BARRIERS TO ADOPTION AND CONSEQUENT CONVERSION TO AGRICULTURAL ECOLOGICAL LAND USE PRACTICES

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Assessing the barriers to adoption and consequent conversion to agricultural ecological land use practices

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Definition of key terms

Baraza: Public meetings or gatherings called upon by administration chiefs (A commonly used Swahili term)

ELUM practice: this was used to denote all ecological land use management practices that are geared towards environmentally friendly food, fibre and livestock production.

Farm Food security: the capacity of the farm to produce all the required food for the household in terms of quantity and quality.

Member Organizations: grass root organizations that collaborate with participatory ecological land use management association (PELUM-Kenya).

Sustainable farming: an approach to farming which is economically viable, environmentally sound, and socially beneficial: works for the farmer, the land and the community, and grounded on the idea of stewardship: preserving the resources that allow us to meet our own needs, so that future generations can meet their own needs as well.

Sustainable systems: this term is used to refer to all sustainable agricultural systems and is not limited to organic agriculture, permaculture, bio-intensive agriculture, agro-ecological agriculture, low external input sustainable agriculture (LEISA), and low inputs sustainable agriculture (LISA).

Acronyms

AEZs	Agro-Ecological Zones
CF	Conventional Farmers
ELUM	Ecological Land Use Management
FAO	Food and Agriculture Organization
FFS	Farmer Field Schools
GDP	Gross Domestic Product
GMO	Genetically Modified Organism
GoK	Government of Kenya
IFOAM	International Federation of Organic Agriculture Movements
KLA	Kenya Land Alliance
MOR	Member Organization Representatives
MOs	Member Organizations
n.d	No date
PaRRSA	Provincial Reconstruction, Rehabilitation & Settlement Authority (Khyber Pakhtunkhwa)
PDMA	Provincial Disaster Management Authority (Khyber Pakhtunkhwa)
PELUM	Participatory Ecological Land Use Management
S.S.E.W	Sustainable Systems Extension Workers
S.S.F	Sustainable Systems Farmers
SPSS	Statistical Package for Social Scientists
ToTs	Trainers of Trainers
UNEP	United Nations Environmental Programme
Ha	Hectare (Land measurement unit)

Executive summary

In October 2012, Participatory Ecological Land Use Management (PELUM) Kenya commissioned an Ecological Land Use Management study on assessing the barriers to adoption and consequent conversion to agricultural ecological land use practices. This report provides the results, findings and the recommendation of the study.

According to the Member Organizations, extension workers and farmers interviewed; the following were the main barriers of adoption to *elum* identified;

At least, 70% of the Member Organizations (MOs) interviewed said that one of the barriers to adoption of *elum* was lack of total commitment by farmers. This lack of commitment according to the interviewees is largely due to the fact that *elum* practices take long to yield results. It is common knowledge that farmers would like quick returns to investment. Therefore, farmers tend to show less commitment in taking up any practice that takes long to yield results. This is confirmed by a 60% level of the MOs identified saying that slow returns from *elum* practices is a major barrier to adoption of *elum*. At least, 30.8% of the extension workers also agreed that slowness in achievement of envisaged results created some resistance especially on farmers who had high expectations. Other barriers include labor constrains and resource scarcity. For example poor farmers with small land holding face a hard time in accessing vegetative matter for compost making.

Extension workers rated labor intensity as the highest (53.8%) barrier to adoption compared to other barriers. Farmers interviewed also indicated that labor was a main barrier to adoption of *elum* (67.5%) followed by inadequate personnel, high capital and unreliable practices.

In this case therefore *elum* was considered as a knowledge intensive practice with 53.5% of sustainable farmers interviewed and 57.5% of conventional farmers interviewed saying so. On gender issues, 53.3% of the conventional farmers believed that some roles within *elum* practices such as disease and pest control was solely a man's affair while only 20% of sustainable famers interviewed thought these roles could be shared. In addition, 70% of the MOs mentioned that they basically concentrate their activities around the female gender therefore the gender role perception would be a barrier to adoption of *elum*. Also 53.3% of conventional farmers interviewed thought that *elum* only concentrated on crop production with only 12.5% of sustainable farmers interviewed confirming this to be the case. This difference gives an indication as to the reason for low adoption of *elum* practices by conventional farmers.

Land ownership was perceived as a control to the rights of the farmer on the choice of

crops diversification. This land issue also affected farmers' rights to make changes on current landscapes such as making terraces, establishment of agroforestry and others. Farmers who had no legal rights to own the land that they utilized for agricultural production hardly adopted *elum* practices. The reason given was that these farmers would expect to gain guaranteed results from practicing *elum* in the distant future as compared to immediate achievements.

Major drivers to adoption of *elum* were also considered in the study. The key ones included food security, economic gains, low cost of production, health, and food and production sustainability.

INTRODUCTION

1.0 Preamble

Agriculture accounts for about 26 per cent of Kenya's Gross Domestic Product (GDP) directly and another 25 per cent indirectly. The sector also accounts for 65 per cent of Kenya's total exports and provides more than 18 per cent of formal employment. More than 70 per cent of informal employment is in the rural areas, (GoK, 2010). However, about 80 percent of the country is arid and semi-arid, while 17 per cent is considered to be high potential agricultural land, sustaining 75 per cent of the population, (FAO, 2005). Despite the fact that 80 per cent of the country is arid and semi-arid, agriculture in Kenya is dominantly rain-fed with an estimated 3.12 million ha being put under food crops in 1998. Furthermore, only about 20 per cent of the land area in Kenya is suitable for rain-fed agriculture, (Mati, 2005; Karina & Mwaniki, 2011).

Sustainable Agriculture is defined as "an approach to farming which is economically viable, environmentally sound, and socially beneficial: works for the farmer, the land and the community." It is grounded on the idea of stewardship: preserving the resources that allow us to meet our own needs, so that future generations can meet their own too. Sustainable farming systems meet the crop requirements i.e. fertile soils and protection from weeds and insect pests in order to produce the desirable with sophisticated management practices grounded in the science of agro-ecology, which views the farm as ecosystems made up of interacting elements – soil, water, plants, animals - that can be modified to solve problems, maximize yields and conserve resources. Research has shown that agro-ecologically based methods – such as use of organic fertilizers, crop rotation, and cover crops - can succeed in meeting present food needs while avoiding harmful impacts of the industrial agriculture, (Union of Concerned Scientists, 2012).

Organic agriculture is defined as: "a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved," (IFOAM, 2009).

Support for Sustainable Agriculture in farming communities offers large numbers of people in rural areas livelihood security - that is, food security and cash income. Compared to larger commercial enterprises, small farms often have higher productivity, related to greater product diversification. Land is used more intensively, so that each unit of ground produces more and requires greater human labour input. Indeed, it is often these small-

scale farms that produce the majority of food, thus making a significant contribution to the supply of staple foods to local and national markets.

Sustainable Agriculture has the potential to ensure food security for the global population - even without the need for additional areas of cultivation. It facilitates increased yields in the countries of the South, provided that change has been made to a form of agriculture that conserves natural resources, particularly soil fertility, and optimizes the material cycle of the farm, thereby enabling intensive and permanent use of the same area of land. An impact study carried out in the Philippines in 2007 showed, even in direct comparison with farms in favoured areas that were reliant on agrochemicals and high-yield seed varieties, small farms using sustainable methods and no expensive material inputs whatsoever could achieve equally high yields. Sustainable agriculture can demonstrate its superiority over conventional methods in arid areas in particular, as it enables stable yields even in drought years - a criterion that, in view of climate change, is increasingly important, (Dorlöchter-Sulser et al., (edts) 2008).

National land policy (Kenya), calls for immediate actions to addressing environmental problems that affect land such as degradation, soil erosion and pollution. For instance, the policy stipulates the principle of conservation and management of land based natural resources, the principle of protection and management of fragile and critical ecosystems including wetlands and arid lands, (The REDD desk, 2011). This creates a better environment that would boost Sustainable Agriculture adoption.Numerous studies have evaluated sustainable farming systems (Lockeretz, 1988; Roberts & Lighthall, 1992; Taylor & Dobbs, 1990 - cited in Drost et al., 1996). Most found that farmers adopt sustainable practices because they want to be good stewards of the soil, to reduce ground and surface-water pollution, to produce quality produce with reduced amounts of chemicals, and to reduce health risks to farm families and livestock.

According to Dale et al., (2000) a critical challenge for land use and management involves reconciling conflicting goals and uses of the land. The diverse goals for use of the land include resource-extractive activities, such as forestry, agriculture, grazing, and mining; infrastructure for human settlement, including housing, transportation, and industrial centers; recreational activities; services provided by ecological systems, such as flood control and water supply and filtration; support of aesthetic, cultural, and religious values; and sustaining the compositional and structural complexity of ecological systems. These goals often conflict with one another and difficult land-use decisions may develop as stakeholders pursue different land-use goals. For example, conflicts often arise between those who want to extract timber and those who are interested in the scenic values of forests. Local vs. broad-scale perspectives on the benefits and costs of land management also provide different views of the implications of land actions.

The birth of land management is resulted from land mismanagement including soil erosion, vegetation-cover destruction from overgrazing and over-cutting without replacing the natural woodland mainly in the developing world, (Larson, 1997 cited in Rukundo, 2012). Demands on the land for economic development and pressures from a burgeoning population are leading to unprecedented land use change, (UNEP, 2009). In turn, unsustainable land use is driving land degradation. The result is a loss of land productivity with impacts on livelihoods and the economy.

Dry-lands were reported to get more vulnerable to desertification in Kenya due to overgrazing and subdivision of land into uneconomic land parcel sizes, (GoK, 2002). The impacts of land degradation and desertification include a reduction in crop and pasture productivity and fuel-wood and non-timber forest products, which are closely linked to poverty and food insecurity. The damage to soil, loss of habitat, water shortages, and siltation reduce biodiversity and ecosystem services and have economic consequences (KLA n.d. Cited in UNEP, 2009). These concerns are substantial in Kenya where agriculture forms the backbone of the economy. Land degradation also increases effects of green-house gases thus contributing to climate change.

Despite the great potential of sustainable agriculture to reduce hunger and poverty, transition problems often limit the adoption, (Auburn, 1994; Taylor & Dobbs, 1990 cited in Drost et al., 1996; Dorlöchter-Sulser et al., (edts) 2008). This is more so because sustainable farming system innovations may require farmers to give up their income during transition, so cost of adopting increases, (Baide 2005). The cost of making the transition to more sustainable production systems is frequently encountered as an obstacle to adoption.

In cases of conversion from agricultural production systems using large amounts of external inputs, there may initially be reductions in yield, which will nevertheless be compensated for later by reductions in capital spending, (Dorlöchter-Sulser et al., (edts) 2008). Drost et al., (1996) found that some farmers especially the older ones felt the transition to sustainable practices would not occur in their lifetimes and thus doubted whether sustainable practices would be beneficial or profitable and therefore perceived them to being unfeasible or impractical.

Equivalently to transition problems, marketing options and a lack of useful up-to-date information also limit the adoption of sustainable farming practices. But the greatest challenge of conversion is the move away from familiar methods of operation corresponding to the agricultural mainstream (Dorlöchter-Sulser et al., (edts) 2008). Furthermore, environmental constraints, and perception problems often limit the adoption of the many sustainable practices. Improved knowledge of the present farming system will allow researchers, extension educators and farmers to develop research agendas and adopt

practices that meet present and future farming needs (Roling, 1988 cited in Drost et al., 1996).

