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Smallholder Farmers' Adoption Decision-making Regarding Soil Erosion Control on Food Security in South Africa

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ABSTRACT

Background: The objective of this paper was to evaluate how smallholder farmers' adoption decision-making regarding the control of soil erosion influence food security in South Africa, using the case of farming at Upper and Lower Areas of Didimana, South Africa.

Methods: A cross-sectional survey was conducted on 60 randomly selected farmers. Farmers' total income was used as a proxy for food security. Data were analysed using the multiple linear regression analysis, because the dependent variable was continuous.

Result: As expected, farmers who had increases in quality of produce had higher probabilities for increased total income. Also, farmers who preferred their traditional erosion-control methods as against extension-recommended, had higher potentials for increased overall income, which was unexpected. Further, farmers whose sustainability was impacted the most by soil erosion had lesser probabilities for increases in their overall income. The conclusion is that the adoption of soil erosion-control measures is significant in increasing farmers' food security potentials in the study area.

Key words: Adoption decision-making, Food security, Smallholder farmers, Soil erosion, Soil erosion control methods.

INTRODUCTION

Accelerated soil erosion, which is the focus of this study, is the erosion type caused by human activities. Although it is an age-long problem, it however remains relevant even for the coming years, especially due to human continued requirements for food and survival on land. Studies reveal that close to 75 billion tons of soil is lost from land every year, which is an equivalent of 13-40 times faster than the natural rate of erosion (Libin *et al*., 2019; Pimentel, 2006). In support, Venkatesan and Dhanasekararan (2019) maintain that the ability of arable land to meet the demand of the ever increasing population is on a decline due to severe soil degradation. Based on several studies, Weldu *et al.* (2017) argue that soil loss by water erosion alone is positively highly related with on- and off-site erosion effects, such as land and water quality degradation, soil organic carbon emission, decrease in agricultural productivity and impacts on biodiversity and ecosystem.

In sub-Saharan Africa (SSA), soils are said to be wearing away at an annual rates of 22 kg/ ha for nitrogen, 2.5 kg/ ha for phosphorus and 15 kg/ ha for potassium (Ajayi *et al*., 2007). Overall, about 65% of land meant for agricultural production is degraded in SSA (Lal, 2019). According to Lal (2015), general occurrence of degraded soils in SSA is caused by factors such as over exploitation, extractive farming, low external inputs and improper soil management. In South Africa as a whole, soil erosion is a serious worry, with a projected 12.6 tons of annual loss of top soil (Le Roux and Hendrik, 2014). According to Kumar and Ramachandra (2003), annual loss of top soil in South Africa is up to about 300-400 million tons. Results of previous research indicated, that over 70% of the land surface of South Africa has been affected by varying degrees and types of soil erosion (Le Roux *et al*., 2007). In relation to cultivated areas, LADA (Land Degradation Assessment in Drylands)-2010 results suggest that 32.7% of cultivated lands in the entire nation of South Africa are moderately to very severely degraded (Von Maltitz *et al.,* 2019). Areas of most impact are the former homeland areas, where the majority of smallholder farmers reside (Lahiff and Cousins, 2005; Rootman *et al*., 2015). These areas are generally characterized with soil degradation and poverty, which are offshoots from apartheid policies. For example, the Eastern Cape, where this study was conducted (a former homeland area), is regarded as one of the three provinces with the most degraded soil (Department of Environmental Affairs [RSA], 2011) and characterised by high levels of poverty in South Africa (Statistics South Africa, 2017) and food insecurity.

The term food security is broad and means different things to different people and organizations (Department of Agriculture, Forestry and Fisheries [DAFF], 2011). According

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to the World Food Summit (1996), "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Based on this definition, four dimensions are obvious: food availability, related to quantity; food access, related to resources to purchase food; food stability, also related to the sustainability aspect of food; and food utilization, related to the quality aspect of food security. Soil erosion impacts on food security indirectly, impacting first on the functional abilities of the soil, causing productivity loses of various kinds, thus leading to food insecurity. According to Sartori *et al.* (2019), soil erosion is a huge problem to agricultural soil productivity. The agricultural productivity loss resulting from soil erosion in the European Union is projected at about €300 million (Panagos *et al*., 2018), while a similar projection of yearly crop yield loses in the African continent is about 280 million tonnes (Wolka *et al*., 2018). In a study, titled 'FAO calls for actions to reduce global soil erosion' by Panagos *et al*. (2019), it was stated that soil erosion represents the most global challenge to soil functions, putting food security at great risk.

