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Influence of Farmer Level of Education on the Practice of Improved Agricultural Technologies: A Case of Nyamusi Division, Kenya

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Abstract: **The study examined the influence of farmers' education level on the practice of improved agricultural technologies by farmers in Nyamusi division of Nyamira County. Multi-stage and stratified sampling techniques were applied for sample selection. Data collection was done by use of semi-structured questionnaires. Both descriptive and inferential statistical techniques were used for data analysis. Among the descriptive statistic techniques used included Mean, Standard Deviations and frequencies. For Inferential statistics, correlation, Chi-square and cross tabulation were used to establish relationships between dependent and the independent variables. Internal consistency technique was used to ensure reliability of the research instrument through the computation of Cronbach's Coefficient Alpha and was found to be 0.81 which meant that the data collection instrument was consistent and reliable. A total of 332 questionnaires were filled by the sampled farmers but only 304 were completely and adequately filled and analysed giving a Questionnaire Return Rate (QRR) of 91.6%. The analysed data was presented using tables. The study revealed that 44.4% of the farmers had completed primary level education. The study established that farmer level of education did not significantly influence the practice of agricultural technologies. In order to boost farmer literacy levels, the study recommends that the Directorate of Adult and Continuing Education should consider working with farmer groups in promoting functionality of literacy centres.**

Keywords: **Improved Agricultural technologies, Farmer Education Level.**

1. INTRODUCTION

Research has proved that in an attempt to address the challenges of poverty and food insecurity among rural population, capacity building of rural farmers on agricultural technologies and practice of the same to improve agricultural productivity and diversification of livelihoods is of paramount importance. Achieving agricultural productivity will only be made possible through a concerted effort by partners in development and dissemination of yield increasing agricultural technologies (Asfaw *et al*, 2012). This is in agreement with Forum for Agricultural Research in Africa(FARA, 2006) that noted that International Collaborations have been established in bid to raise agricultural productivity in Africa through technology access, development, delivery and adoption by farmers. One such initiative is the African Union New Partnerships for African Development (AU-NEPAD) whose strategy is the revitalizing, expanding and reforming of African research, technology dissemination and adoption efforts.

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At the global level, the practice of improved agricultural technology is now considered critical to the attainment of Sustainable Development Goals (SDGs) number 1 and 2 of reducing extreme poverty and hunger. Although substantial public resources have been devoted to the development and provision of modern crop varieties in Sub-Saharan Africa (SSA) in the past 30 years, overall adoption rates for improved technologies have lagged behind other regions (World Bank, Agriculture for Development: Overview, 2008)

Agriculture is dominated by smallholder farmers who occupy the majority of land and produce most of the crop and livestock products. The key long-standing challenge of the smallholder farmers is low productivity stemming from the lack of access to markets, credit, and technology, in recent years compounded by the volatile food and energy prices and very recently by the global financial crisis (Adeleke *et al*, 2010) Despite the number of sound agricultural policies adopted by most countries, implementation has been lagging behind.

Concerns over food availability are motivated by the need to feed an increasing population and one way of addressing these concerns is to increase food production and local food supply by improving agricultural productivity (Chima, 2015). Decades of research have led to significantly improved understanding of the nature of world food insecurity. USAID (2009) reported a decline in the percentage of the world population suffering from malnutrition from 20% in 1990/92 to 16% in 2006. Yet over one billion people still face both chronic and transitory food insecurity and poverty in Africa and parts of Asia. Ensuring adequate food security/availability for such a large share of the world's population is increasingly challenging, due to increasing world population pressure, poorly functioning input market, rapid urbanisation, outdated agricultural practices, climate change and recent global food, energy and financial crises (Adesina, 2009). Long before the recent crisis Africa was already in food crisis; one in three people and a third of all children are malnourished and half of all Africans live on less than one US dollar per day (Nambiro et al, 2007).