Since demands on farmers are very high and agricultural policies seldom offer small farmers such benefits as advice and/or ease of access to the investment capital they need, the successes that can be seen today are overwhelmingly based on the initiative of the farmers themselves, supported and mentored by development organizations, (Dorlöchter-Sulser et al., (edts) 2008).

In brief, achievement of sustainable and ecological land use management has been hampered by various barriers such as weak policy support, inadequacies in research and extension services; inadequate information sharing and networking, high manpower requirements; difficulty in accessing to inputs and/or the long time taken in their preparation; policies and laws not targeted to environmental protection but production; and the high cost that farmers incur during certification. Without certification, therefore, the entire organic framework lacks credibility.

1.1 The Research Problem

A wide variety of pressures have led to the adoption of unsustainable land management practices in Kenya, including mono-cropping, poor land farm planning/rotation cycles, continuous tillage and soil nutrient mining, continuous overstocking, overgrazing, frequent rangeland burning, and overutilization/abuse or clearance of woodlands and forests. The impacts of these practices include loss of soil and other natural resources, changes in natural habitats and ecosystems, reduced ecosystem services such as water infiltration and loss of agro-biodiversity and wild biodiversity as well as decreases in land productivity leading to poor harvests and food shortages. Combined together, these impacts result to poorer living conditions and poverty than could otherwise be the case. Climate change is now further exacerbating these problems.

Notwithstanding the high potential that good agricultural practices would offer the farming communities, as well as the whole country (for instance) increased agricultural productivity, farmers are faced with problems of utilizing these good practices which has given into negative effects on the environment, food supply chain among others and this has resulted to inexplicable vicious cycles of poverty. Efforts have been made to sensitize and educate the farmers on these good agricultural practices that would offset the negative effects and instead boost production while enhancing and conserving the environment.

A commonly asked question that poses the challenge in conservation is “why forgo today’s achievement for the benefit of the future that may not be considerate to our sacrifices when resources are finally accessed?” However, research shows that farmers

who practice sustainable farming system do not necessarily “forgo today’s achievements for the benefit of the future.” A sustainable agro ecosystem has direct benefits such as food production as well as indirect ones such as climate regulation, nutrient cycling or cultural values (FAO, 2012). Hobbs & Powell (2011) used evidence from Africa and Asia, including other evidence from projects involving Christian Aid’s partners, to argue that it is possible to increase production and to meet food security and income needs, through agro-ecological approaches that put farmers in the driving seat. Gibbon & Bolwig (2007) also found that conversion to organic production in tropical Africa has been associated with yield increases.

PELUM-Kenya which is an umbrella organization harboring at least 36 Member Organizations that promote ecological land use management practices realized a slow rate in adoption of *elum* practices along various sustainable farming systems. Annual Report PELUM-Kenya (2010). PELUM therefore commissioned for a research that would address the question thus: What are the barriers that have hindered and continue to hinder the adoption and uptake of ecological land use management practices despite its present and future benefits?

1.2 Research Objective

The main objective was to identify the key barriers that have hindered and continue to hinder the adoption and uptake of ecological land use management practices.

1.3 Purpose of the Study

The purpose of the study was to seek barriers to adoption and subsequent conversion to agricultural ecological land use practices. Promoters of these sustainable farming systems will understand the gaps that can be addressed to ensure positive adoption of the systems. Various stakeholders such as students, researchers as well as governments and other interested beneficiaries will use the research results as a reference point to guide in development of mechanisms that respond to identified barriers. This is important because agriculture researchers will draw more interest and expand the research to help solve issues bordering agricultural ecological land use practices. Policy makers for instance, will find the results useful as they formulate or amend agricultural policies from an informed perspective that are in line with the economics of nature.

MATERIALS AND METHODS

2.0 Research Design

Cross-Sectional Survey design was used. This explanatory survey went beyond mere gathering of data on variables but attempted to explain the relationships among these variables. Personal interviews were employed in order to obtain standardized information from all subjects in the sample. Open-ended questions, observations, as well as the interview guides were used to collect data.

Sustainable systems farmers, conventional farmers who use different farming practices, promoters of organic farming, as well as those promoting conventional farming were engaged in responding to research questions which helped to seek answers to the research problem. This population formed an appropriate group due to its common observable characteristics. These were believed to provide the required information for the study. It was not possible to undertake a study of the entire population and therefore researchers opted to identify and define an experimentally accessible population.

2.1 Research Study Area and Population Sampling

The study was carried out in expansive agro-ecological zones of Kenya where farming is practiced. This constituted mainly, the highland parts of Kenya, medium as well as parts of low land areas where farming communities are found. These areas were chosen to enable a holistic visualization of the entire concept. The study was aimed at determining the barriers to adoption and subsequent conversion to agricultural ecological land use practices.

2.2 Study Sample

The individuals selected formed the sample for the study. The sole purpose of sampling was to secure a representative group which would enable the researchers to gather information about the target population.

2.2.1 Sampling Techniques

Stratified random sampling was used. First, researchers stratified their sampling frame by dividing it into agro-ecological zones since these were used as a stratification variable. Member Organizations were arranged in accordance to the agro-ecological zones. Then, the proportional representation of agro-ecological zones by the Member Organizations was calculated with a target of 10 of these to represent all the MOs. The 10 selected Member Organizations were contacted and asked to present a list of farmers and extension workers that they worked with. This was in addition to providing contacts of conventional extension workers within their operational areas. This action assisted in attaining

the five categories of respondents required i.e. 10 Member Organization representatives, 13 sustainable systems extension workers, 40 sustainable systems farmers, 15 conventional farmers and 4 conventional extension workers. A total of 82 respondents was attained.

In each and every category, random sampling was carried out using computer software known as Stat Trek random number generator to select individuals from the lists provided.

2.3 Research Procedures

Upon the research proposal approval by PELUM- Kenya, a preliminary meeting between the researchers and PELUM – Kenya Heads was held. The meeting was aimed at briefing both parties on modalities of the study, signing of the contract agreement and commissioning of the research. Researchers then went ahead to collect data using the consequent outlined methods. This was followed by data analysis, interpretation and development of a final report. The report was packaged in three ways; a PDF format; booklets and CD copies produced as back up material for each booklet.

2.4 Data Collection Instruments

Data collection instruments used included personal interviews, observations, questionnaires and an interview guide. The interview guide was most preferred as it allowed for longer and more complex interviews, had high response quality, took advantage of interviewer presence and acted as a multi-method data collection tool. Using the same tool, researchers were able to employ an analysis of available literature. Significantly, researchers trained interviewers to aid in carrying out the study.

Interview guides were both structured (close ended) and unstructured (open ended). This was essential since it allowed for face to face interactions between the researcher and the respondent in the course of oral discussions.

The questions had the following features:

i. Contained several response options hence respondents were able to identify with the preferred response accordingly.
ii. Provided two responses from which the respondent would select. Agree or disagree, yes or no.
iii. Provided several responses that were coded and ranked according to responses.
iv. Additional space to provide any observation that would further confirm the answer given or provide an explanation as to why the respondent differed.

A questionnaire was developed to serve as the interview guide and as a recording sheet. Researchers preferred to tour the respondent's farm together with the respondent so as to make use of the tools co-currently. During the tour, researchers observed and asked questions using the guide and recorded responses from the respondents. This helped in clarifying the answers given. The recorded results were check-listed using other information analyzed from literature review and recorded farming practices.

2.5 Data analysis

Statistical Package for Social Scientists (SPSS) was used to analyse quantitative data. Data collected was screened and coded before being key punched into a computer for analysis. Researchers analyzed the information gathered from the field in a systematic way making valuable conclusions and recommendations. Thematic analysis technique for qualitative data was also utilized and this enabled provision of answers to study questions.

Qualitative data was continually analyzed during field data collection. Field notes formed part of data recording.. Themes and the code categories were identified and inserted in the margins of the field notes and assembled together using different ink shades. This action enabled verification of data, uniformity, accuracy, consistency, legibility and comprehensibility after which data was finally coded manually. The coded data was fed into a Microsoft Excel spread sheet and analyzed using Statistical Package for Social Scientists (SPSS) software.

After collecting and coding the data, as well as backing it up into a spreadsheet, the data was later imported to SPSS where further statistical analysis was carried out. It is important to note that Data collected was given values according to the coding. This was followed by descriptive analysis which included Frequency of distribution tables and charts containing percentages and mean, and further cross-tabulated to evaluate the relationship among the variables.

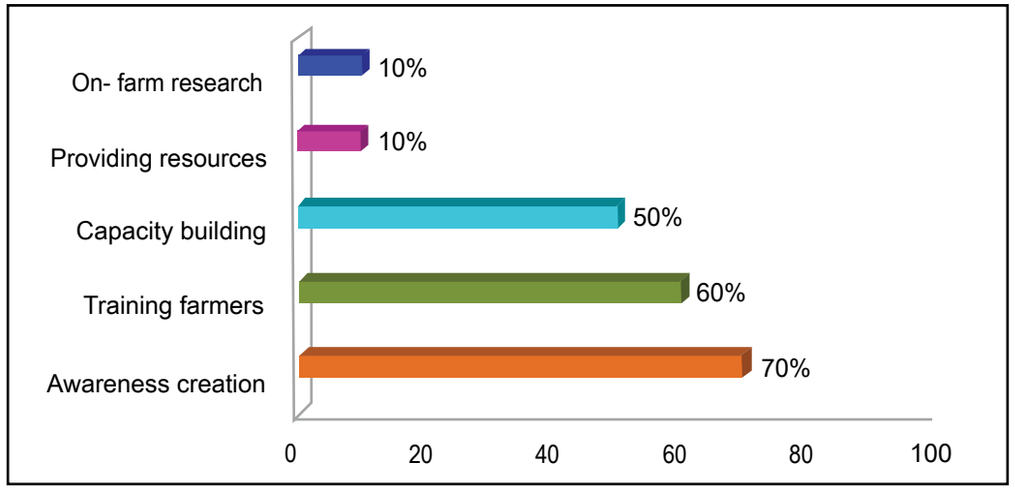
RESULTS, FINDING AND DISCUSSION

3.1.1 *elum* awareness and its influence on adoption rate

In the view of Awareness as a determinant of adoption rate, it was hypothesized that if sensitization on *elum* practices to the farmers was undertaken, there would be increased chances of adoption. Further, if the sensitization was done on the general public basis thereby reaching majority of the community if not all, then awareness would be enhanced greatly unlike the case where sensitization was done at the basis of a target group/audience only.

On this note Member Organizations were asked to state their roles in relation to *elum* promotion. It was revealed that, above everything else, the organizations emphasized on awareness creation scoring at 70%. Training was the second most emphasized role scoring 60%, capacity building scored 50% while provision of resources and on-farm research scored 10%. Details of these are seen in Figure 1 below.

Figure 1: Member Organizations' roles geared towards *elum* promotion



It was further revealed that though all the conventional farmers were aware of *elum* practices, only 50% of the conventional extension workers were aware. Therefore it can be argued that farmer to farmer approach is more linked as compared to promoter to promoter approach. What this further means is that at farmer level there is better information exchange and flow (regardless of the type of farming practice in use) whereas the extensionists (promoters) are less interactive in regard to information exchange and may often engage in what they know or have a background on. This depicts farmer to farmer mode of extension as being more efficient as compared to other modes of extension approaches.