The adoption of soil erosion control methods by smallholder farmers is imperative for food security for a number of reasons. Firstly, the global population is high and continues to do so. Annually, 79.3 million people (according to Engelman, 2010) and 83 million (according to the World Economic Forum, 2017) are added to world population and these figures have been consistent for about a decade (Engelman, 2010). This indicates a growing need for an increased food production, which agriculture supplies. With this level of growth, food production must increase by 70 percent to be able to feed the population of the world (DAFF, 2011).

The second reason is the huge number of population in developing countries which depend on agriculture for survival. Approximately 60-70% (and close to 85% in Ethiopia, as reported by Düvel *et al.,* 2003 and Weldu *et al*., 2017) of rural farmers in developing countries, especially in sub-Saharan Africa, depend largely on agriculture as their main source of livelihood (Alliance for a Green Revolution in Africa [AGRA], 2017). In the face of these, the daunting reality is that within the next 50 years, if no strong adaptive measures are taken, climate change impact will decrease food crop yields by about 16% (25% according to Voegele and Roome, 2016) globally and 28% in Africa (DAFF, 2011). Another very important reason why adopting soil erosion/ degradation control measures is non-negotiable is the high risk associated with agriculture as against other livelihood measures, especially that relating to climate change and variability. According to Kašparová *et al.* (2019), the adoption of better ways of farming is imperative to minimize risk, productivity and water-use efficiency increases, soil health sustainability, as well as income increase for farmers.

However, the major challenge facing smooth agricultural development today may not be whether or not there are improved technologies for sustainability, but more related to the adoption behaviours by farmers, especially smallholders. This is alluded to by several literatures. For example, Düvel (1991) posits that the major problem agricultural development has to grapple with is not merely related to the invention of new technologies or new ways of doing things, but ultimately that of two types: (1) non-adoption or (2) inappropriate adoption of certain recommended practices. The adoption decision-making behaviour of farmers therefore is one of the most important factors influencing the spread or dissemination of innovations in agriculture (Toborn, 2011). In Southern Africa, it is revealed that despite the potential of renewable soil fertility replenishment (RSFR) technologies in the region, the adoption and spread among smallholder farmers has generally lagged behind scientific and technological advances, thereby reducing their impact (Ajayi *et al*., 2007).

Understanding farmers' behaviours therefore is said to be central to enhancing the capacity of farmers to adapt and promote sustainable agriculture (Feola *et al.,* 2015). This is why this study is relevant. It seeks to evaluate how smallholder farmers' adoption decision-making regarding the use of soil erosion control methods affects food security, using the farming situation of Upper and Lower Areas of Didimana, Eastern Cape, South Africa as a case study. The main hypothesis of the study is that there is no significant relationship between smallholder farmers' adoption decision-making regarding the control of soil erosion and food security in the study area. The objectives of the study are to: a). assess smallholder farmers' perception on the severity of soil erosion impact in their area; b). assess smallholder farmers' perception on food security level in their area and c). evaluate the influence of smallholder farmers' adoption decision-making regarding soil erosion control on food security in their area.

MATERIALS AND METHODS

Study area

This study was conducted in Upper and Lower Areas of Didimana. Upper and Lower Areas of Didimana is located in Tsolwana local municipality, Chris Hani District Municipality, Eastern Cape Province of South Africa. The area is positioned on latitude 32°06′00″S and longitude 26°34'59"E, consisting of three villages: Upper Didimana, Lower Didimana and Romanslaagte respectively, all located in ward three of the local municipality. The socioeconomic situation of the study area consists of about 53% poverty, high unemployment levels and livestock farming is an important income source for people in the area (Chris Hani district Municipality, 2012-2017). Climate and vegetation condition of the area varies from arid to very cold high veldt and falls mainly into two climatic zones: the arid and semi-arid moderate midlands and arid and semi-arid cold high lying land; with a mean annual precipitation of between 301-600 mm; average maximum temperature is 22.3°C and average minimum is up to 8.9°C respectively.