Agricultural extension agents in most Sub-Saharan nations play an important role of transferring agricultural technologies to farmers. This has also seen the involvement of many donor countries through their International agencies in complementing the government efforts of ensuring that the technologies developed reach the intended users. The challenge remains that most of the promoted agricultural technologies have not fully led to the realization of the targeted goals of improving agricultural productivity and improving food security (Mohammed *et al*, 2012).

As observed by Langat *et al*, (2013), a decade down the line the impact of tissue culture banana technology is yet to be felt among smallholder farmers in the country where despite its potential for high yields, farmers in Kenya are yet to take up tissue culture banana technology. It is projected that less than 10 percent of all banana farmers in Kenya have so far adopted Tissue Culture banana production in the country. A common believe among many technologists is that any beneficial innovation will naturally sell itself, that the obvious benefits of a new idea will be widely realized by potential adopters, and that the innovation will therefore diffuse rapidly.

The availability of modern agricultural technologies to end users and the capacities of the end users to adopt and utilize these technologies are critical (Mamudu *et al*, 2012). For example, food security and farm incomes have markedly increased in West Africa, while use of 'smart' subsidies for key inputs in countries like Malawi has greatly impacted yields, showing that smallholder farming can respond to properly targeted economic policy interventions.

Agricultural sector in Kenya has been identified as one of the six sectors aimed at delivering 10 percent economic growth rate under the Vision 2030. One key policy goal of the sector is to increase agricultural productivity through generation and promotion of technologies and increased resource allocations. Crop development and management is also one of the major programmes undertaken by the sector, beside policy regulation and coordination, and information management among others (GOK, 2011).

In Nyamusi Division Specifically; the role of Government and Development Agencies in spearheading farmers' capacity building on improved agricultural technologies is worth noting. A large number of promising technologies are already available in Nyamusi. These include improved livestock breeds, tissue culture banana, green house farming, modern bee keeping, and value addition among others. Unfortunately, while available in principle; farmers' contact with new technology is distinctly limited in practice. This translates to low rates of technology adoption as farmers' ability to practice these technologies has not kept pace. With the understanding that the practice of agricultural technologies is an essential factor for transformation of agriculture, it is of necessity to determine the factors influencing practice of improved agricultural technologies in Nyamusi Division, Nyamira County, Kenya.

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2. LITERATURE REVIEW

Different factors influence the practice of different agricultural innovations and technologies. According to Mamudu *et al*, (2012), the factors influencing farm households' practice of modern agricultural production technologies are grouped into three main categories namely economic, social and institutional factors. The economic factors included farm size, cost of adoption, access to credit, expected benefits from the adoption and the off-farm income generation activities that farm households engage in. The social factors included the age of farmers, the level of education, membership to a farmer group and gender. The institutional factors included access to extension services.

Influence of farmers' level of education on the practice of agricultural technologies:

To realize sustainable development in social, economic and environmental sectors, farmers must be educated. Agricultural training and education has a direct impact on agricultural productivity as it also stimulates implementation of knowledge driven economic growth strategies and poverty reduction (FARA, 2006) The information that is transferred along production and marketing value chains through extension must be of high quality, adequate, relevant and timely. It should aim to empower farmers by providing them with knowledge, technologies, innovations and skills. Therefore, AES needs to draw on an integrated, complete information system involving agricultural research, agricultural education and information-providing businesses (NASEP, 2012).

Improving agricultural productivity, profitability and sustainability in the developing world depends on the ability of rural people to change and innovate in their use of technologies, management systems and environmental resources. The capacity to innovate depends on access to knowledge and information services. A study by (Meike *et al*, 2008) indicated that while the farmer groups share production technologies and consumer preferences to their members through field schools and extension visits, education plays a critical role especially in the cases of knowledge-intensive technologies in conservation agriculture.

According to FARA(2006), Farmer empowerment plays a key role in improving agricultural productivity and efforts to develop systems that foster greater farmer knowledge, control of funds, organizational power and institutional participation; allowing producers to become more active partners in agricultural productivity initiatives. The FARA framework indicates that farmers who have the capacity to analyse their constraints and identify opportunities, articulate their needs, exchange knowledge, and improve their bargaining power will have better access to, and use of, relevant agricultural knowledge and technologies. While farmer empowerment may target farmer and farmer group building, it should be mainstreamed throughout agricultural technology development and dissemination systems to allow the emergence of a more bottom up approach, giving end users true voice.