In the same sense, *elum* promoters can be viewed as those who have widely created awareness among the farming and pastoralist communities. Though some of the conventional extension workers were never aware of *elum* as a training component to their curriculum, they demonstrated an inclusion of majority of the practices (such as legume cropping, terracing, composting and compost use, among others) within their training programmes.

3.1.2 Sensitization applied to create *elum* awareness to the farmers

The research sought to find out how awareness was created and as Table 1 below illustrates, four major sensitization channels were used to sensitize farmers about *elum* practices. Those interviewed included sustainable extension workers, sustainable farmers and conventional farmers. Majority of the extension workers rating at 92.3% said that they created awareness through group meetings. This can be the very reason why majority of the conventional farmers comprising of 46.7% revealed that such awareness is created by fellow farmers, while 50% of sustainable farmers had a face to face interaction with the extension workers. Awareness at general public meetings such as barazas was rated second by the extension workers with 46.2% but was however rated the least by both the sustainable and conventional farmers, with 17.5% of the former and 20% of the latter.

This was therefore classified as a narrow sensitization concentration along target groups that would have hindered a certain level of adoption. The situation is worsened by the fact that extension capability (empowerment) of the locals to perform further extension was not highly preferred as evidenced by only 7.7% saying that they engaged farmers in sensitizing others. On the other hand 22.5% of the sustainable farmers used this similar extension method for awareness creation. Quality of information passed on from one person to another was likely to suffer dilution if the farmers were not well informed on the subject matter. This was likely to hinder levels of adoption with gaps being identified in the messages provide.

Table 1: Sensitization applied to create *elum* awareness to the farmers

Descriptions	S.S.E.W		S.S.F		C.F	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Public Barazas	6	46.2%	7	17.5%	3	20%
At groups e.g. Agricultural gatherings	12	92.3%	11	27.5%	6	40%
Extension Workers on face to face	1	7.7%	20	50%	6	40%
Fellow Farmers	1	7.7%	9	22.5%	7	46.7 %

3.1.3 Mobilization methods applied to create groups for *elum* knowledge and information dissemination to the farmers

Further the research sought to find out how mobilization of farmers was carried out. The hypothesis stated that if the farmers, after being sensitized, mobilized themselves for training, it would then mean that they were willing to adopt to *elum* practices unlike the case where they joined groups either through 'pushing' or luring.

With regards to this and as illustrated on Table 2 below, Member Organizations (MOs) said that majority of the farmer groups comprising of 40% are mobilized through the extension workers aid, while 20% are those groups that are voluntarily formed by the farmers. Another 20% of the groups existed even before the organizations' started promoting *elum*. This differs to a certain extent with results provided from an analysis of the extension workers response. This group that comprised of 38.3% mentioned that majority of groups existed even before the start of *elum* concept. They claimed to aid 30.8% group formations, while self-mobilized farmers comprised of 7.7%. However, 15.4% of the extension workers did not respond to this question.

Self-mobilization scored equally to aided mobilizations, each favored by 27.5% of sustainable farmers. At least, 22.5% of the sustainable farmers existed as groups by the time *elum* awareness was created. Unfortunately, 20% of the sustainable farmers did not respond to this question. 33.3% of the conventional farmers said that farmers form groups voluntarily. 26.7% said that groups are formed through the assistance of extension workers. 13.3% said that a combination of existing groups , self-mobilization and aided mobilization were used to form groups to be trained on *elum* practices, (I.e. the farmer groups currently practicing elum were formed using a combination of a wide variety/range of techniques/processes, and not one distinct, isolated or specific process).

Table 2: Method of mobilization used to form groups to be trained on *elum* practices

Descriptions	By MOs		By S.S.E.W		By S.S.F		By C.F	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
None	-	-	2	15.4%	8	20%	3	20%
Self-mobilization	2	20%	1	7.7%	11	27.5%	5	33.3%
Aided mobilization	4	40%	4	30.8%	11	27.5%	4	26.7%
Existing groups	2	20%	5	38.5%	9	22.5%	-	-
Existing & Self-mobilization	1	10%	1	7.7%	-	-	-	-
Aided & self existing groups	1	10%	-	-	-	-	-	-
Both aided & self	-	-	-	-	1	2.5%	1	6.7%
Existing, aided & self	-	-	-	-	-	-	2	13.3%
Total	**10**	**100%**	**13**	**100%**	**40**	**100%**	**15**	**100%**

3.2.0 Attraction to *elum* practices due to witnessed or praised benefits

The benefits of practicing *elum* (cited during sensitization/promotion of *elum* practices, and/or the actual benefits witnessed from practicing *elum* at demonstration sites, contact farmers' plots, shows and exhibitions) were viewed as attractants that would trigger

adoption of the practices. Three categories of respondents were engaged in this process. These included Member Organizations, sustainable extension workers and sustainable farmers.

1. Aided mobilization is the one where farmers are mobilized by extension workers directly or indirectly.
2. Self-mobilization is where farmers mobilized themselves without influence of extension workers or any other developers.
3. Existing groups comprise of those farmers groups that were formed before being targeted by different organizations targeted for specific projects or programmes.

As illustrated in Table 3 below, different variables (benefits) scored differently among the three categories. Food security scored the highest, as rated by 60% of the Member Organizations representatives, 69.2% of sustainable extension workers and 50% of the sustainable farmers. Equivalently Member Organizations representatives ranked economic gains on the top. Efficiency in terms of production costs, healthy foods and a healthy environment rated 20% from the MOs respectively. The highest scoring variable was that of production sustainability with an 84.6% score as rated by sustainable extension workers. Efficiency in terms of production costs, healthy environment and improved livelihood rated at 30.8% respectively as reported by the S.S.E.W. Efficiency in terms of production cost was rated at 47.5% as recorded by S.F score. Famers also rated production sustainability at 40%, and healthy foods and environment at 25% respectively, while economic gains were rated at 17.5%.

Table 3: Benefits of practicing *elum*

Descriptions	MOs	S.S.E.W	S.S. F
Food security	60%	69.20%	50%
Efficiency in production	20%	30.80%	47.50%
Production sustainability	-	84.60%	40%
Healthy foods	20%	7.70%	25%
Healthy environment	20%	30.80%	25%
Economic gains	60%	7.70%	17.50%
Suppressed weeds, pests &diseases	-	-	10%
Knowledge build-up	-	-	10%
Full capacity farm utilization	-	7.70%	2.50%
Farmer independence	-	-	2.50%
Improved Livelihood	-	30.80%	-
Climate change mitigation	-	7.70%	-
Risk distribution	10%	-	-
Resilience	10%	-	-

This showed that there is likelihood for poor farmers adopting *elum* practices to enhance and sustain their food security at household levels at a lower cost of production, as well as register an economic gain. It also implied that environment and human health add to the potential benefits that can attract farmers to adopt to *elum* practices. Therefore the will or interest by the farmer to take up *elum* as a practice proved to be of major determinant to adoption of ecological land use management.

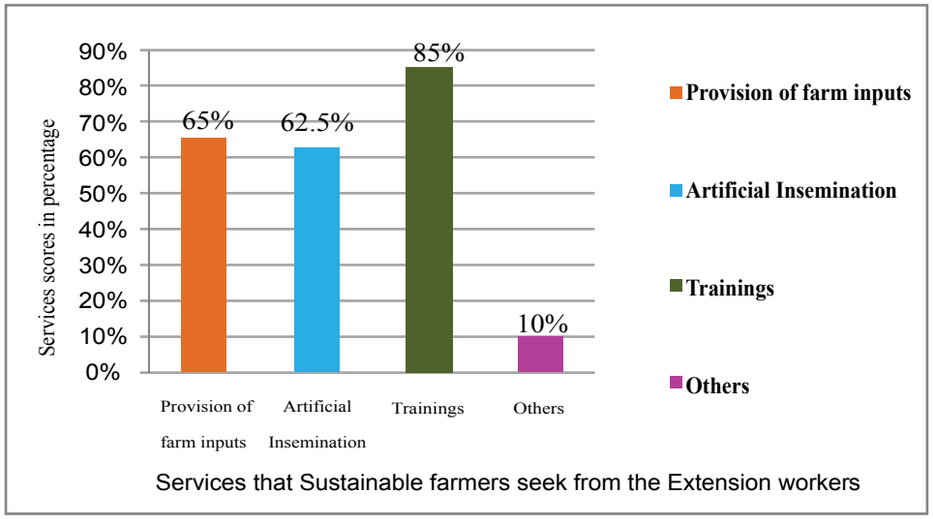
3.3.0 Extension services in relation to *elum* practices adoption

3.3.1 Services sought from extension service providers by sustainable farmers

The services that the farmers sought from the extension service providers were evaluated in order to further seek farmers' interests that would increase their adoption rate. It emerged that farmers' quest for knowledge and skills ranked highly with 85% of them seeking training on both production techniques as well marketing information voluntarily. These same farmers also mentioned on their need for farm inputs (65%) such as seeds and seedlings, breeding stocks among others, while 62.5% sought to improve their animal breeds and therefore required Artificial insemination services. At least 10% required other services such as financial management and table banking skills. Details of these are seen in Figure 2 below.

With provision of farm inputs scoring as much as 65% it should be noted that adoption of certain practices depends largely on the provision and availability of such inputs. Without such inputs/resources a slower adoption rate or non-adoption would be observed.

Figure 2: Services that Sustainable farmers seek from the Extension

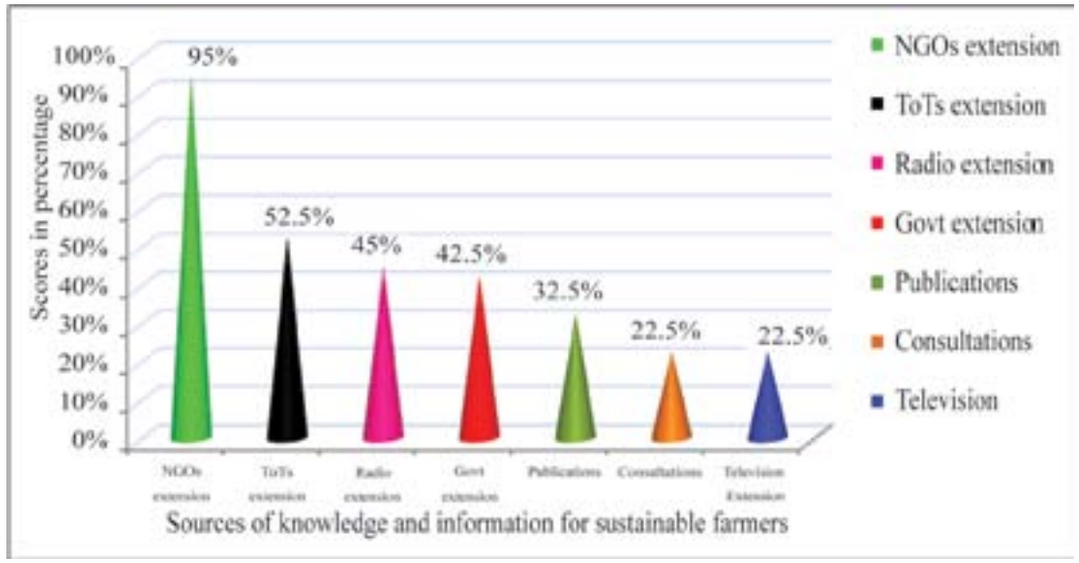


3.3.2 The sources of knowledge and information for sustainable systems farmers

The research sought to find out where sustainable farmers derived their knowledge and information from. It was revealed that extension services from non-governmental organizations (including community and faith based organizations) were the major sources of knowledge and information to the sustainable farmers comprising of 95%.

