*Asian Journal of Agricultural Extension, Economics & Sociology*

***38(10): 111-122, 2020; Article no.AJAEES.51902***
***ISSN: 2320-7027***

# Perception of Farmers' on Soil Fertility Problems and Replenishment Technologies in the North Rift Region of Kenya

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author MAO coordinated the study and performed the statistical analysis, managed the literature searches and wrote the first draft of the manuscript. Authors ES and CO were involved in design of the study and interpretation of data. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/AJAEES/2020/v38i1030437
Editor(s):
(1) Kamarulzaman Ab. Aziz, Director, Entrepreneur Development Centre, Multimedia University, Malaysia.
(2) Dr. Tulus T. H. Tambunan, University of Trisakti, Indonesia.
Reviewers:
(1) John Walsh, RMIT, Vietnam.
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(3) Ranjit Sambhaji Patil, Lokmangal College of Agriculture, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/51902

***Review Article***

***Received 20 May 2020***
***Accepted 26 July 2020***
***Published 06 November 2020***

## ABSTRACT

This paper investigates the farmers' perception on soil fertility replenishment technologies in the North Rift Region of Kenya. A survey was conducted in Trans Nzoia and Uasin Gishu counties of the North Rift Region of Kenya. A total of 108 respondents were interviewed. A two stage random sampling technique was employed in the study. In the first stage, farmer groups growing maize as the main crop were selected. The second stage involved the selection of farmers who were practicing cereal banking for ease of marketing of their produce. A survey and field demonstration plots were adopted. On-farm demonstration were carried out and used to ascertain the farmers' perception towards the technologies. A structured questionnaire was administered to them to elicit

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information on their perception on soil fertility replenishment technologies (SFRT). Descriptive statistics and the multiple regression analysis was done using a Statistical Package for Social Sciences (SPSS). The results revealed that farmers perceived that technologies could be used to address the declining soil fertility. The inputs were affordable available, the Ministry of Agriculture, Livestock and Fisheries (MOALF) was effective in disseminating the technologies and that the technologies could work on any farm at mean score of 3.5, 4.1, 4.0, 3.4 and 4.6 out of 5.0 respectively. Farmers in Trans Nzoia county identified lack of capital (70.4%) compared to Uasin Gishu (39.9%) as the greatest challenge in the adoption of SFRT technologies. Credit schemes that offer loans with low interest rates should be established to enable farmers have access to credit.

*Keywords: Farmers perception; SFRT; Likert scale.*

## 1. INTRODUCTION

Most of Sub- Saharan Africa (SSA) countries are extremely dependent on agricultural production [1,2]. However, Continuous cropping, removal of field crop residues for feeding livestock and overgrazing between cropping seasons with little or no external inputs, have reduced the productive capacity of arable lands and threatens the sustainability of food production systems in the sub Saharan Africa, Kenya included [3]. Increasing land productivity and being able to contribute to profitable agriculture requires among other things, addressing the major biophysical factors on land through technologies on soil enhancement, prevention of nutrient loss, and conserving available nutrients either individually or in technology combinations.

Soil fertility degradation is one of the major problems facing maize productivity in Kenya. It is defined by [4] as the loss of soil physical and nutritional qualities. It has been an issue of concern throughout the sub-Saharan Africa (SSA), and cuts across many different soils and crops [5]. The concern for soil nutrient depletion and low soil fertility has led to the development of several soils fertility management technologies (SFMTs) by a number of national and international research institutions [5]. However, these technologies have not been adopted to any appreciable extent by farmers.

There are several factors that influence the uptake of technological innovation, one of which is farmers' perceptions. [6] indicated that the perceptions and views of the farmers are important in adoption of agricultural technologies. A study [7,8] showed that farmers' perceptions do influence their adoption decisions. Adoption of technologies by farmers may reflect rational decision-making based on farmers' perceptions of the appropriateness of the characteristics and the value of technology to them in the coming years. The decision of farmers to adopt soil fertility management practices begins with their perception of decline in soil fertility as a problem. These perceptions may be shaped by farmers' socio economic characteristics (e.g. gender, age, level of education, household size and access to extension services, farm size, farm income, off farm income and cost of technology) [9,10].