Data collection, study design and data analysis

Adopting the cross-sectional research design, through a random sampling procedure, primary data were gathered in a one-on-one data collection process. In this process, enumerators who were first trained on the objectives of the study interviewed smallholder farmers in the study area and information from 60 participants form the basis of discussion and recommendations. Basic information collected in the study area were demographic and socioeconomic characteristics, like age, gender, marital status, education status; variables on farmers' perception on soil erosion impact; as well as farmers' perception on food security variables such as yield of farmland, product quality, soil erosion impact on sustainability, percentage of crops sold for profit. Data were captured and analysed with the SPSS (statistical package for the social sciences) software version 25. Specific analyses of data were with basic descriptive statistics, while empirical results were modelled using the multiple linear regression, because the dependent variable was continuous in nature.

Model specification: multiple linear regression analysis

According to Laerd Statistics (2018), multiple (linear) regression analysis is used when there is a need to predict the value of a variable (regarded as the criterion or dependent variable) based on the value of two or more other variables (regarded as the independent or explanatory variables). Multiple regression analysis models are specified as follows:

$$y=\alpha + \beta X + \varepsilon \quad \ldots\ldots (1)$$

Where

y= Dependent variable (overall income of farmers)

X= Exogenous input data of food security

α= Intercept of y

β= Partial regression coefficient

α and β= Parameters to be estimated

ε = The stochastic error term

$$Y= \alpha + \beta 1AGE + \beta 2EDU + \beta 3MAR + \beta 4GEND + \beta 5YIELD + \beta 6QUAL + \beta 7SUST + \beta 8EXADV + \beta 9TREXT + \beta 10SECRPL + \beta 11FARMS + \beta 12CRPR \quad \ldots\ldots (2)$$

Variables' explanations: independent and dependent variables

Variables' explanations- dependent variable

The dependent variable (y) of this study is the food security status of smallholder farmers. Based on this study, effort is geared towards understanding food security from the angle of how much access farmers have to food in their area. Therefore, their overall/total income was used as a proxy for food security measurement, which is quantitative. Carletto *et al*. (2013) emphasize variations of food security measurement indicators in the literature: some are quantitative, others however are qualitative, based on perception and self-assessment. Following this, farmers' overall income was calculated by summing up all incomes received by a farmer in the year. As such, overall income was divided into three aspects. The first was incomes from non-agricultural sources (INCOFF). These related to all incomes not related to agriculture. Examples were social welfare grants, private businesses and remittances. The second was incomes from livestock production (INCLIVE), while the third was incomes from crops (INCCROPS). Table 1 and 2 provide clear pictures of all variables used in the study.

RESULTS AND DISCUSSION

Farmers' perception on soil erosion severity and food security in the study area

Meijer *et al*. (2015) define perception as farmers' views regarding any new technology based on their felt needs and previous or past experiences. According to literature evidences (Alemu *et al*. 2019; Bopp *et al*. 2019), perception plays prominent roles in technology adoption processes. In this regard, farmers' perception regarding the severity of soil erosion, measured on various areas of their livelihoods, was censored. This is because the type of perception (positive or negative) a farmer has on prevailing soil erosion situation determines whether the farmer will adopt any kind of control measure. Ighodaro and Mushunje (2017) posit that positive perception usually increases chances for technology adoption. According to Table 3, farmers' perception on the impact of soil erosion on various aspects of their agricultural and food security levels: farm enterprise, amount of food available to the home and number of families who are food self-sufficient are in the order of 81 percent, 62 percent and 67 percent respectively. The indication is that farmers' perception is positive, as it reflects a high level of soil erosion impact in the area, which according to literature is expected to motivate farmers toward the adoption of soil erosion control methods for improved food security in the study area (Ervin and Ervin, 1982; Asafu-Adjaye, 2008).

Similarly, farmers were also interviewed based on their perception regarding various aspects of their food security characteristics. These include household food produced by the farmer, community members who always have enough food for their families and food security level of the farmer. According to findings (Table 4), almost half (49%) of the population of farmers said they produce less than 41 percent of their household food, which may indicate the subsistence nature of agricultural production in the area. A reasonable large percentage (45%) said very few families always have enough food for their homes, which suggests some levels of food insecurity. To buttress further, farmers were interviewed on how food secured they are. As findings indicate (Table 4), only 13 percent of farmers' population said they are food secured.

Based on the foregoing, farmers' perception on the impact of soil erosion on various aspects of their livelihoods and food security is positively high, while their perception regarding the level of food security is low. This is actually the result of uncontrolled erosion in any area: eventual

Table 1: Study variables, measurement and a priori expectations.