These organizations would further train some local representatives who would then train the rest in a farmer to farmer/trainers or trainers (TOTs) extension approach which rated at 52.5% by the sustainable farmers' cluster. Of the farmers, 45% listened to Radio programmes that gave information on agricultural issues, 42.5% accessed government extension services, 32.5% accessed books, magazines and other publications on agriculture, while those who watched agricultural television programmes or hired consultants where need be rated at 22.5%. Details of these are illustrated in Figure 3 below.

Figure 3: Sources of Knowledge & information for sustainable systems farmers



3.3.3 Government aids received by the sustainable farmers and their influence on *elum*

With government aided services reaching the farmers, a particular question was 'what were the services that the government provided to the sustainable farmers?' In line with Binns (2012), subsidies of market prices for unsustainable inputs (e.g. lower costs for synthetic fertilizer or electric power used for irrigation pumping), would thereby reduce competitiveness of more efficient and sustainable farming inputs and methods. Such services would lower adoption of the sustainable farming systems.

As illustrated in Table 4 below, it was revealed that 50% of farmers were receiving government aids. Those who received financial support were only 5%, with another 2.5% receiving both financial support and training. Those who received training only were 32.5%, while 10% were those who received other aids such as seeds. It was not clear however whether the training offered included information on *elum* practices but according to a few Ministry of Agriculture officers, training in *elum* formed part of their training notes in the absence of *pelum* programs. It was observed through that training programmes from the Ministry of Agriculture did not incorporate all aspects of *elum* practices.

Table 4: Cross tabulation of types of Government Aids received vs. sustainable farmer recipients

Receives Government Aids	Types of Government Aids received	Frequency	Percent
Receives	Grants/loans/financial support	2	5%
	Training	13	32.5%
	Others	4	10%
	Both training and financial support	1	2.5%
Do not receive	None	20	50%
Total		**40**	**100%**

3.3.4 *elum* dissemination methods

With training being the most sought services that farmers require, the research further investigated how *the concept on elum* was disseminated. This was geared towards evaluating the preferred dissemination methods against their effectiveness and therefore their implication on adoption rate. Both the Member Organizations and their extension workers revealed that a combination of tools and methods were necessary for successful dissemination of *elum* practices.

Training, both in theory and practice, in workshops, seminars, meetings as well as use of farmer to farmer extension scored 100% in both of the two categories with a further emphasis on farmer to farmer extension by 30% of the Member Organizations. Demonstrations and field days/exhibitions/model farmers attracted 50% of the MOs while extension workers further broke-down these methods into three; follow-up services, on farm demonstrations, exchange visits which was supported by 61.5%. Field exhibitions and/or field days were supported by 30.8% of the sustainable extension workers. 20% of the MOs were also pro-farmer field schools as well as exchange visits. (See Table 5 below for more details).

Table 5: *elum* dissemination methods			
Descriptions		Frequency	Percent
MOs	Farmer to farmer/TOTs	3	30%
	FFS/exchange visits	2	20%
	Demonstrations and field days/exhibitions/model farmer	5	50%
	Open forum debates/Networking	5	50%
	Trainings/seminars/workshops	10	100%
S.S.E.W	Training (Theory and practical), meetings, farmer to farmer	13	100%
	Follow-ups services, On farm demonstrations, exchange visits	8	61.50%
	Field exhibitions and/or field days	4	30.80%
	Radio talk shows and/or debates	1	7.70%
	Posters, magazines and/or documentaries	6	46.20%

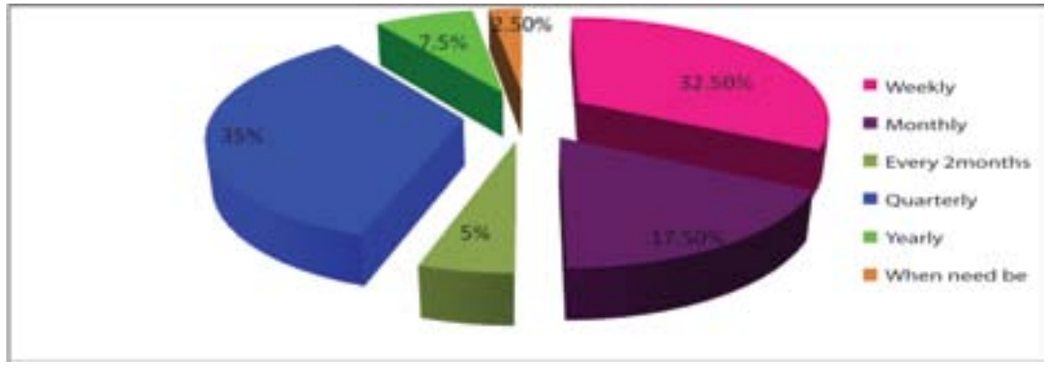
Open forum debates/networking was also preferred by 50% of the MOs, a classification that the extension workers prefered to split into two; Radio talk shows and/or debates indicated by 7.7% and posters, magazines and/or documentaries indicated by 46.2%. These methods of dissemination were considered appropriate and were expected to lead to immediate or early adoption due to the type of skills and knowledge developed.

3.3.5 Follow-up services and their impact to *elum* adoption

Most of all, follow-up services, on farm demonstrations and exchange visits were considered very essential and could not have been achieved without asking the farmers if they received follow-up services from the service providers.

All the farmers (both conventional and sustainable) said that they received follow-up services though at different times. 35% of the farmers received follow-up visits at a 3 month basis, 32.5% were visited at weekly basis, 17.5% were visited every month, 7.5% were visited once a year, 5% were visited every 2 months, while 2.5% were visited when need arose either through individual calls or by the extension workers. Details of these are illustrated in Figure 4 below.

Figure 4: Frequency of follow-up services



The differences in the number of visits to the farmers by the extension workers resulted from many factors. Researchers undertaking the study inferred that the frequency of visits depended on the experiences built by the farmers. Therefore older trained farmers required lesser visits than the newly trained farmers. Another assumption of the differences was the use of farmer to farmer approach which reduced the number of visits. This was with the assumption that farmers would manage activities on the ground to a certain extent even with the absence of extension workers. Contact farmers and model farmers would receive frequent visits while setting up demonstrations and organizing field days. It should be noted that though most of the farmers showed to have no or little problem with the frequency of visit (especially with the primary service providers), the link with secondary service providers was not as strong due to infrequent visits.

At some point, the researchers while collecting data noted a possibility of umbrella organizations reaching out to farmers for trainings while leaving the grass root organizations to make follow-ups. This may have attributed to slow adoption of *elum* practices that were pegged on training offered through such methods/programmes. Training of trainers and use of farmer to farmer extension as well as farmer field schools therefore received credit in terms of score rate.

3.4.0 Rating *elum* practices amongst diverse technologies

3.4.1 Prevailing or conflicting technology promotions

Other areas of concern that the study sought to understand were in relation to prevailing technologies that competed with *elum* promotion. The research sought to find out whether Member Organizations promoted any other practices other than those related to *elum*. As Table 6 below illustrates, 70% of the Member Organizations promoted other

practices and livelihood support programs other than *elum*, while 84.6% of the sustainable extension workers were engaged in disseminating not only ELUM but also other livelihood support technologies and or practices.

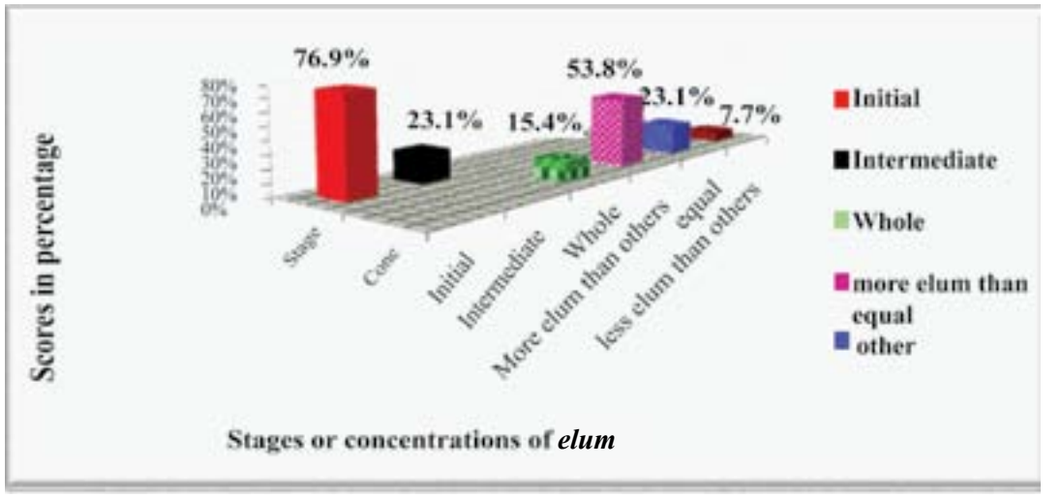
table 6: Promotion of other practices alongside *elum*

Descriptions	Member Organization Representatives		Sustainable Systems Extension workers	
	Frequency	Percent	Frequency	Percent
Yes	7	70%	11	84.6%
No	3	30%	2	15.4%
Total	10	100%	13	100%

3.4.2 Introductory stage of *elum* and its concentration

It was revealed that *elum* was introduced by majority of the promoters (76.9%) at the initial/early stages of engagement with the farmers while 23.1% introduced it at an intermediate stage.15% of the Member Organizations promoted only *elum* practices. 53.8% promoted more *elum* practices than any other practice. 23.1% promoted both *elum* practices and other practices equally, while 7.7% of Member Organizations promoted less *elum* practices than others. Details of these are illustrated in Figure 5 below.

Figure 5: *elum* introduction stage and its concentration



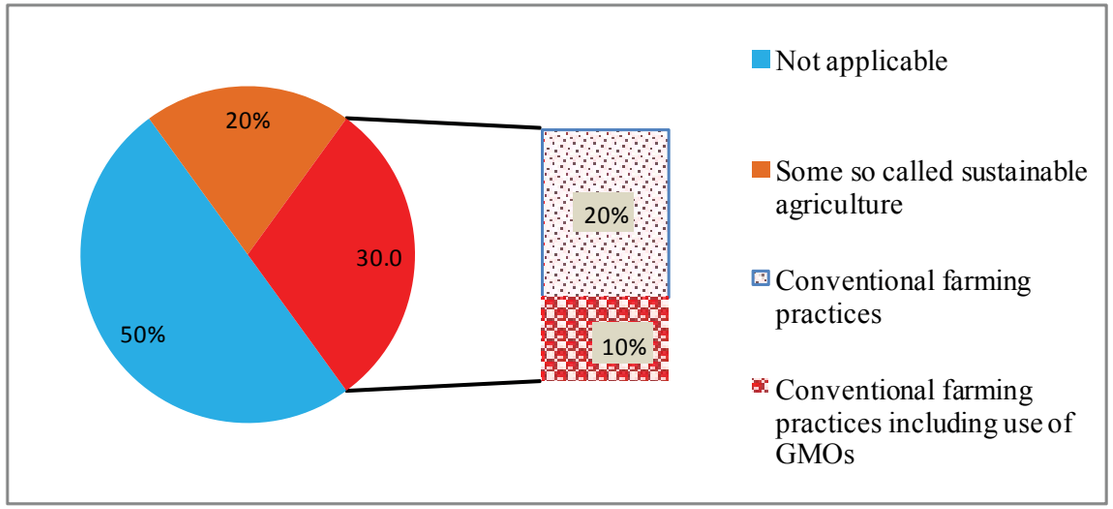
Adoption rate therefore differed among Member Organizations with some recorded to having quickly adopted to use of *elum* practices while others showed signs of laggardness.