Many studies have tried to focus on the impact of education on the practice of technology. Education is believed as one of the significant resources necessary to nurture productivity in any occupation. Studies by (Adetiba, 2005), (Adeoti, 2002), (Ajani, 2000), (Bravo-Ureta, B.E, Rieger, C., 1991), and (Ajibefun &Abdulkadri, 2004) confirmed that education is crucial to improved productivity among farming households in the humid forest, dry savannah and moist savannah agro-ecological zones of Nigeria and in New England. This is probable because good education is believed to drive heads of farming households to access and practice new technologies that are vital to increasing farm productivity. Additionally, (Ali& Flinn,1989) demonstrate significant role of farmers' education in raising farming efficiency in the Punjab region of India and Pakistan.

With respect to education levels, (Davis *et al* 2010) found varied effects. While household heads in Kenya with primary and secondary education were more likely to take part in groups (Farmer Field Schools (FFS) than their counterparts with no education, the reverse was observed for Uganda. A study by (Bennin, *et al* 2008) on the factors that influence the decision for households to join National Agricultural Advisory Services (NAADs) in Uganda found that farmers with some post-primary education, are more likely to participate in NAADS groups, signifying that efforts to empower farmers to demand advisory services should be reinforced by programs that help farmers to improve their education. Indeed, the role of education in influencing farmer group participation in Uganda still has mixed findings given that it could enhance participation or discourage participation in groups.

Results of the study by Adong *et al*, (2015) in Uganda suggest that individual characteristics matter as it concerns group membership. They observed that education is a very essential factor influencing the farmer's decision to be a member of a farmer group. The higher the education level, the higher the probability of being a member. Their results indicate that an individual who has attended some primary education has about 5 percent probability of joining a group compared to the farmer without any formal education. An individual with some secondary education has even a higher percent of 7 when compared to a farmer with no education and lastly, the highest percentage probability of being a member of a group is by those individuals with an advanced secondary education (A level) at 10 percent when compared to no education at all. According to Timu et al (2012), the coefficient for education is positive and statistically significant at 5 percent level on practice of improved sorghum variety in Kenya.

Results from a study undertaken by Catholic Relief Services and the International Centre for Tropical Agriculture in 2005-06 indicated that farmers required multiple skills to improve their market linkage (Ashby *et al*,2011).The study found out that the desired set of skills was common across wealth levels and locations in the farmer groups. The skill sets were classified as group management skills, financial skills marketing skills, innovative skills for accessing new technology, and sustainable production and natural resource management skills. Additionally, the maximum level of the education within the household was found to be significantly related with the probability of technology adoption in Ghana (Mamudu *et al* 2012).

According to Langat *et al*, (2013),educated level of head of household, household size, off farm income, farm size and extension information were found to favour adoption of tissue culture banana. Educated household heads with access to extension information were likely to try on the new technology compared to their counterparts with less schooling. Additionally, education of the household head has a consistently positive relationship to most technology adoption decisions (Eaiene*et al* 2009). In relation to their study, it was observed that the effect was stronger for higher levels of education where by completion of at least lower primary school implied a much higher tendency to practice agricultural technologies than zero levels of education. Additionally, a study by (Meike & Thies, 2008) noted that the higher the maximum educational level attained by the household members, the more soil conservation practices were adopted.

Participation in farmer trainings was noted to positively affect the practice and economic impact of technology by improving its relevance and appropriateness to the potential beneficiaries, thereby increasing the number of potential adopters (Kathleen &Gale, 2009). They observed that training needed to take into account farmers' different technological needs and production preferences. Providing some level of ownership for the farmers in identifying new technology and feeding into the development process ultimately resulted in greater take-up of technology. There is an important role for intermediaries like trainers and projects in enhancing the take-up of new technologies. According to (Adeleke *et al*, 2010)productivity gains through innovation and technologyadoption can be facilitated through farmers' training as this ensures that the farmers have the required skills for production of commodities that meet the quality standards that will make them to compete on domestic and international markets.