S/N	Variables	Description	Measurement	A priori expectation
	Dependent			
Y_i	INCTOTAL	Total income (food security)	INCCROPS+INCLIVE+INCOFF	
	Independent			
X_1	AGE	Age of farmers	Years	+/-
X_2	EDU	Education of farmers	Years	+
X_3	MAR	Marital status	1= Married; 2= Others	+
X_4	GEND	Gender	1= Male; 2= Female	+/-
X_5	YIELD	Satisfaction with crop yield	1= Totally dissatisfied; 2= A little dissatisfied; 3= Moderately satisfied; 4= Satisfied; 5= Highly satisfied	+
X_6	QUAL	Level of satisfaction with quality of produce	1= Totally dissatisfied; 2= A little dissatisfied; 3= Moderately satisfied; 4= Satisfied; 5= Highly satisfied	+
X_7	SUST	Sustainability after erosion	1= Very severe; 2= Severe; 3= Moderately severe; 4= A little severe; 5= Not limiting at all	-
X_8	EXADV	Extension advise	1= Ineffective; 2= Limited in effective; 3= Moderately effective; 4= Effective; 5= Very effective	+
X_9	TREXT	Traditional method of erosion control against extension recommendations	1= Ineffective; 2= Less effective; 3= Moderately effective; 4= Effective; 5= Very effective	+/-
X_{10}	SECRPL	Erosion impact on crop planning decisions	1= Changes in planting sequence; 2= Degradation problems; 3= Poor crop yield/quality; 4= Increase in production cost; 5= Others	-
X_{11}	FARMS	Farm size	Hectares	+
X_{12}	CRPR	% of crops sold for profit	Percentages	+

Table 2: Overview of independent variables of study.

Variables	Code	Descriptive results
Age	AGE	Average age (57years); Youth (15%)
Education	EDU	>Grade 12 (5%); ≤Grade 12 (95%)
Marital status	MAR	Married farmers (60%); Others (40%)
Gender	GEND	53% (male); 47% (female)
Yield	YIELD	Moderate/satisfaction with yield (66.6%); Others (33.4%)
Produce quality	QUAL	Moderate/satisfaction with produce quality (68.3%); Others (31.7%)
Sustainability (after erosion)	SUST	Severe impact (53%); Others (47%)
Extension advises	EXADV	Ineffective/limited in effect (58.3%); Others (41.7%)
Traditional versus recommended practices for erosion control	TREXT	Traditional is more effective (53%); Traditional is moderately effective (17%); Traditional is less effective (30%)
Erosion impact on crop planning decisions	SECRPL	High/low impacts (76.7%); Others (23.3%)
Farming experience	EXP	<10 years of farming; ≥10 years of farming
Farm size	FARMS	<2ha (73%); ≥2ha (27%)
% of crops sold for profit	CRPR	53% of farmers (sold 0% of crops); Others (47% of crops)

reduction in food security and livelihoods measures. For instance, in the European Union, the problem due to erosion was said to be one of the environmental agenda in the union because of how soil erosion negatively affects food production, quality of drinking water, ecosystem services, mud floods, eutrophication, biodiversity and carbon stock shrinkage (Panagos *et al*., 2015).

Farmers' adoption decision-making on soil erosion control methods and food security in the study area

Checking for multi-collinearity among variables is a necessary assumption in implementing a regression analysis. Based on this, a correlation matrix of all explanatory variables adopted for the study was executed. This is presented in Table 5. As partially expected, age (AGE)

related fairly positively (r=.333) with farm yield (YIELD), indicating that older farmers have more potentials for increases in the yield of their farms in the study area. Also marriage (MAR) related fairly negatively (r= -.323) with sustainability (after soil erosion) (SUST), indicating that farmers who are married have less probability to be sustainable after the impact of soil erosion, which was expected. Similarly, crop planning of farmers related fairly negatively (r=-.304) with sustainability (after soil erosion), indicating also that farmers whose crop planning decisions are impacted highly by soil erosion are also those who are less sustainable, which was as also expected. Further, farm size (FARMS) related fairly positively (r=.320) with extension advise (EXTAD), suggesting that farmers who adhered to extension advises are those who had potentials for large farm sizes. Apart from these, the correlation coefficients of almost all the other variables of the study are minimal, with the absolute zero of the majority falling below 0.2, suggesting that the problem of multi-collinearity is not serious among variables of the study.