3.4.3 Promoted livelihood practices or technologies that conflict with *elum*

Member Organization representatives said that some practices or technologies promoted to farmers conflicted with *elum* principles and therefore limited the rate of *elum* adoption.

As Figure 6 below illustrates, 50% of MOs did not experience such conflicts but the other 50% confessed to have faced resistance from fellow sustainable agriculture promoters who promoted some environmentally unfriendly practices such as use of artificial fertilizers. Conventional agriculture promotion ranged at 30% of the total with 10% of this promoting the use of Genetically Modified Organisms (GMOs).

Figure 6: Practices competing with *elum* and presented by Member Organizations

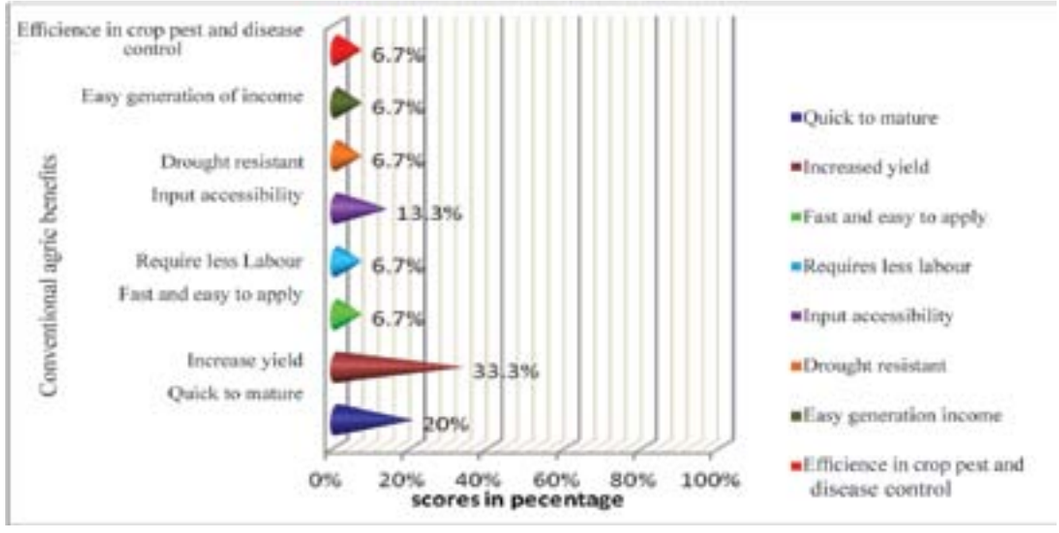


3.4.4 Benefits of Conventional Agriculture hindering adoption of *elum* practices

Conventional Agriculture farmers were asked to describe benefits behind conventional farming that may have hindered their conversion to sustainable production systems. It emerged that 33.3% believed that conventional agriculture offers better yields. 20% believed that conventionally grown crops mature earlier. 13% stuck to conventional production systems due to availability and accessibility of farm inputs at local agro vet shops. Fast and easy application, less labor requirement, drought resistant crop varieties, easy generation of income and efficiency in pest, diseases and weed control received 6.7% support each. Details of these are illustrated in Figure 7 below.

It should however be noted that most conventional farmers were practicing some form of ***elum*** practices while others were in the transition process of conversion to sustainable production systems such as organic farming system.

Figure 7: Benefits of Conventional Agriculture hindering adoption of *elum* practices



3.4.5 Current and previous production systems and their influence on practices adoption

Taking into account the production system that sustainable and conventional farmers used, it was hypothesized that this could also affect the speed at which *elum* practices were adopted. It was assumed that farmers who converted from traditional farming systems to sustainable systems were likely to adapt to *elum* practices faster as compared to those who converted from traditional systems to conventional systems. It is with an additional note that a certain percentage may never adopt at all. Those who practiced sustainable systems and are still in that system would adopt *elum* practices earlier and quite fast.

The results indicated that at least 97.5% of sustainable farmers are currently using sustainable farming systems. Only 2.5% of the respondents interviewed did not respond to the question regarding the kind of farming system they currently used as indicated in Table 7 below. Those who previously used conventional methods of farming constituted 45% while 27.5% of the respondents could not describe the system that they were using previously. 2.5% of the respondents used sustainable methods of farming previously.

Table 7: Previous and Current production system for both sustainable and conventional farmers

Description		Previous		Current	
		Frequency	Percent	Frequency	Percent
Sustainable	Not aware	11	27.5	1	2.5
	Sustainable system	1	2.5	39	97.5
	Conventional	18	45.0	-	-
	Parallel production	-	-	-	-
	Traditional	10	25.0	-	-
	Total	**40**	**100.0**	**40**	**100.0**
Conventional	Not aware	3	20.0	1	6.7
	Sustainable system	-	-	2	13.3
	Conventional	9	60.0	7	46.7
	Parallel	-	-	5	33.3
	Other/traditional	3	20.0	-	-
	Total	**15**	**100.0**	**15**	**100.0**

Adoption of ecological land use management practices *(elum)* by farmers who practiced traditional system previously was presumably dependent upon the availability of labor as well as capital. Those who currently use sustainable system are likely to adopt fast and early, while those who practiced conventional farming system could have a slow adoption rate or never adopt at all.

Results indicate that 6.7% of conventional farmers interviewed could not describe what kind of current farming system they were using. 13.3% were using sustainable farming system while 46.7% purely used conventional system. The rest 33.3% of farmers currently used both conventional and sustainable farming systems at the same time (Parallel system) as seen in Table 7 above.

Of the total conventional farmers, 20% of them indicated that they could not describe the farming system they previously used before converting to their current system of production. 60% utilized conventional system earlier while another 20% used traditional system and are still using the same system currently. In the case of conventional farmers, it was noted that there was a drop of 13.3% out of the total farmers who previously practiced conventional system. This can be argued to signal a positive indicator towards adoption of *elum*.

3.5 Reasons or difficulties causing farmers' resistance to full or partial adoption of *elum* practices

Member Organization representatives, sustainable systems extension workers and sustainable systems farmers were targeted to provide their views as to the reasons why farmers generally resist adoption of *elum*; either partially or wholly. Majority of the MOs comprising of 70% mentioned that bad attitude towards change and lack of commitment to practices that take long to yield potential results were some of the causes to low adoption of *elum* practices (See Table 8 below). This was backed by 60% MOs clarifying that slowness in achieving expected results and low levels of pesticide efficacy of the organic locally prepared pesticides (bio-rations) were such other reasons to low adoption of *elum* practices.

Some *elum* promoters were accused of not being transparent and therefore not passing adequate information to the farmers. 40% MOs believed that this was one of the major hindrances to adoption of *elum* practices. Another 40% (MOs) said that resistance to adoption of *elum* practices was due to the nature of the practice in terms of labor intensity or its close monitoring requirment (time consuming). 20% (MOs) believed that scarcity of resources led to low adoption of *elum* practices by farmers faced with difficulties in accessing to *elum* technologies. A major example identified was that of composting where poor farmers with small land holding faced a hard time to access vegetative matter needed for composting. Further a tie of 10% (MOs) on poor channel of information and distracted attraction by incentives from non-*elum* promoters was recorded.

Though labor constrains rated third among the major reasons of resistance, as reported by MOs, 53.8% of sustainable systems extension workers (S.S.E.W) were in agreement with this observation. This was so for 12.5% of sustainable systems farmers interviewed. 30.8% of the S.S.E.W also agreed that slowness in achievement of results created some resistance especially on farmers who had high expectations.

Lack of adequate knowledge (ignorance) and peer pressure from conventional farmers were both supported by 23.1% of the S.S.E.W. Four respondents (within the S.S.E.W cluster), each at 15.4%, agreed that other causes of low adoption to *elum* practices included unaffordable organic inputs as compared to conventional ones, lack of government support to *elum* practices, farmers' lack of commitment to the slow yielding practices and land tenure systems in relation to age that limited youth from accessing to resources such as land. At least 7.7% of the (S.S.E.W) reported inadequate support such as follow-up services; inadequate information and/or overreliance on certain cash crops as causes of resistance to *elum* adoption.

Table 8: Reasons or difficulties causing farmers' resistance to full or partial adoption of *elum* practices

	Descriptions	Frequency	Percent
M.O. Representatives	Farmers' negative attitude/lack of commitment	7	70%
	Slowness in achievement of results/Pesticide efficacy of bio-rations	6	60%
	Inadequate knowledge on *elum* practices/lack of transparency of the promoters	4	40%
	Labour intensive/time consuming	4	40%
	Scarcity of resources	2	20%
	Channels of information dissemination	1	10%
	Conservativeness of the farmers in adopting to change	1	10%
	Distracted attraction through incentives from non *elum* promoters	1	10%
S. Extension Workers	Labour constrains	7	53.8%
	High farmers' expectations vs. slow achievement of expected results	4	30.8%
	Ignorance	3	23.1%
	Influence by fellow conventional farmers and firms	3	23.1%
	Unaffordable organic inputs	2	15.4%
	Lack of government support	2	15.4%
	Lack of farmers' commitment	2	15.4%
	Age limits affecting access to resources/access	2	15.4%
	Support and follow-up	1	7.7%
	Inadequate information	1	7.7%
	Over-reliance on certain cash crops	1	7.7%
By Sustainable farmers	Labour intensity	5	12.5%
	Unreliability	4	10%
	Capital intensive	4	10%
	Inadequate training personnel	4	10%
	Lack of government support	3	7.5%
	Lack of resources	3	7.5%
	Slow plant growth	1	2.5%
	Time consumption	1	2.5%
	Seeds inaccessibility	1	2.5%

As mentioned above, majority of the sustainable systems farmers comprising 12.5% said that labor constrains limited their partial or full adoption to *elum* practices. 10% of the farmers considered some *elum* practices to be unreliable and/or capital intensive. Another 10% of these mentioned that services related to *elum* practices were inadequate due to lack of sufficient field officers available to provide them with information, training and follow-up services.

Lack of government support to *elum* practices in addition to inadequate resources necessary to undertake the practices were recorded as other difficulties faced by at least 7.5% of the sustainable systems farmers. 2.5% of the same farmers recorded poor crop

performance brought about by slow growth, seed inaccessibility and/or long periods taken to actualize certain practices considered to be complex.