Despite such common beliefs regarding the paybacks of schooling in farm activities, the existing studies on the determinants of agricultural technology practice and by extension farm productivity are largely in-conclusive on the question of a positive yield from education. There is weak empirical evidence to advocate for educational investment in agrarian societies. For instance, (Coelli&Battesse, 1996) failed to identify any significant impact of farmers' education on farming efficiency in India. Additionally, Hasnah *et al*, (2004) rather reported a significantly negative impact of education on technical efficiency in West Sumatra-Indonesia.

Based on the foregoing, previous studies present mixed observations on the impact of farmer education on agricultural productivity, access to agricultural extension services and practice of improved technologies. In Nyamusi division, most of the agricultural technologies availed to farmers such as tissue culture banana, green house farming, Artificial Insemination among other require some level of knowledge for one to be able to grasp the concepts. Additionally, most of the extension services are delivered through trainings and workshops yet no study has been carried out in the division to ascertain how farmers level of education influenced their understanding and subsequent practice of the promoted technologies. This study therefore sought to fill the gap.

3. MATERIALS AND METHODS

Study area:

The study was conducted in Nyamusi division, Nyamira County Kenya. The division is covered by two major agro-ecological zones; the highland (LH1 and LH2) and the upper mid land zone (UM1, UM2 and UM3). The latitude is 0^{o} and

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30° South and Longitude 34° 45′ and 35° 00 east, the area receives long rains (2300-2500mm) and short rains (600-800mm). The annual maximum temperatures range from 10.1^{0}C to 28.7^{0}C while the annual mean temperature is 19.4^0 C. The vegetation is natural grassland with exotic trees and scattered shrubs while the soil type is red volcanic which is suitable for arable farming.

Research techniques and sampling method:

Multistage sampling was employed in the study. The first stage was purposive selection of Nyamusi division because of the fact that it had recorded a large number of agricultural technologies promotions by the Government of Kenya and other Non-Governmental organizations relative to other divisions within Nyamira North Sub-County. According to the agricultural extension office in Nyamusi Division, there were a total of 2460 farmers in Nyamusi Division reached with agricultural extension services (with approximately 1760 being members of various farmer groups while 700 operated as individual farmers. The distribution of the farmers in relation to their education levels was as follows;

Farmers Education level	Total	Percent
Illiterate	210	8.5
Primary education	1230	50.0
Secondary education	870	35.4
Post-secondary education	150	6.1
Total	2460	100

To arrive at the required sample, stratified random sampling was used. According to Mugenda& Mugenda,(2003), the sample size can be determined as follows;

$$n = \frac{Z^2 pq}{d^2}$$

Where;

n= the desired sample size (if the target population is greater than 10,000)

z= the standard normal deviate at the required confidence level which is 1.96

p= the proportion in the target population estimated to have a characteristic being measured

q= 1-p

d= the level of statistical significance level set which is 95% for this study

However, since the target population for this study was less than 10,000, then the required sample size was smaller. In that case, the final sample estimate (n_f) was calculated using the following formula;

$$n_{f=}\frac{n}{1+\frac{n}{N}}$$

Where;

$n_{f=}$the desired sample size (when the population is less than 10,000)

n = the desired sample (when the population is more than 10,000)

N= The estimate of the population size

Therefore using the above formulae;

$$n = \frac{(1.96)^2\,(.50).50)}{(.05)^2}$$

n=384

Consequently,

$$n_{f=}\frac{384}{1+\frac{384}{2460}}$$

$$n_{f=332}$$

Using proportions the strata samples were calculated as follows;

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Sample of farmers with no education *was* $\frac{210}{2460}x332$ =29

Using the above calculation, the sample size for each stratum was obtained as follows;

Table 1: Sample size for each stratum

Farmers Education level	Total
Illiterate	29
Primary education	166
Secondary education	117
Post-secondary education	20
Total	332

Therefore, the total number of farmers interviewed in all the strata was 332. Having got the sample sizes per stratum as above, simple random sampling was then be used in selecting appropriate number of subjects for each stratum.