In order to implement the model of analysis, twelve input variables were regressed against the food security measure (overall income: dependent variable y) of smallholder farmers in the study area. At significance levels of $p<0.01$ and $p<0.05$% respectively, three of the variables were significant. These are produce quality (QUAL), traditional versus extension methods for erosion control (TRAEXT) and farmers' sustainability (SUST), respectively. Results are as presented in Table 6. According to results, QUAL relates positively with overall income (INCTOTAL) of farmers at $p<0.01$ significance level. The indication is, that farmers with increase in produce quality have a higher probability for increases in their total incomes, thus increasing their chances for food security, which was expected. This is because, income is a major resource that guarantees access to food security. This is consistent with Tarasuk (2017), in a study titled 'implications of a basic income guarantee for household food insecurity. In this regard, households were regarded food secure on the basis that they had no income-related problem when it comes to their access to food.

Table 3: Farmers' perception on soil erosion severity in study area.

Impact of soil erosion on:			
Scales	Agric. Enterprise (%)	Household foods (%)	Food self-sufficient families (%)
Insignificant	8	15	7
fA little significant	5	13	10
Significant	15	30	42
Much significant	20	32	23
Very much significant	52	10	18
Total	100	100	100
Average scores	81%	62%	67%

Source: Fieldwork, 2012.

Table 4: Farmers' perception on food security in the study area.

Certain food security characteristics of study area			
Household food produced by farmers		Always have enough food for their families	Food security level of the farmer
Food produced (%)	Responses (%)		
<20	27	None (7%)	Food insecure (7%)
20-40	22	Very few (45%)	A little food secure (35%)
41-60	22	About half (23%)	Moderately (45%)
61-80	13	More than half (20%)	Food secure (10%)
>80	17	All the people (5%)	Very food secure (3%)

Table 5: Correlation matrix of erosion control variables in the study area.

	YIELD	MAR	SECRPL	FARMS	AGE	TRAEXT	SUST	EXTAD	QUAL
YIELD	1.000								
MAR	.178	1.000							
SECRPL	-.087	.042	1.000						
FARMS	-.159	-.104	-.088	1.000					
AGE	.333	.079	-.030	.149	1.000				
TRAEXT	.080	.194	-.180	.214	-.029	1.000			
SUST	.058	-.323	-.304	.085	-.004	.139	1.000		
EXTAD	-.215	-.285	-.204	.320	-.242	.178	.175	1.000	
QUAL	-.475	-.015	-.062	.039	-.181	.168	-.272	.043	1.000

NOTE: CRPR= % of crops sold for profit; GEND= Gender; EDU= Education; MAR= Marital status; SECRPL= Erosion impact on crop planning decisions; QUAL= Quality of produce; AGE= Age; TREXT= Traditional method versus erosion control methods; EXTAD= Extension advise; SUST= Sustainability; FARMS= Farm size; YIELD= Productivity of farm land.

Table 6: Regression estimates for influence of farmer' adoption on food security.

	Unstandardized coefficients			Collinearity statistic	
	B	T	Sig.	Tolerance	VIF
AGE	107.155	1.686	.098	.779	1.284
MAR	1310.053	1.395	.170	.731	1.368
FARMS	8.722	1.258	.214	.777	1.286
SECRPL	637.642	1.439	.157	.817	1.224
QUAL	2270.396	2.534	.015***	.611	1.636
TRAEXT	1387.781	1.970	.055**	.744	1.344
EXTADV	- 323.460	-.475	.637	.702	1.425
SUST	- 1853.746	-2.682	.010***	.673	1.487
YIELD	- 1139.173	-1.427	.160	.603	1.658
CONSTANT	- 160.451	-.026	.979		
R2	.326				
Adjusted R2	.197				
Overall Sig.	.019				

Note: *= 10%; **= 5%; and ***= 1% levels of significance.

The role of agricultural extension in technology adoption and food security cannot be overemphasized. Oladele and Tekena (2010) maintain that agricultural extension is the catalyst for the development of agricultural and rural areas, as it brings information and new technologies to farming communities that when adopted improves production, incomes and living standards of people. In fact, the effect of extension in the adoption process, was found to be positively significant (Adewole, 2010), showing the role of extension in improving farmers' production for increased food security. In a study conducted in KwaZulu-Natal Province of South Africa, Baiyegunhi *et al*. (2019) found that participation in extension programme had a positive impact in improving farmers' net income. A similar finding from a study conducted in four districts of Zimbabwe, as well found a positive relationship between extension systems and the adoption of new, improved and/or useful farming technologies (Makate and Makate, 2019) for improved food security. However, based on findings of this study, the reverse is the case, as farmers rather preferred their traditional practices for erosion control instead of recommendations by extension officers. A finding like this however may not be too surprising. This is because, in researches, situational factors sometimes prevail on findings, thereby creating unexpected observable differences as we move from one location to another.