3.6 Land use rights

By design, researchers of the study perceived land ownership to control the rights of the farmer in terms of choice of crops to grow, as well rights to make landscape changes such as formation of terraces, agroforestry among others. Those who did not own the pieces of land that they used for agricultural production would hardly adopt *elum* practices as they were thought to only guarantee better results in the distant future as compared to immediate benefits. A few of those that cared about nature could still, though reluctantly, adopt the practice for the common good of an enhanced and conserved environment. The research proceeded to find out ownership status of the land that the farmers were utilizing for agricultural production. The results are illustrated below:

Majority of the farmers (both sustainable and conventional) utilized the land that was personally owned and well backed by ownership of a title deed or that owned by a family member (see Table 9 below). Those who owned the land that they fully utilized were 72.5% of the sustainable farmers and 73.3% of the conventional farmers. This indicated that majority of the conventional farmers had the potential to adopt sustainable systems practices including long-term based land utilization, and were therefore not hindered by land ownership constrains.

Those who utilized land owned by a relative were 22.5% of the sustainable farmers and 26.7% of the conventional farmers. This category was viewed to have had limited control of the pieces of land that they used unless otherwise stated by the legal owners of the same piece of land. They were therefore limited in terms of the depth of involvement adopting *elum* practices. Furthermore, this kind of practice was believed to have long time effect on the land. To certain extents such farmers would by choice segregate some practices in favor of those that gave them faster results.

Further, the sustainable farmers used public or leased land, with 2.5% using public land while another 2.5% leased portions of land. Though some farmers in this category leased pieces of land that they utilized for agriculture, they were viewed as being the extreme poor. There was an assumption that this category of farmers could not afford external inputs hence shifted to other agriculture practices other than conventional practices.

Further on, such farmers were forced to practice sustainable farming not necessarily by choice but rather by their status quo. In this category, legal owners of land (public or private) had high controls on what type of enterprise to allow for farming within their respective farms. On the other hand, inadequate time by farmers to tend their land was reported

to be an additional impediment to adoption of elum; reason being, such farmers were forced by circumstances to seek additional income through being hired for labor in other farms. By so doing these farmers could then be left with limited time to tend their gardens except for those that acquired sizeable land for production. This is in line with PDMA - PaRRSA (2013), who reported that where farming alone cannot provide the income and employment needed for sustained livelihood and prosperity, many of these households experience food deficits and rely on remittances to meet their needs. As a result majority of the energetic men engage on off farm employment.

Table 9: Land tenure system for both sustainable and small scale conventional farmers

Descriptions	Sustainable farmers		Conventional farmers	
	Frequency	Percent	Frequency	Percent
Personally owned with title deed	29	72.5%	11	73.3%
Owned by a family member	9	22.5%	4	26.7%
Leased	1	2.5%	0	0%
Public	1	2.5%	0	0%
Total	40	100%	15	100%

Research questions related to Gender rights in land ownership were an inevitable. Though some farmers were reluctant to respond to this question, their significance was outweighed by the recorded high score of those that were in support of equal rights to land ownership as indicated in Table 10 below. 70% of the sustainable farmers and 80% of the conventional farmers said that women had equal rights to land ownership. This was highly supported by the newly voted Kenyan constitution of 2010. At least 10% of the sustainable farmers and 13.3% of the conventional farmers indicated resistance in allowing women to equally own land alongside the men. Though relatively new, the constitution's mandate to fight against women discrimination to resource accessibility and ownership was taking roots, something viewed as a potential to increase *elum* adoption.

Table 10 : Land tenure and gender

Descriptions	Sustainable farmers		Conventional farmers	
	Frequency	Percent	Frequency	Percent
Not applicable	8	20%	1	6.7%
Inequality	4	10%	2	13.3%
Equality	28	70%	12	80%
Total	40	100%	15	100%

3.7.0 *elum* classification and its implications to adoption rate

3.7.1 *elum* classification by sustainable and conventional farmers

Respondents were also asked to give their views regarding the nature of ecological land use management practices *(elum)* that they generally engaged in. It was postulated that the nature of *elum* in terms of practice was also limiting the adoption either in part or in full.

From the analysis above, it was found that, knowledge gap featured as one of the highest barrier inhibiting adoption of *elum* by both conventional and sustainable farmers constituting 57.5% and 53.3% respectively. 37.5% of sustainable farmers said *elum* practices were labor intensive while the percentage of conventional farmers stood at 46.7%. Another 53.3% of conventional farmers thought that *elum* practices were crop specific and that formed a major barrier to adoption compared to only 12.5% of sustainable farmers thinking otherwise. A slight difference in terms of gender sensitive perception as a barrier to adoption by both conventional and sustainable farmers was recorded with; 20% of conventional farmers saying that *elum* was gender sensitive and 17.5% of sustainable farmers having similar thoughts.

Regarding the question on capital intensiveness of *elum* practices, sustainable farmers perceived the practices to be quite capital intensive therefore scoring 15% way above the sustainable systems extension workers who constituted 7.7% as compared to conventional farmers who constituted 6.7%. Another 6.7% of conventional farmers indicated that *elum* practices were agro-ecological zone specific with 2.5% of sustainable farmers feeling the same. In addition, 38.5% of the sustainable systems extension workers admitted this to be the case as well. There were some differences between these two groups of farmers since 13.3% of sustainable farmers were not aware of the nature of *elum* practices. This can be seen in Table 11 below.

Table 11: *elum* classification by sustainable extension workers, sustainable and conventional farmers

Descriptions	Sustainable E. Workers	Sustainable farmers	Conventional farmers
Capital intensive	7.7%	15%	6.7%
Labor intensive	69.2%	37.5%	46.7%
Knowledge intensive	69.2%	57.5%	53.3%
Crop specific	7.7%	12.5%	53.3%
Gender sensitive	30.8%	17.5%	20%
Agro-ecological zone specific	38.5%	2.5%	6.7%
Not classified	0%	0%	13.3%

3.7.2 Gender roles and labor distribution among the sustainable vs conventional farmers

Due to such classifications as labor intensity and gender intensity, further the research sought to find out particulars of gender roles and labor distribution. As indicated in Table 12 below, none of the variables applied for comparative purposes indicated absolute results in regard to gender sensitivity for both conventional farmers as well as sustainable farmers. It however showed that some practices are best adopted by either women or men or would work best for married families where both male and female labor was available.

Of great interest to note is that men engage in pest and disease control practices as compared to women in both conventional and ecological systems. This meant that 42.2% sustainable farmers believed that this was a men's job and was similar to 53.3% of conventional farmers who felt the same. This was competing strongly with 52.5% of the sustainable farmers and 20% of the conventional farmers who believed that roles could be equally performed by either male or female. Only 5% of the sustainable systems farmers and 13.3% of conventional farmers believed otherwise. This similarly featured with effect to nursery establishment and management, soil and water conservation as well as agroforestry and tree planting practices where men took the lead role.

Table 12: Gender roles and labor distribution among the sustainable vs. conventional farmers

Descriptions	Sustainable farmers				Conventional farmers			
Practices	Female	Male	Both	N/a[4]	Female	Male	Both	N/a
Composting	12.5%	17.5%	62.5%	7.5%	13.3%	20%	53.3%	-
Tillage	10%	17.5%	72.5%	-[5]	13.3%	40%	33.3%	-
Nursery bed management	10%	32.5%	55%	2.5%	13.3%	33.3%	33.3%	20%
Planting	30%	5%	65%	-	40%	-	46.7%	13.3%
Watering	10%	7.5%	80%	2.5%	40%	6.7%	40%	13.3%
Pest and disease control	5%	42.5%	52.5%	-	13.3%	53.3%	20%	13.3%
Weeding	12.5%	5%	82.5%	-	33.3%	6.7%	46.7%	13.3%
Pruning	12.5%	37.5%	50%	-	26.7%	20%	40%	13.3%
Harvesting	22.5%	2.5%	75%	-	46.7%	-	40%	13.3%
Transporting	20%	7.5%	72.5%	-	13.3%	6.7%	53.3%	13.3%
Storage	45%	7.5%	45%	2.5%	46.7%	6.7%	33.3%	13.3%
Marketing	37.5%	15%	45%	2.5%	46.7%	-	40%	13.3%
Soil and water conservation	5%	50%	45%	-	6.7%	40%	40%	13.3%
Agro-forestry & tree planting	2.5%	40%	57.5%	-	6.7%	53.3%	26.7%	13.3%

[4] In this report N/a is used to signify the miss-out in a theme/category that makes it less than 100%.
[5] A dash was applied where a respondent did not have an answer that matched that theme/category in the open ended questions.

On the other hand roles such as planting, harvesting and storage practices were more inclined towards women for both sustainable and conventional systems. This was an indication that some practices would be less adopted depending on the gender of the tar-

geted farmers. Cultural beliefs in addition to labor were also perceived to affect the rate of adoption of certain practices. For example, agro-forestry practices were best suited for men in majority of the communities due to their unpopularity to have women climb trees for pruning purpose among others.

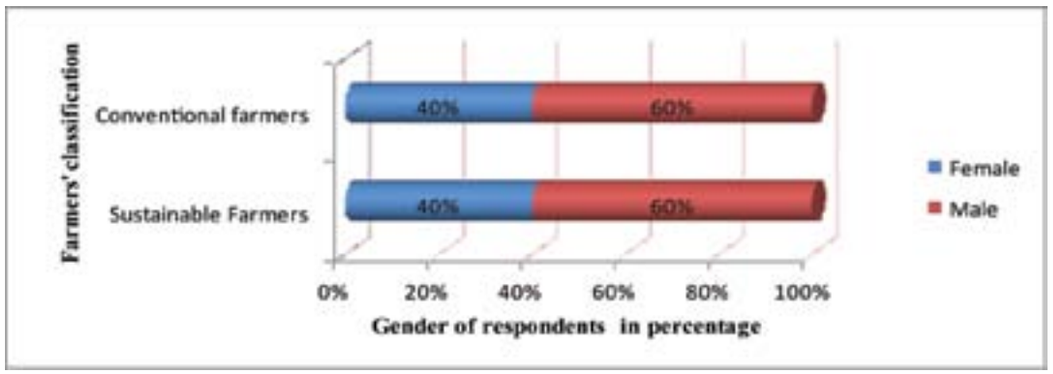
To confirm gender impact on *elum* adoption, the ratio between male and female in *elum* program was sought. Majority of the MOs comprising of 70% said that they mostly dealt with females as compared to males in the *elum* program as seen in Table 13 below.

Table 13 : Gender representation of *elum* farmers

Descriptions	Frequency	Percent
Not Applicable	1	10%
More males than females	1	10%
Equal males and females	1	10%
More females than males	7	70%
Total	**10**	**100%**

This however contradicted with the farmers' gender representation under the random selection method. As indicated in Figure 8 below, in both conventional and sustainable farmers, 60% were males while 40% were females. From this therefore gender sensitivity could not be considered as a potential determinant of the rate of adoption.

Figure 8: Gender representation among conventional and sustainable farmers



While knowledge intensity was a subject addressed by training and information sharing, labor would constrain even those who had the knowledge. This is supported by the fact that their families could not sustain farm labor requirements which resulted to slow or none adoption of *elum* practices. From Table 14 below, an indication is that in both systems the major labor source was by the family members. 50% of the sustainable farmers solely depended on family labor whereas 37.5% depended mostly on family labor. Casual labor was sought whenever need arose.

Further, 2.5% had pooled their individual family labor into group labor through combined efforts to accomplish duties in each member's farms. This created a social cohesion that the conventional farmers did not indicate. As revealed in this study, profitability of sustainable farming systems would offset labor constrains. This is confirmed by 10% of the sustainable farmers who had attained a level of becoming mere employers in the farming system; an additional category that conventional farmers did not have.