### 1.1 Statement of the Problem

Over the years, efforts addressing soil fertility in Kenya have focused on improving the nutrient balance and the bio-physical characteristics of the soil [11] by encouraging use of fertilizers (both organic and inorganic), improved varieties and incorporation of other improved farming practices, including planting legumes and diversified crop rotations within cropping systems [12,13]. However, in the developing countries, many studies which examining farmers' perception towards soil fertility replenishment technologies (SFRT) have failed to assess their knowledge, perception and constraints they experience in adopting of these technologies and practices [14,15]. By understanding the farmers' perception or constraints, this research creates an opportunity for scholars, practitioners, and farmers to identify and utilize appropriate soil fertility management strategies relevant to the local context.

#### 1.1.1 Purpose of the study

The current study examined the perception of farmers towards soil fertility replenishment technologies (SFRT). Specifically, this research explores how key socio-economic factors (gender, age, level of education, household size and access to extension services, farm size, access to credit, sources of income and off farm income) influence farmers' perceptions and challenges faced by farmers in adoption of SFRT.

## 2. METHODOLOGY

The study was conducted in main maize-growing counties of the North region of Kenya. The selected counties were Trans Nzoia and Uasin Gishu counties. These are the maize growing counties in Kenya commonly referred to as the 'grain basket' counties of Kenya. The farmers who were selected for the study were organized into groups. The study area consists of three sub counties namely Turbo and Soy sub counties in Uasin Gishu and Cherangany in Trans Nzoia. A two stage random sampling technique was employed in the study. In the first stage, farmer groups growing maize as the main crop were selected. This was mainly because the technologies used in this study were geared towards addressing decline of soil fertility among the maize farmers. The focus on farmer-groups was necessitated by the fact that extension service delivery in the study area largely targeted farmers groups. The second stage involved the selection of farmers who were practicing cereal banking for ease of marketing of their produce. In both counties farmers who engage in cereal banking do farming business and hence can easily adopt new technologies to maximize profit from their maize produce. Collective bulking and storage are essential for meeting market demand and for development of forward contracts with processors. Minimum orders with millers are about 100 tons or more, and only when several Local Cereal Banks coordinate their efforts can these size contracts be secured. Furthermore, sound storage practices allow the Local Cereal Banks to "wait out" the low prices following peak harvest in order to obtain a larger profit from their grain. Further, revolving credit and partial payment for deposited grain are important features within cereal banking because it provides access to capital at the farm level. A total of 39 respondents were interviewed in Trans Nzoia and 69 in Uasin Gishu, making a total of 108 respondents. A structured questionnaire was administered to access the socio economic characteristics of the farmer. The questions included person details (gender, age, level of education, household size and access to extension services) and farm details (farm size, access to credit, sources of income and off-farm income). To assess the perception of farmers towards SFRT on-farm demonstration were carried out as explained below.

### 2.1 On-farm Demonstration

On-farm demonstrations of selected soil fertility replenishment technologies at each of the three sub- counties were carried out. In this study, the demonstrations provided a rare opportunity to compare side-by-side, the performance of soil fertility management options. The farmers managed the trials and participated on technology evaluation, the prerequisite for technology adoption. The materials used and their rates of application, varied with each technology. In this study, six soil fertility replenishment technologies were tested using inorganic and organic fertilizers: The following are inputs used in the demonstrations

**-Diammonium phosphate DAP** - DAP fertilizer is an excellent source of P and nitrogen (N) for plant nutrition. It contains Nitrogen - 18% N and Phosphorus - 46 % $P_2O_5$.

**Rutuba Fertilizer**-This is an organic fertilizer which is fortified with macro and micro nutrients. It contains the following nutrients Nitrogen (N) – 1.05%, Phosphorous ($P_2O_5$) 0.75%, Potassium ($K_2O$) 1.63%, Calcium (CaO) 0.8%, Magnesium (MgO) 0.2%, Iron mg/kg 7600, Copper mg/kg – 450, Manganese mg/kg 1207 and Zinc mg/kg 438. It is manufactured in Kenya.