Possible reasons that may be ascribed for findings above may be, firstly that relating to the particular stage of the innovation diffusion process farmers in the study area are usually, according to Rogers (1983), many farmers at the early stage of technology spread are more conserved and less open to new technologies. They only begin to change their minds as they observe the effect of the new technology in the lives, family and farms of the early adopters of such technologies. A second reason also could be the manner the new technology was presented by extension officers. Perhaps the communication strategy used was not convincing enough. Farmers who for one reason or the other rate their own practices of higher prominence than those of extension officers usually prefer their own practices to extension recommendations (Rogers, 1983; Düvel, 1991). A third reason could as well be the problem where development agents, whether consciously or unconsciously, think and take farmers just as clients or customers that need to be served only, as such, ignoring farmers' experiences and indigenous knowledge. New approaches of agricultural development take farmers as partners in the course of technology creation. Franzel (2001) maintains that, researchers in the tropics are progressively acknowledging the need to take farmers as partners in the process of developing new technologies.

Furthermore, empirical results show a negative significant relationship between SUST and overall income at $p<0.01$ significance level. The suggestion is that farmers who suffer from the problem of unsustainable farming due to soil erosion impact on their farms have a lesser probability for income and thus more vulnerable to food insecurity, which is congruent with literature. This is why uncontrolled soil erosion is detrimental, not just to farmers only, but also to the generality of society where farmers live. According to a study conducted to determine the economic impact of soil erosion in a corn to soybean rotation farm in Iowa, findings suggest that the effect of soil loss was quite significant and can contribute to a huge loss in revenue by farmers (Glindinning, 2016). In the same study, actual estimates put yield loss in corn to the tune of $4.3 million in the first year, soybean $2.75 million, total yield loss for both crops as $7 million; while estimates measured over a ten-year period, indicate yield loss could rise up to a staggering amount of $315 million (Glindinning, 2016).

CONCLUSION AND IMPLICATIONS FOR AGRICULTURAL EXTENSION

As world population increases to nine billion by 2050, agriculture has been recognized as the only hope to feed

the world. In most developing countries, especially sub-Saharan Africa, including South Africa, smallholder farmers constitute the largest proportion of population in rural areas, whose livelihoods revolve largely around agriculture. Agriculture therefore is a vital element in the development life-cycle of rural people and their areas. Uncontrolled soil erosion, does not only put food security measures at risk, but the overall global sustainability agenda. Hence, efforts aimed at mitigating soil erosion should be thought essential. According to findings of this paper, farmers' perceptions regarding the impact of soil erosion and levels of food insecurity in their area are both high, suggesting a positive understanding of the relationship between soil erosion and food security in the area. From empirical findings, quality of produce related positively with food security, suggesting that any improvement of produce quality has the potential for increased food security, through the adoption of soil erosion control measures in the study area, which was expected. Similarly, there was a positive relationship between traditional methods of soil erosion control measured against extension recommendations (TRAEXT) and food security. Any increase in farmers' preference for their own practices as against extension recommendation, caused an increase of farmers' overall income, which was unexpected. Further, farmers' sustainability after soil erosion impact (SUST) related negatively with food security of study area. The suggestion is that farmers whose ability to be sustainable is affected more by soil erosion have less potentials for total income, thus making them more vulnerable to food insecurity, which was expected.

The recommendation therefore is, that all factors that could improve produce quality in the study area should be eagerly pursued by the government and all agencies for agricultural development in the area. This could begin from ensuring all farm inputs, such as quality seedlings, requisite fertilizers, extension services, *etc*., are readily made available to farmers, at the right time and at affordable prices. Also, since many farmers prefer their own soil erosion control measures as against extension recommendations, governments should increase efforts at the early stage of technology intervention, so the time for technologies to impact on early adopters could be shortened, in order that others may be convinced easily about such technologies. Also, extension officers should ensure that communication strategies chosen to communicate new technologies are well convincing. More so, agricultural intervention agencies must as a matter of urgency take farmers as partners in the process of technology development and spread and not as customers and clients. Finally, adequate education and training on various soil conservation/ erosion control measures should be made available to extension officers and farmers, so they can develop skills to identify soil erosion factors early in the farm and to know what to do to mitigate them before they become very damaging.

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