Conventional small-scale farmers largely relied on family labor too, with 53.3% being dependant on family labor and the rest (46.7%) would hire casual labor where need arose. This explained the potential of conventional farmers to resist adoption of *elum* practices since they were used to easily adoptable practices that rarely exceeded their family capability. Adopting *elum* for such farmers required the commitment to supply extra labor as well as extra capital to meet the cost of this additional labor supply.

Table 14: Labour Source in both Sustainable & Conventional Farmers

	Sustainable Farmers		Conventional Farmers	
Descriptions	Frequency	Percent	Frequency	Percent
Family Members	20	50%	8	53.3%
Hired labor	4	10%	0	0%
Both family & hired	15	37.5%	7	46.7%
Group labor	1	2.5%	0	0%
Total	**40**	**100%**	**15**	**100%**

3.8.0 *elum* present and possible future

3.8.1 Widely and least adopted practices as per MOs and sustainable extension workers and their impacts

Member Organizations as well as sustainable extension workers were asked to indicate the most widely and least adopted ecological land use management practice. According to the analysis, it was discovered that soil and water conservation practices emerged as the widely adopted practice by farmers as indicated by both sustainable extension workers and the Member Organizations. The score of this variable was similar with only a difference of 1.5% where MOs indicated a 60% adoption rate while that of sustainable extension workers stood at 61.5%.

This effect was associated with the direct benefits this practice had to farmers, for instance, increased yields which translated to enhanced income and food security. However, the same practice emerged the second most resisted practice at a 38.5% of the sustainable system extension workers and 10% of the MOs. This effect was associated with labor requirements and expected rate of returns by farmers. The average score therefore was 42.56% with its adoption being higher than the average rate.

38.5% of the sustainable extension workers reported wide adoption of different cropping systems as opposed to 50% reported by MOs. This therefore had some contradictions on what MOs thought to be the actual case and what sustainable extension workers had in view. The cropping systems reported a 44.25% mean score; MOs reported a slightly higher score than the mean. Enterprise diversification scored 53.8% from sustainable extension workers and 30% for MOs hence a mean of 41.9%. The reason for this practice being adopted at that considerable rate was due to its multiple benefits. For example, farmers that had diverse enterprises within their farms reported a gain in risk distribution, increased income and food security. This was backed by availability of resources for waste recycling. Such a single variable would highly increased the adoption rate.

Table 15: Widely and least adopted practices as per MOs and sustainable extension workers

Descriptions		MOs		S.S.E.W	
		Frequency	Percent	Frequency	Percent
Widely adopted practices	Soil and water conservation	6	60%	8	61.5%
	Cropping designs	5	50%	5	38.5%
	Enterprise diversification	3	30%	7	53.8%
	Seed banking	3	30%	2	15.4%
	Agroforestry	2	20%	7	53.8%
	Composting	2	20%	9	69.2%
	IPM/EPM	2	20%	4	30.8%
	Tillage techniques	2	20%	4	30.8%
Least adopted practices	IPM/EPM	6	60%	4	30.8%
	Soil and water conservation	1	10%	5	38.5%
	Composting	3	30%	-	-
	Seed banking	1	10%	2	15.4%
	Environmental conservation	2	20%	1	7.7%

Agroforestry was also a widely adopted practice that scored 53.8% as per the extension workers in relation to a 20% score from MOs. The average was 36.9%. This score was attributed to agroforestry benefits. For instance, availability of building materials, fodder for animals, and resources for composting and other environmental goods like carbon sinks and shade. Composting scored 69.2% (S.S.E.W) as one of the most widely adopted practice by farmers. This was due to the positive effects compost had on farms since it aided in increasing food productivity, improved soil structure, and saved capital, provided healthy foods among others. 20% of the MOs said composting is widely adopted while 30% had a different opinion. It is postulated that farmers would find it difficult to adopt composting as a practice due to either lack of composing materials or the high labor requirements in its production.

Seed banking scored 30% from MOs and 15.4% for sustainable extension workers. This was thought to be important since famers had a source of inputs for the next season/

saved capital, and improved breeds, non-dependency on commercial companies among other benefits. However, 10% of the MOs and 15.4% of the S.S.E.Ws listed seed banking as the least adopted *elum* practice. This was attributed to availability of a wealth of information disseminated to them regarding other competing practices such as promotion of hybrid seeds. Tillage techniques scored 30.8% as per the extension workers in addition to a 20% score from the MOs, hence an average score of 25.4% adoption. The difference was not huge therefore; these practices were thought to be beneficial to farmers for they reduced the cost of production.

IPM and EPM emerged as the least adopted practice scoring 60% as per the MOs response and 30.8% as per the extension workers response. Only 30.8% of the S.S.E.Ws and 20% of the MOs reported that IPM and EPM were being widely adopted. Their adoption therefore averaged at 42.56%. This resistance was thought to emanate from low pesticide and knowledge intensity that these practices required during pest and disease control in the field. Another least adopted practice was environmental conservation ranked bottom most in the category of the least adopted practices for both MOs and extension workers. This was characterized by farmers' belief on its slow rate in guaranteeing quicker benefits.

3.8.2 Possibility of fast adoption of *elum*

This was a straight forward question aimed at seeking the opinion of promoters on whether the practices they promoted had potential for fast adoption or not. Slow adoption is what most of the Member Organization representatives and the sustainable systems extension workers indicated comprising 70% of the former and 61.5% of the latter. Those who believed that *elum* practices could be adopted fast were 30% of the Member Organization representatives and 38.5% of the sustainable systems extension workers, (See Table 16 below). This was an indication that the success of any adoption was subject to time and that premature evaluation would lead to poor results.

Table 16: Possibility of Fast adoption of *elum* practices

Descriptions		Frequency	Percent
Member Organization representatives	Can be adopted fast	3	30.0
	Cannot be adopted fast	7	70.0
	Total	10	100.0
Sustainable systems extension workers	Can be adopted fast	5	38.5
	Cannot be adopted fast	8	61.5
	Total	13	100.0

3.8.3 Challenges/difficulties faced by *elum* promoters while promoting the practice

The question posed to respondents in regard to challenges faced by *elum* promoters was aimed at uncovering the underlying obstacles that promoters of this practice faced during their day to day work.

Table 17: Challenges during *elum* promotion

Descriptions	M.O.Rs		S.S.E.W	
	Frequency	Percent	Frequency	Percent
Lack of government support	9	90%	-	-
Farmers' slow adoption/resistance to change	9	90%	7	53.8%
elum practices being tedious and labor intensive	7	70%	-	-
Poverty level	-	-	9	69.2%
Low farmers attendance/participation/ initial resistance	6	60%	-	-
Insufficient resources to reach farmers efficiently	4	40%	7	53.8%
High competition and/ or Anti-*elum* campaigns from conventional practitioners	4	40%	7	53.8%
Poor infrastructures	-	-	4	30.8%
Difficult situations such as climate change or extremely infertile soils	-	-	4	30.8%
Poor time management by the farmers	2	20%	-	-
Lack of harmonized curriculum resulting to duplication of practices	-	-	2	15.4%
Farmers having very high expectations	1	10%	2	15.4%
Lack of supportive facilities such as organic agro-vets and shops	1	10%	-	-

As indicated in Table 17 above, 90% of the Member Organization representatives said the greatest challenge that they faced was lack of government support towards elum practices. It was in their view that if *elum* practices were disseminated through government line ministries, a faster and wide adoption of the practice would be realized. Another 90% indicated that farmers took long in taking up the concept of *elum* practices as introduced to them hence classified as a challenge to increased adoption of the practice. A total of 53.8% of the sustainable systems extension workers attested to this. In average therefore, 71.9% of the promoters perceived farmers' slow adoption as a challenge to promotion of *elum* practices. This was attributed to the fact that farmers perceived *elum* to be labour intensive. However, many of the MOs practiced a general integrated system of Agriculture which hindered or confused farmers on the choice of uptake.

The nature of *elum* practices being perceived to be labor intensive and tedious was again a challenge that 70% Member Organization representatives faced. Farmers involved in *elum* programmes and had poor soils posed a challenge to adoption of uptake as faced by 69.2% of the sustainable systems extension workers. Initial resistance that resulted to low farmers' participation was a challenge that 60% Member Organization representatives faced. Insufficient resources (such as funds and assets like motorbikes) to reach farmers efficiently challenged 40% of member organizations and 53.8% of sustainable systems extension workers. Equivalent to this challenge was high competition and/or Anti-*elum* campaigns from the conventional side.

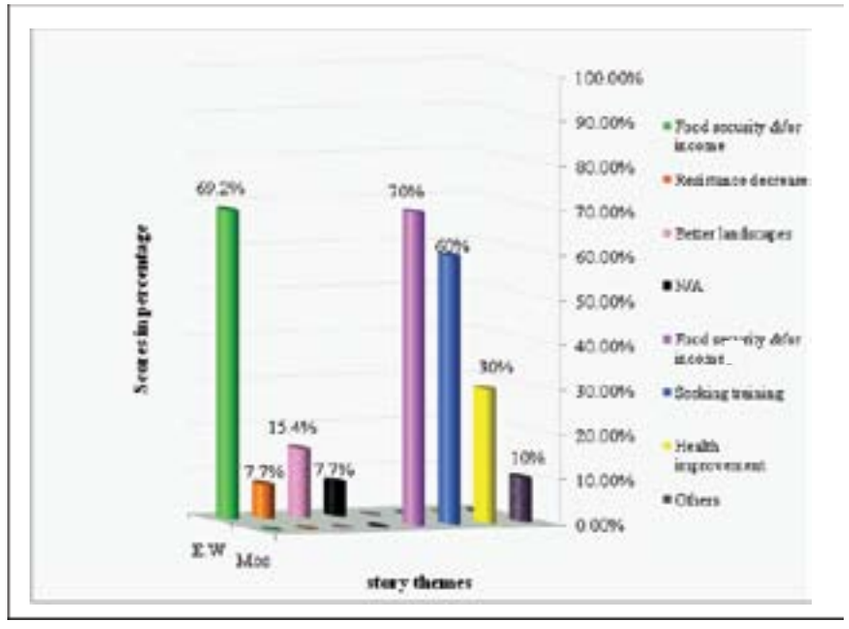
Poor infrastructure such as roads as well as difficult situations such as climate change or very infertile soils challenged 30.8% of the sustainable systems extension workers each. 20% of the Member Organizations' farmers were poor time managers thereby costing them in terms of time wasted versus the turn-up level during training. Lack of harmonized curriculum resulting to duplication of practices was a challenge reported by 15.4% of the sustainable systems extension workers. Farmers having very high expectations were a challenge to 10% of the MOs as well as upto 15.4% of S.S.E.W. Another 10% of the MOs reported a challenge in lack of supportive facilities such as organic agro-vets and shops.

3.8.4 *elum* success evaluation

Benefits of *elum* would remain in documentation format unless practical successes were reported from the field. The future of adoption required success in its previous practices. As indicated in Figure 9 below, Member Organizations and their extension workers had witnessed the success of *elum* hence 100% (MOs) and 92.3% extension workers mentioned this to be true.