- **Mavuno fertilizer** - It is manufactured by Athi River Mining Company Limited in Kenya. It is a blended fertilizer. The fertilizer comes in two forms of "planting" and "top dressing". The Essential Nutrients contained in MAVUNO planting are: Nitrogen (N) 10%, Phosphorous ($P_2O_5$) 26%, Potassium ($K_2O$) 10%, Sulphur ($SO_4$) 4%, Calcium (CaO) 10% and Magnesium (MgO) - 4%. Further, the fertilizer has additions of other Trace Elements like: Zinc, Copper, Molybdenum and Boron.

**- NPK (23:23:0)**-This fertilizer contains different amounts of nutrients. The nutrients are often written on the bag or packing slip as percentages, or as N: P: K (Nitrogen: phosphorus: potassium). The essential nutrients contained in 23:23:0 include Nitrogen (23% N) and Phosphorus (23% $P_2O_5$)

- **Calcium Ammonium Nitrate (CAN)** -Calcium ammonium nitrate contains 27% N, is a highly efficient nitrogen fertilizer with calcium. It contains nitrogen in both the N- $NH_4$ at 13, 5% and N- $NO_3$ at 13.5%. N- $NO_3$ forms to provide plant nutrition during the plant growing period.

**Manure** - Manure is the decomposed form of dead plants and animals which is applied to the soil to increase the production. It is a valuable fertilizer that contains a broad range of nutrients such as nitrogen (N),phosphorus (P) and potassium (K) as well as micronutrients such as copper (Cu), manganese (Mn) and zinc (Zn).

Manures with added bedding are also an excellent source of organic matter which improves soil quality when applied to soil.

**Lime**- Koru lime, also known as Super calcium fertilizer, is a mixture of calcium hydroxide, calcium oxide and calcium carbonate, a by - product of the hydration plant at Homa Mining Company in Koru, Kenya. It contains 78.58% $CaCO_3$, CaO (burnt lime), $Fe_2O_3$ 0.29%, $Al_2O_3$ 1.2%, MgO 1.06%, $SiO_2$ 0.42%.

### 2.1.1 Demonstration Treatments

(i) FURP recommendation: 75 kg N + 26 kg P /ha - 129 kg DAP/ha fertilizer was used at planting to give 26 P kg/ha + 191.9 kg/ha CAN at topdressing to bring N to 75 kg N/ha.
(ii) FURP plus lime recommendation: 75 kg N + 26 kg P /ha + 2 ton of lime (CaO) - 129 kg DAP/ha fertilizer was used at planting to give 26 P kg/ha + 191.9 kg/ha CAN at topdressing to bring N to 75 kg N/ha + 2 tones lime.
(iii) ½ (FURP + Rutuba recommendation**:** 13 kg P /ha DAP + 37.5 kg N /ha (64.5 kg DAP/ha fertilizer was used at planting to give 13 P kg/ha + 96 kg/ha CAN at topdressing to bring N to 37.5 kg N/ha) + I/2 rate Organic manure (trading under the name Rutuba bio organic) 125 kg/ha at planting + ½ rate CAN- topdressing 125 kg/ha.
(iv) Rutuba recommendation**:** 250 kg/ha at planting + 187.5 kg/ha CAN topdressing.
(v) Mavuno recommendation**:** 250 kg/ha at planting + 187.5 kg/ha CAN topdressing.
(vi) National Agricultural Accelerated Input Access Programme (NAAIAP) recommendation**:** 250 kg/ha 23:23:0 at planting and 150 kg/ha CAN plus 225kg/ha Manure 6 tons/ha.

### 2.1.2 Selection of farmers to host demonstration

Site selection involved the farmers themselves, researcher, area chief and the local agricultural extension officers. One farmer was selected per sub-county. The selection of the respective maize farmers was done during the *barazas* (local gathering) organized by the area chief and agricultural extension officer. Maize was given special emphasis among the crops grown due to its importance both as a staple food crop and cash crop. The objectives of the demonstration were explained during the *barazas*. Participants selected to host demonstrations had to meet the following criteria: they had to (i) be landowners who planted maize as the main crop on an area between 1 to 20 hectares (ii) own a herd of cattle so that they could have access to farmyard manure. The farmers interested in hosting in demonstrations were selected by acclamation. The selected farmer for each site was then visited to confirm the suitability of the site. These activities were carried during the months of January and February, 2017. This was early enough to enable farmers set aside land for demonstrations as planting of maize in both the counties is done from mid March to mid April.