Data analysis:

The independent variable studied was farmer's education level while the dependent variable was the practice of improved agricultural technologies. Farmer education level had four levels (no formal education, primary school, secondary school and post-secondary education) andpractice of improved agricultural technologies had four levels as well (never practiced, low practice, moderate, high and very high). The data collected was analysed using computer software known as Statistical Package for Social Sciences (SPSS) version 20. The data was scored, edited, coded, categorized and entered into a computer. Descriptive analysis was done to produce frequencies, percentages, mean, and standard deviation to provide statistics that described the basic features of the data of the study.

Further statistical analyses were carried out using cross tabulation, Chi-square and Pearson Moment correlation to determine the relationship between the variables under study. The results were presented using tables where possible, discussed and recommendations and conclusion drawn in line with the research findings.

4. RESULTS AND DISCUSSION

Distribution of the Respondents' Education Level:

The researcher sought to establish the education level of all the sampled farmers so as to determine whether they had any impact on practice of agricultural technologies. The respondents indicated their education level as presented in table 4.3.4 below.

Table 2 respondents' level of education completion

Level of education	Frequency	Percentage
Illiterate	76	25.0
primary	135	44.4
secondary	87	28.6
Post-secondary	6	2.0
Total	304	100.0

The data analysed revealed that majority of the farmers interviewed 135(44.4%) had completed primary school education. Those who had completed secondary education were 87 (28.6%). The respondents who had not completed any education level were 76(25%) while those who completed post-secondary education were the minority at 6(2%). These finding are comparable to those of beekeeping studies in Mwingi where 54.5% of farmers had primary education. The results are further consistent with a study on CIG performance in Gilgil Naivasha that showed that only 3.3% of farmers had post-secondary school education as well as the observation by (FARA, 2006) that indicated that Most African farmers only have access to primary education.

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Influence of Farmers Level of Education on the Practice of Improved Agricultural Technologies:

The purpose of this study was to determine whether farmer's level of education influenced their ability to practice new agricultural technologies promoted in Nyamusi. The technologies that the study focused on included use of certified seeds, value addition, green house farming, tissue culture banana, artificial insemination as well as dairy goat farming. For this to be achieved, the farmer level of education was cross-tabulated with the level of practice on the technologies by the farmers as shown in table 4.4.1 below.

Table 3: Farmer Level of Education versus Agricultural Technology Practice Cross tabulation

	Illiterate	Primary	Secondary	Post-Secondary
Agricultural technologies				
Use of certified seeds				
Never practiced	2 (2.6%)	3(2.2%)	2(2.3%)	0(.0%)
Low	5 (6.6%)	18(13.3%)	13(14.9%)	1(16.7%)
Moderate	7 (9.2%)	8(5.9%)	1(1.1%)	0(.0%)
High	44(57.9%)	70(51.9%)	39(44.8%)	3(50.0%)
Very high	18(23.7%)	36(26.7%)	32(36.8%)	2(33.3%)
Crop value addition				
Never practiced	62(81.6%)	118(87.4%)	71(81.6%)	6(100%)
Low	12(15.8%)	11(8.1%)	15(17.2%)	0(.0%)
Moderate	1(1.3%)	1(0.7%)	0(.0%)	0(.0%)
High	1(1.3%)	5(3.7%)	1(1.1%)	0(.0%)
Green-house farming				
Never practiced	66(86.8%)	120(88.8%)	79(90.8%)	5(83.3%)
Low	7(9.2%)	8(5.9%)	6(6.9%)	1(16.7%)
Moderate	2(2.6%)	2(1.5%)	0(.0%)	0(.0%)
High	1(1.3%)	5(3.7%)	2(2.3%)	0(.0%)
Tissue culture banana				
Never practiced	15(19.7%)	20(14.8%)	14(16.1%)	0(.0%)
Low	33(43.4%)	61(45.2%)	42(48.3%)	2(33.3%)
Moderate	2(2.6%)	4(3.0%)	1(1.1%)	0(.0%)
High	14(18.4%)	42(31.1%)	24(27.6%)	4(66.7%)
Very high	12(15.8%)	8(5.9%)	6(6.9%)	0(.0%)
Artificial Insemination				
Never practiced	34(44.7%)	59(43.7%)	29(33.3%)	2(33.3%)
Low	16(21.1%)	25(18.5%)	30(34.5%)	3(50.0%)
Moderate	7(9.2%)	8(5.9%)	3(3.4%)	0((.0%)
High	19(25.0%)	43(31.8%)	22(25.3%)	1(16.7%)
Dairy goat farming				
Never practiced	71(93.4%)	130(96.3%)	85(97.7%)	6(100.0%)
Low	2(2.6%)	5(3.7%)	2(2.3%)	0(.0%)
Moderate	2(2.6%)	0(.0%)	0(.0%)	0(.0%)
High	1(1.3%)	0(.0%)	0(.0%)	0(.0%)