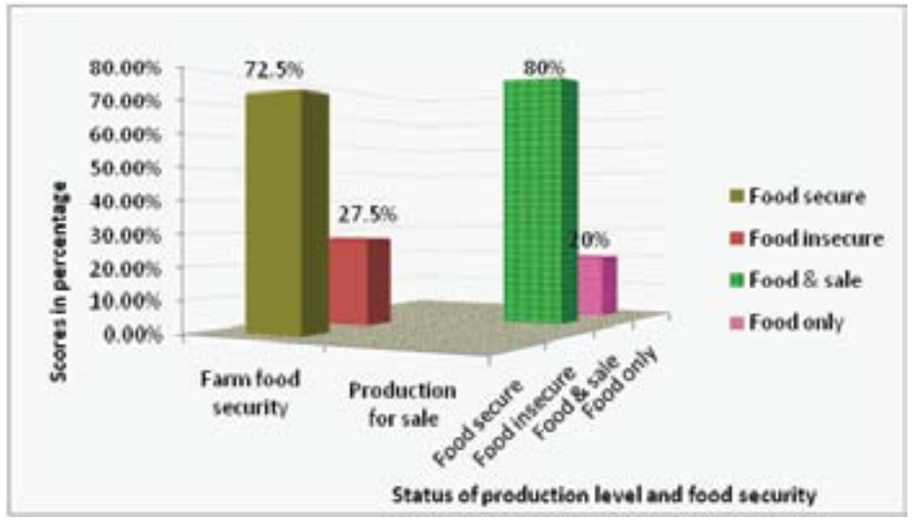
The stories they gave were evaluated into several themes that included: improved livelihood due to food security and/or increased income (70% of Member Organizations and 69.2% of the sustainable extension workers); farmers who first resisted to change were now adopting as narrated by 7.7% of the sustainable extension workers; embraced practices by farmers and more farmers seeking to be trained as narrated by 60% of the Member Organizations; health and livelihood improvement narrated by 30% of Member Organizations; mixed themes successes as narrated by 10% of the Member Organizations; better landscapes with better soils and microclimate narrated by 15.4% of the extension workers. 7.7% of the extension workers did not narrate any success story.

Figure 9: Theme of successful story about *elum*



From the farmers, the great determinants used to measure the success of practicing *elum* were food security and farm economic gain. The sustainable systems farmers were used to determine evidenced success. In regard to food security, 72.5% were food secure while 27.5% did not fully depend on their farm production for food security. Concerning farm economic gains, 80% of the farmers had surplus gain while 20% concentrated on food crops and not exceeding what they would consume. Details of these are illustrated in Figure 10 below.

Figure 10: Food security and production for sales status



3.8.5 Suggested way forward by the farmers

The farmers emphasized on continued training supported by 65% sustainable farmers and 86.7% of the conventional farmers (see Table 18 below). A proposal was that sensitization on *elum* be improved so as to reach out to more farmers to enable increased adoption. This was called for by 30% of sustainable farmers and 6.7% of the conventional farmers. Agencies and government support were suggested to be a positive move towards adoption by 20% of the sustainable farmers and 13.3% of the conventional farmers. Sustainable farmers (12.5%) also suggested for increased resources and financial support to ease adoption. 10% of farmers already trained to lead by example suggested the presence of improved information delivery modes that would keep the farmers knowledgeable. This would reduce chances of ignorance by farmers. Another suggestion was that extension personnel should work towards linking farmers to better markets.

Conventional farmers suggested an increase on the number of extension workers providing *elum* information, training and other services (6.7%), farmers to be given motivation and/or incentives (6.7%), and vigorous demonstrations to be carried out in order to create a clear picture of what *elum* can deliver (6.7%). Frequent demonstrations on elum were also suggested by 2.5% of the sustainable farmers.

Table 18: Way forward suggested by the farmers for the promotion of *elum*

Descriptions	S.S.F		C.F	
	Frequency	Percent	Frequency	Percent
Need to be more trainings	26	65%	13	86.7%
Improved sensitization	12	30%	1	6.7%
Agencies and Government to support *elum*	8	20%	2	13.3%
Resources and financial support	5	12.5%	-	-
Leading example farmers	4	10%	-	-
Improved information delivery	4	10%	-	-
Link to market	3	7.5%	-	-
Increase on the Extension workers in No.	-	-	1	6.7%
To be given motivation	-	-	1	6.7%
To be given incentives	-	-	1	6.7%
Vigorous demonstrations	1	2.5%	1	6.7%

CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The research aimed at assessing the barriers to adoption and consequent conversion to agricultural ecological land use practices as well as seeking to investigate the level at which *elum* practices were being adopted in addition to reasons hindering adoption. Various hypothesized barriers were used to test their impact with regards to barring adoption as well as testing the adoption itself. With the use of five categories of respondents within the agro ecological zones where PELUM Member Organizations operate, the following key findings were outstanding as the answer to the research objectives:

- Lack of government support towards *elum* practices; it was viewed that if *elum* practices were disseminated through government line ministries, faster and wide adoption would be realized. This may have also had an adverse effect on the capacity of promotion due to the fact that the private sector had to compete with the government both for niche and for resources such as staff. A high competition and/or Anti-*elum* campaign from the conventional side was an obvious case.
- Farmers were viewed as a challenge since their rate of adoption was very slow and majority resisting change. They were also poor time managers hence promoters spent a lot of resources to convince a small population per time. Severally farmers were said to have very high expectations not realizable within the time limits considering slow returns from *elum* practices.
- The nature of *elum* practices being labor intensive and tedious.
- High poverty levels among the target population whose resources were exhausted.
- Insufficient resources (such as funds and assets like motorbikes) to reach farmers efficiently.
- Poor infrastructure in the rural areas such as roads.
- Challenging situations such as climate change or very infertile soils; this was a challenge to both promoters and the farmers.
- Lack of harmonized curriculum resulting to duplication of practices and misinformation.
- Lack of supportive facilities such as organic agro-vets and shops as compared to the conventional system.
- Land ownership was found not a hindrance to adoption of *elum* practices since majority of both conventional and sustainable systems farmers personally owned the pieces of land that they cultivated. A few however, were perceived to have had limited land use rights and would therefore hardly adopt *elum* practices especially those without immediate benefits since they guaranteed better results in future.

It was revealed however that majority of practices within *elum* were easily adopted beyond the Member Organizations' scope of coverage. This meant that such a study should be split into more than one phase. *elum* practices seemed to attract both conventional and sustainable systems farmers therefore, since there was a great demand for environmentally friendly practices, adoption of *elum* by conventional farming systems gained ground with the Ministry of Agriculture and Ministry of Livestock. In this, the major driving force for adoption of *elum* were production sustainability, food security, economic gains, reduced production cost, production of healthy foods and having a healthy environment.

4.2 Recommendations

Following the outcomes of this research, the following were the recommendations that could increase *elum* adoption as would be expected as wished:

- A harmonized *elum* curriculum with well outlined principles and practices should be worked upon to avoid duplication of practices and mis-information.
- Lobbying government to ensure that there are favorable policies that support *elum*. The government should also solve land tenure crisis to ensure that the farming community owns the land they used for production so that they can be good stewards of such resources.
- PELUM should popularize the *elum* holistically to government line ministries and to all other organizations that reach farmers so as to eradicate conflict in *elum* dissemination.
- Widely and deep sensitization should be emphasized by all key players to eliminate any negativity among the farmers and pastoralists thereby boosting the attitude and commitment among the farmers and pastoralists towards elum practices.
- Government and funding community should emphasize their support to the resource poor farmers and pastoralists through incentives, financial and resources support to facilitate rehabilitation of depleted land to condition that favor elum sustainability.
- Government should enhance development of the rural areas by provision of quality infrastructure that will not only improve the information flow but also boost the rural livelihood by enhancing fast and reliable transportation of produce to markets.
- Being a participatory program, PELUM and Member Organizations should work upon a platform where willing farmers would become manufacturers and suppliers of sustainable farming systems inputs acting as local agro-vets. This would boost adoption since some farmers prefer purchasing of inputs compared to their manufacture. It would also boost economic gains of those utilizing the opportunity. This is in addition to educating those farmers who view the practices as being labor intensive and tedious.

- Among others, *pelum* should initiate a favorable marketing platform for *elum* practitioners through: sensitizing the consumers on the importance of consuming sustainably produced food and fibre, establishing a cheap and accessible certification program for the producers that would ease their marketing, facilitating produce collection and supply to reduce brokerage which often frustrates producer efforts with mingle returns for their produce.

Areas of further studies

- A further study may be conducted to evaluate time allocation for non/slow income generating *elum* practices versus income generating activities and its influence on adoption rates.
- Further research is needed to evaluate the impacts of *elum* on climate change mitigation and adaptation and social-economic status among those involved.

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Appendix

The agro-climatic zones of Kenya (Sombroek, et al., 1982 Cited in Infonet-Biovision, 2012)

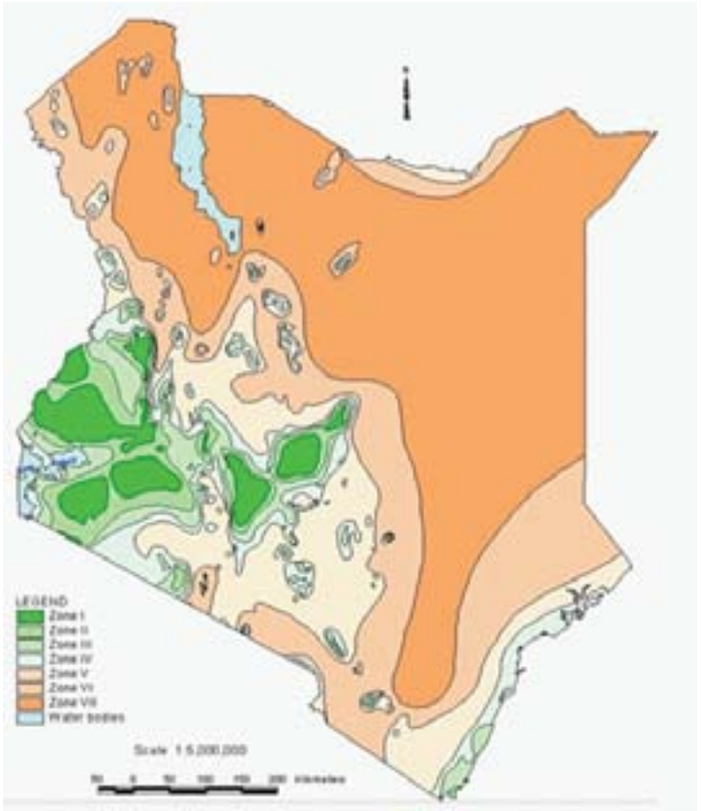

Table 19: Summary description of Kenyan Agro-Ecological Zones	
Zone	**Description summery**
I. Agro-Alphine	Source of rain and some rivers/streams
II. High Potential O	ccurs as a forest or open grasslands
III. Medium Potential	The most significant for agricultural cultivation
IV. Semi-Arid H	ome of most Acacia trees and shrubs
V. Arid L	ow trees and shrubs
VI. Very arid	Semi desert and is the driest part of Kenya
VII. Saline desert S	alt desert with very sparse salt bushes
Rest (waters etc)	Water bodies

Source: Developed with aid reference from Infonet-Biovision, (2012).

This research considered these agro-ecological zones as a guide for sample selection to ensure proper representation of the respondents within the whole PELUM Kenya area coverage.