The researcher provided the maize seed, inorganic fertilizers and Rutuba while the farmers provided the manure. The farmer also provided labour. The farmers groups participated in the major activities for example planting, weeding, topdressing and harvesting. Supervision was undertaken to ensure farmers understood the treatments. Assessment on farmer's perception towards the selected technologies was done when the crop was at maturity stage. In Turbo, Soy and Cheranganyi, 39, 37 and 32 farmers were part of the assessment, respectively. The on-farm trial was conducted in 2017 and in 2018 assessment was done to establish the challenges facing the farmers who participated in the demonstration and had decided to adopt the technologies.

## 2.2 Analysis of Data

The data was analyzed using descriptive statistics and the multiple regression analysis. Frequency counts and percentages were used to describe the socio-economic characteristics of the respondents. The challenges facing the farmers in the adoption of technology were also analyzed using descriptive statistics. Following [16] a 5-point Likert-scale was used to determine the perception of farmers on soil fertility replenishment technologies (captured with a scale thus: Strongly agree = 5; agree = 4; undecided = 3; disagree = 2 and strongly disagree = 1). The respondents were required to indicate the extent to which they agree or disagree with carefully constructed statements which depicted their perception on SFRT. A mean score was obtained for each respondent and adopted as a measure of the level of perception [17,18].

This is summarized with the equation below:

X = Σfn/N.
Where
X = mean score;
Σ = summation sign;
F = frequency or number of respondents who responded
Positively;
n = Likert nominal value of each scale;
N = Number of respondents.

The multiple regression analysis method was employed to investigate the effect of selected socio-economic characteristics of the respondents on their perception on SFRT. The choice of this model was based on it's proven adequacy in situations where there is the need to predict the value of a variable (the dependent variable) based on the value of two or more other variables [19]. According to [19], the regression model in it's explicit form is given as:

$$Yi = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_p X_{pi} + e_i \ldots\ldots$$

Where
$Y_i$ is the dependent variable
$\beta_0$ is the constant term
$\beta_1$ to $\beta$p are coefficients relating to p explanatory variables of interest
$e_i$ is the error term.

## 3. RESULTS AND DISCUSSION

### 3.1 Socio Economic Characteristics of the Respondents

The study sought to establish the perception of farmers on SFRT in Uasin Gishu and Trans Nzoia counties. The findings are shown in Table 1. The results revealed that 27(69.6%) and 49 (69.9%) of the households were headed by men for Trans Nzoia and Uasin Gishu, respectively. In Trans Nzoia county, 12 (30.4%) of the house heads were women whereas 21(30.1%) of households were headed by women in Uasin Gishu county. These findings indicate that gender household heads in the study region were dominated by males and this is in line with earlier findings [20,21]. This could be attributed to male dominance of the society in Trans Nzoia and Uasin Gishu counties whereby the male are favoured in terms of land ownership thus access to loans, credit and agricultural inputs such as agro-chemicals, fertilizers and extension services. In both counties the majority of the respondents sampled were above 45 years of age. These results suggest that the youth do not engage themselves fully in the farming activities. Thus, if the youth farmers' do not engage themselves in these practices, then sustainable agricultural productivity may be constrained [22]. However, several studies show that age plays an important role in the dissemination, adoption and diffusion of innovations and are believed to be positively correlated with age. Younger farmers are known to be less resistant to change than the old farmers and they accept and adopt innovations and new technologies readily and quickly, resulting in an accelerated diffusion rate [23]. Majority (above 40%) of the respondents had attained secondary level of education, which is considered adequate for the farmer to be able to understand and interpret the technical information on SFRT from print media, extension contact and other informants. According to a study conducted by [24,25], level of education was found to affect technology adoption as well as increased farm productivity levels. An average household size of 6 members was prevalent among respondents. These results indicate over 80% of farmers in both Trans Nzoia and Uasin Gishu counties have access to agricultural information. This implies that farmers in these counties were able to access agricultural information on any innovation or technology from the extension officers. According to [25], exposure to information about new technologies as such significantly affects farmers' choices about it. The majority (>65%) of the household heads in both counties are smallholder farmers owning farms of less than five hectares. The observed results are in line with those of [26], who argued that population increase in developing countries, Kenya inclusive significantly impact on the ability adopt to new technologies. Further, the results in the Table 1 shows that 65.6% of the interviewed households in Trans Nzoia county depend on farming as their major source of income while in Uasin Gishu county 67.2% depend on the same. According to [27,28], being engaged fully in farming is an indication that farmers depend mainly on farming activity as one of their endeavour in earning their livelihood. Despite the importance of access to credit, the results in this study reveal that majority of farm households, especially in Trans Nzoia county lack access (56.8%) to formal credit. These findings concur with [29] who revealed that many farmers have difficulty accessing credit due to high interest rates, which prevents investment in profitable technologies. The findings also revealed that 61.5% and 44.9% of the household interviewed from Trans Nzoia and Uasin Gishu county, respectively, had off-