From the cross tabulation, use of certified seeds appeared to be highly practiced by all categories of farmers irrespective of education levels at 23.7% and above. Additionally, it was observed that majority of the farmers who highly practiced technologies such as value addition (3.7%), green house farming (3.7%) and Artificial Insemination (31.8%) fell on the primary level of education completion category except for dairy goat farming (1.3%) and tissue culture banana (15.8%) that were highly practiced by farmers who had not completed any level of education. From the cross tabulation alone, it's impossible to tell whether these differences are real or due to chance variation. Further analysis was therefore performed using Chi-square test to ascertain the level of significance between farmer level of education completion and practice of agricultural technologies by farmers. Chi-square values for the all the agricultural technologies were tabulated as in table 4.4.2 below.

Table 4: Farmer level of education completion*Agricultural technology practice chi-square values

Pearson Chi-square	Value	Degree of freedom	Asymp.Sig.(2-sided)
Certified seeds	12.623	12	0.397
Crop value addition	8.725	9	0.463
Green house farming	5.109	9	0.825
Tissue culture banana	15.845	12	0.198
Artificial Insemination	13.723	12	0.319
Dairy goat farming	9.676	9	0.377

The two-sided asymptotic significance of the chi-square statistic is greater than 0.05 for all of the agricultural technologies it can therefore be inferred that the differences in practice of agricultural technologies by farmers of different education levels are due to chance variation, which implies that farmer's practice of improved agricultural technologies is not significantly related to his or her level of education completion. This is in agreement with the study by (Ajah, 2012)which indicated that farmer level of education did not significantly affect access to agricultural technologies. The result is also contrary to prior expectation that educated farmers are in a better position to access farm production resources including extension services more than non-educated teachers (Nwaru, 2007). It also differs with observation by (Langat, *et al* 2013) which showed that educated farmers are better able to process information and search for appropriate technologies to alleviate their production constraints. Farmers with formal education are believed to have the ability to perceive, interpret and respond to new information much faster. It is also contrary to World Bank (2008) report which indicated that education played a role in influencing the attitude of farmers towards the adoption of modern technology by enhancing the willingness of rural people to adopt new ideas. Based on the result, it can be inferred that those with post-secondary education were not interested in agricultural activities as most of them do not have agriculture as their main occupation and probably most of them are employed in other sectors and only take up agriculture as a part time business. Additionally, those with only primary and a few with secondary level education opt for agriculture to sustain their livelihoods (Machuki, 2013).

5. CONCLUSION AND RECOMMENDATIONS

The chi-square statistic for farmer level of education and practice of various agricultural technologies was greater than 0.05 for all of the agricultural technologies. The study therefore concludes that the differences in practice of agricultural technologies by farmers of different education levels are due to chance variation, which implied that farmer's practice of improved agricultural technologies is not significantly related to his or her level of education completion. In order to boost farmer literacy levels, the study recommends that the Directorate of Adult and Continuing Education should consider working with farmer groups in promoting functionality of literacy centres

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