital basis and improves risk-bearing ability; thus, farmer income is particularly important in influencing farmer decisions about field management practices. The table also shown that 7.4% of the cassava farmers produced between 31-40 tons of cassava, 22.7% of the farmer produced between 10-20 tons of cassava. 30.6% produced between 21-30 tons, 14.6% of the cassava farmers produced between 41-50 tons of cassava, 12.1% produced between 51-60 tons while 8.8% produced more than 61 tons and above. Mean of cassava output was 47 tons of cassava while mean farm size was 3.0. It can therefore be deduced that cassava farmers produced averagely 16 tons per hectares during the farming season which was more than the national average cassava yield / production of 12.8 tons per hectare. However, the farmer yield per hectare was below the expected value of 20 to 25 tons per hectare as targeted by the Nigerian Cassava Growers Association (NCGA). However, cassava production can reach up to 25-40 tons per hectare (FAO, 2018); if cassava farmers are trained and there is a proper adoption of good farmland management practices (ARC, 2014).

4.2 Tobit Regression analysis of the factors of farmland management sustainability

Table 2 presents the marginal effect of the factor of sustainable farmland management; it was revealed that farm size and farming experience with SFLM is favorably correlated ($p < 0.05$). This suggests that the likelihood of increasing SFLM with an increase in the amount of farmland use and farmers farming experience is high. This corroborate the findings of

(Yusuf *et al*., 2011; Oloyede *et al*., 2014 and Agboola *et al*., 2015), supported by Kebede *et al*., (2017) that farmers involvements in SFLM is determined by the number of land available for use and years of farming experience. Mode of cultivation have negative and significant relationship ($p<0.05$) with SFLM. This suggests that if farmers continue to cultivate using manual methods, there is a chance that sustainable land management may not be improved. This may be due to the practices of the farmer involving the use of manual method of cultivation that they are used to by not adopting the mechanical means of cultivation due to high cost of the farm implements in the study area. Fertilizer and pesticide application, organic manure, organic matter, residue cover and profit per hectare are significant ($p<0.01$) respectively. This suggests that while these have a positive association to SFLM, increasing any of these variables will raise the farmer's degree of sustainable land management techniques. These are in line with the conclusions reached by Saka *et al*., (2011), Olumba and Rahji (2014), and Agboola *et al*., (2015). It was also stated that there is a likelihood that SFLM will be improved as farmers' profit per hectare rises because farmer's gross farm income may inspire the farmer to run a comprehensive land management system, which may improve farmer's farmland sustainability, efficiency and productivity. This was at variance with the findings of Ogbonna *et al*., (2007), Ikechukwu and Nwakwo (2013) and also agreed with Akinnagbe and Nmukoro (2011) and Apan *et al*., 2017). That sustainable farmland management practices could be enhanced through the application of these variable factors in the study area

The sigma pseudo R^2 was 0.7973, and the Chi2 was significant ($p<0.01$). This shows that the model provided a satisfactory fit for the study when the sigma value and number of significant variables in the model application were considered.

5. CONCLUSIONS AND RECOMMENDATIONS

Years of farming experience, farm size, farmers mode of cultivation, organic matter, fertilizer application, pesticide application, organic manure, proper management of erosion runoff, residue cover and profit per hectare are the major factors of farmland management (FLM). Farmers socioeconomic and farm specific factors significantly determine sustainable farmland management practices which in variably affect crop output. Majority of the farmers depends on personal savings cooperative society for their source of credit; this may not allow the farmers to adopt mechanized farming implements and other smart agricultural activities which may enhance efficiency and productivity. Majority of the farmers were unable to utilize mechanical means of cultivation and also. Less than half of the farmers operates mechanized means of irrigation in the study

In terms of recommendation there should be more support and encouragement for the farmers to maintain and improve on their level of farmland management at the current level of operations. Support should be given to this farmer through the availability of formal credits, smart agricultural implements at subsidized rate and policies on agricultural sustainability should be implemented by the governments at all levels.

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Table 1. Framers Farm Specific

Variables	n=330 Frequency	Percentage	Mean
Source of Credit			
Friend	13	3.9	
Family	11	3.3	
Government	7	2.1	
Loan	70	21.2	
Cooperative	174	52.8	
Personal Saving	55	16.7	
Source of farmland			
Inheritance	117	35.5	
Purchase	111	33.6	
Rent / Lease	86	26.1	
Community	10	3.0	
Government	6	1.8	
Years of farming experience			
1- 10	162	49.1	
11- 20	126	38.2	
21- 30	29	8.8	
31and above	13	3.9	13.0
Source of irrigation			
Artificial irrigation	59	17.9	
Rainfall	271	82.1	
Means of cultivation			
Manual	218	66.1	
Mechanical Technology	112	33.9	
Farm size (hectares)			
0.5-5.0	277	83.9	
5.1-10	48	14.6	
10.1-15	5	1.5	3.0
Farmland (years)			
1-10	136	41.2	
11-20	141	42.8	
21-30	42	12.7	
31 and above	11	3.3	14.1
Farm income (Naira)			
10000-100000	27	8.2	
101000-500000	230	69.7	
501000-1000000	58	17.6	
1000001 and above	15	4.5	486619.4
Output (tons)			
10-20	75	22.7	
21-30	101	30.6	
31-40	37	7.4	
41-50	48	14.6	
51-60	40	12.1	
61 and above	29	8.8	47.0

Source: Authors Field Survey

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Table 2. Tobit Analysis of the factors of farmland management sustainability in Oyo State

Variables	Coeff	dy/dx	Std error	T-stat
Constant	0.2481		0.1561	1.59
Z_1 = Age of farmers	-0.0016	-0.0016	0.0004	-0.37
Z_2 = Experience in farming	0.0014**	0.0014**	0.0006	2.43
Z_3 = Income	-0.0310	-0.0310	0.0280	-0.78
Z_4 = Size of farm	0.0086**	0.0086**	0.0032	2.69
Z_5 = Manure	0.0273***	0.0273***	0.0096	2.83
Z_6 = Fertilizer application	0.0750***	0.0750***	0.0138	5.43
Z_7 = Continuous cropping	-0.0069	-0.0069	0.0104	-0.66
Z_8 = Erosion runoff	0.0796***	0.0796***	0.0136	5.87
Z_9 = Pesticide application	0.0463***	0.0463***	0.0093	4.77
Z_{10} = Organic matter	0.0870***	0.0870***	0.0119	7.33
Z_{11} = Cultivation mode	-0.0251**	-0.0251**	0.0104	-2.41
Z_{12} = Education	-0.0031	0.0031	0.0054	-0.58
Z_{13} = Residue cover	0.0703***	0.0703***	0.0139	5.08
Z_{14} = Profit per hectare	0.1749***	0.1749***	0.0205	8.54
Sigma	0.7973			
Chi^2 (14)	289.25***			

Source: Authors Analysis.

(*) implies, p<0.10; (**) implies, p<0.05; (***) implies p<0.01.