farm income. Off-farm income generating activities such as formal employment and business may help farmers to finance production costs like buying inputs, seeking market information, accessing extension services and hiring of labour [30].

## 3.2 Perception of Farmers on SFRT

The farmers were asked to give their perceptions about the technologies in the demonstration plots by responding to some positive statements using a likert scale Table 2. The results revealed that farmers in Trans Nzoia and Uasin Gishu counties had a clear and good perception of the declining soil fertility. This is evidenced by their agreement with the positive statements (mean score 5.0) which highlight the decline of the same. This is in line with the findings of [31] in Uganda where most of the respondents cited a decline in fertility of their fields. The data shows that the respondents were fairly aware that the inputs used in these technologies were available at a mean score of 3.4. However, their knowledge and availability of information about of these technologies had score of 1.8 and 2.6, respectively. This could be an indication that almost half of the extension officers were not aware of these technologies. This concurs with studies by [32,33]. The farmers agreed that the inputs used were fairly available with a score of 3.4. This is probably because the majority of the farmers in this region depend on Government subsidized fertilizer which at times is difficult to access due to the bureaucracy involved and the distance to National Cereal and Produce Board (NCPB) depots. A study by [34] reveal that in most countries in SSA, farmers' adoption decisions for soil fertility technologies are influenced in part by level of access to external inputs such as mineral fertilizers, improved seed and herbicides. Farmers' proximity to input sources positively increases their use [35,36,37]. Generally, the closer the resource-poor farmers

**Table 1. Selected Socio economic characteristics of respondents in Trans Nzoia and Uasin Gishu counties**

| | Trans Nzoia | | Uasin Gishu | |
|---|---|---|---|---|
| **Variable** | **Frequency** | **Percent** | **Frequency** | **Percent** |
| **Gender of the respondents** | | | | |
| Male | 27 | 69.6 | 48 | 69.3 |
| Female | 12 | 30.4 | 21 | 30.7 |
| **Age of the respondents** | | | | |
| 18 to 35 years | 3 | 7.7 | 2 | 1.4 |
| 36 to 45 years | 13 | 33.3 | 13 | 18.8 |
| 45 to 55 years | 12 | 30.8 | 27 | 39.1 |
| >55 years | 11 | 28.2 | 28 | 40.7 |
| **Education level** | | | | |
| Non formal education | 2 | 5.1 | 3 | 4.3 |
| Primary | 12 | 30.8 | 19 | 27.5 |
| Secondary | 17 | 43.6 | 32 | 46.4 |
| Tertiary | 8 | 20.5 | 15 | 21.7 |
| **Access to extension** | | | | |
| Access | 37 | 94.9 | 58 | 84.1 |
| Do no access | 2 | 5.1 | 11 | 15.9 |
| **Size of land** | | | | |
| <5 | 28 | 72.0 | 48 | 69.5 |
| 6 to 10 | 7 | 18.0 | 10 | 14.5 |
| >11 | 4 | 10.0 | 11 | 16.0 |
| **Source of income** | | | | |
| Farming | 26 | 66.7 | 46 | 66.7 |
| Business | 8 | 20.5 | 11 | 15.9 |
| Formal Employment | 4 | 10.2 | 7 | 10.1 |
| Casual work | 1 | 2.6 | 5 | 7.2 |
| **Access to credit** | | | | |
| Access | 21 | 53.8 | 27 | 39.1 |
| Do not access | 8 | 46.2 | 42 | 60.9 |
| **Off-farm income** | | | | |
| Available | 24 | 61.5 | 31 | 44.9 |
| Not available | 15 | 38.5 | **38** | 55.1 |

*Source; Survey Data 2018*

are to input markets, the lower are their transaction costs in terms of travel time and transportation costs, thereby lowering production costs [38] and increasing opportunities to access to new and improved soil fertility management technologies [39]. Further, they agreed that these technologies were affordable a mean score of 4.1. The farmers in this region also perceived that the technologies could work well in any farm (mean score 4.6). This was expected as farmers in both counties have similar soil management practices. These include the use of inorganic fertilizers and to a lesser extend organic fertilizers. According to a study by [40] the highest adoption of mineral fertilizer in maize production zones was in the High-Potential Maize Zone. On average, 95% of the households in this region used fertilizer. However, high adoption rates of fertilizers are necessary but not sufficient for high maize productivity. The high adoption rates needs to be accompanied by use of recommended quantities of the fertilizers.

**Respondents Perception of SFRT**

**Table 2. Respondents Perception of SFRT**

| S/no | Perception Statement | Strongly Agree (5) | Agree (4) | Undecided (3) | Disagree (2) | Strongly Disagree (1) | Total | Mean rating Max = 5 |
|---|---|---|---|---|---|---|---|---|
| 1. | There are SFRT that can be used to address decline in soil fertility | 45 (45.5%) | 40 (40.4) | 1 (1%) | 10 (10.1%) | 3 (3%) | 99 (100%) | 3.5 |
| 2. | The SFRT are common | 15 (29.4%) | 0 (0%) | 3 (5.9%) | 18 (35.3%) | 15 (29.4%) | 51 (100%) | 1.8 |
| 3. | The information about these technologies are readily available | 25 (34.2%) | 24 (32.9%) | 0 (0%) | 14 19.2%) | 10 (13.7%) | 73 (100%) | 2.6 |
| 4. | The inputs used in these technologies are readily available | 65 (59.6%) | 28 (25.7%) | 0 (0%) | 16 (14.8) | 0 (0%) | 109 (100% | 3.4 |
| 5. | These technologies are affordable | 75 (65.2%) | 28 (24.3%) | 0 (0%) | 12 (10.4%) | 0 (0%) | 115 (100%) | 4.1 |
| 6. | These technologies can work well in any farm | 100 (78.1%) | 24 (18.8%) | 3 (2.3%) | 0 (0%) | 1 (8.0%) | 128 (100%) | 4.6 |
| 7. | These technologies have negative effects on soil fertility. | 65 (64.4%) | 28 (27.7%) | 0 (0%) | 0 (0%) | 8 (7.9%) | 101 (100%) | 3.6 |
| 8. | There are no challenges involved in using these technologies. | 45 (52.9%) | 12 (14.1%) | 0 (0%) | 24 (28.3%) | 4 (4.7%) | 85 (100%) | 3.0 |
| 9. | The MOALF is effective in disseminating the technologies | 65 (58.6%) | 28 (25.2%) | 6 (5.4%) | 12 (10.8%) | 0 (0%) | 111 (100%) | 4.0 |
| | **Total mean** | | | | | | | **30.6** |
| | **Grand mean** | | | | | | | **3.3** |

*Source; Demonstration Data, 2018*

### 3.3 Determinants of Farmers' Perception on SFRT

Linear multiple regression analysis was computed to determine the factors that affect farmers' perception. The findings of the regression analysis are presented in Table 3. Age of the respondents negatively influenced perception at p<0.01. This indicates that as the age of the respondents increases their corresponding perception to use and invest on SFRT decreases. This suggests that older farmers are reluctant to invest on SFRT compared with young farmers [41]. The result is also in agreement with [42] who obtained a similar result. Further, level of education negatively influenced perception at p<0.01. This is contrary to the expectation of this study. Level of education has been linked to increased exposure, awareness and knowledge [43,44]. Variable cost of technology had negative significant (p < 0.01). The results are similar to the findings of [45,46] who found that high cost of feeds and other inputs contributed up to 97% of the production problems faced by fish farmers in Nigeria. Variable size of land and access to credit positively influenced perception at p < 0.01 while farm income has a positive significant perception on SFRT at p < 0.05. This is probably because credit access facilitates purchase of inputs especially improved seed varieties and inorganic fertilizers [47,39] while higher incomes are associated with higher levels of adoption rates [7,48]. Higher income means that the farmer can buy inputs for farming and hence can in adopt SFRT.

### 3.4 Challenges Affecting Farmers in Adoption of SFRT

According to the results of this study (Table 4) lack of capital was ranked the highest (70.4%) among the limitations preventing farmers from fully adopting SFRT in Trans Nzoia county. These results in this study imply that the majority of the farmers in Trans Nzoia county were not able to get credit or they were reluctant to access the credit probably due to high interest rate the financial institutions in Kenya charge. Similar challenges have been identified elsewhere in literature [49,50]. In Trans Nzoia county, cost of inorganic fertilizer ranked the least constraint in adopting SFRT at 0.0% and at 2.3% in Uasin Gishu. This is probably because of government subsidized fertilizer sold to farmers through National Cereal and Produce board (NCPB) in Kenya. The results of the study concur with the findings of [49,51] who reported that the cost and level of subsidy on fertilizer were determinants of financial attractiveness and the potential adoptability of the different soil fertility options.

**Table 3. Regression Analysis to Identify the Determinants of Farmers' Perception on SFRT**

| Variable | Unstandardized Coefficent | | T | Sig. |
|---|---|---|---|---|
| Variable | B | Std error | | |
| Constant | 3.470 | 0.608 | 6.154 | 0.000 |
| Age | -0.360*** | 0.125 | -2.873 | 0.005 |
| Education | -0.197*** | 0.677 | -2.912 | 0.004 |
| Household size | -0.001 | 0.022 | -0.067 | 0.947 |
| Access to extension | 0.086 | 0.163 | 0.527 | 0.598 |
| Size of land | 0.031*** | 0.012 | 2.631 | 0.009 |
| Farm income | 0.460** | 0.205 | 2.252 | 0.026 |
| Off farm | -0.019 | 0.171 | -0.112 | 0.911 |
| Cost of technology | -0.083*** | 0.031 | -2.249 | 0.006 |
| Access to credit | 0.171*** | 0.040 | 4.258 | 0.000 |

*$R^2$; 0.682: significance = 0.568; sterisks denote the level of significance *= 10%, ** = 5% while *** = 1%*
*Source: Survey Data, 2018*

**Table 4. Constraints to Adoption of STRT**

| | Trans Nzoia county | | | Uasin Gishu county | | |
|---|---|---|---|---|---|---|
| Challenge | Freq | % | Rank | Freq | % | Rank |
| 1. Cost of inorganic fertilizer | 0 | (0.0) | 6 | 6 | (2.3) | 5 |
| 2. Lack of manure | 19 | (15.2) | 2 | 33 | (12.7) | 3 |
| 3. Lack of soil amendments | 1 | (0.8) | 5 | 3 | (1.6) | 6 |
| 4. Labour | 2 | (1.6) | 4 | 15 | (6.8) | 4 |
| 5. Lack of capital | 88 | (70.4) | 1 | 102 | (39.6) | 2 |
| 6. Non | 15 | (12.0) | 3 | 170 | (65.6) | 1 |

*Source: Survey Data, 2018*

## 4. CONCLUSION AND RECOMMENDATION

The perception of farmer's regarding SFRT, availability of inputs, affordability of the inputs used in the technologies was high. The main challenge hindering the adoption of SFRT in Trans Nzoia county was lack of capital. However, the majority of the respondents in Uasin Gishu county did not anticipate any challenges in the adoption of SFRT. Based on these findings, introduction of new technologies to farmers should go hand in hand with on-farm demonstrations since it by doing that they would develop confidence and allay their fears associated with the technology. The government should device a policy that should encourage the youth involvement in the agricultural activities. This would enhance sustainable agricultural productivity as the old are aging out.

## CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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