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# Assessments of Farmer's Indigenous Knowledge on Conservation Agriculture in Different Agro-Ecologies of Ethiopia

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***Abstract:*** **This study was carried out to analyze indigenous knowledge practices of conservation agriculture employed by farmers in some district of Ethiopia. A total of 121 farmers were randomly selected from three district of Ethiopia Oromia regional state. Questionnaire and FGD interview were used to obtain information from the respondents. Descriptive statics and Chi Square test were used to analyze data collected. Results showed that 25.6% of respondents agree climate change affects the crop production 20.7% reported that shortage of farm land was serious problem and 19.8% of the respondents are in agreement that deterioration of soil fertility was problem of the farming systems. 92.67 % of the respondent was applied inorganic fertilizer 84.3% of the respondents use organic fertilizers like FYM (farm Yard Manure) and Compost. Chi-square test also shows that there is significant difference ($\chi 2=54.233^{a}$, p=0.000) between farmers exercising fallowing but there is no significant difference ($\chi 2=2.983^{a,}$ p=0.668) in using placing of crop residue on farm plot. the most widely used forms of organic fertilizers are manure, house hold garbage and humus because of lack of capacity to buy inorganic fertilizer 86.1% of the respondents confirmed that highly inclined to use their own indigenous knowledge of fertility maintaining mechanisms. 13.1% of the respondents appeared to be indifferent. Chi-square test also shows that there is significant difference ($\chi 2=65.463^{a}$, p=0.000) between farmers adopting indigenous knowledge of applying compost on farm lands. Therefore before adopting such indigenous knowledge, integrating it into development programs, practices need to be examined for their appropriateness just as any other technology. It is very clear that there is much to be learned from the indigenous knowledge systems of local people. The recommendation for Ethiopian farming system all the academics, policy makers, development partners should pay greater attention to this very useful wealth of knowledge that is in jeopardy by disappearance.**

***Keywords:*** **Indigenous knowledge, Conservation agriculture.**

## 1. INTRODUCTION

Indigenous knowledge can play a key role in the design of sustainable agricultural systems, increasing the likelihood that rural populations will accept, develop, and maintain innovations and interventions. It can be defined as the sum of experience and knowledge of a given rural community that forms the foundation for decision-making in the features of well-known and unknown problems and challenges.

During the past decade, the world has lost a third of its arable land, about 430 million hectares (FAO. 2016). Conservation Agriculture is a farming system that can prevent such losses while regenerating degraded lands. It promotes maintenance of a permanent soil cover, minimum soil tillage, and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and improved and sustained crop production. In many countries, intensive crop production has depleted soils, to the extent

that future production in these areas is jeopardizing. Conservation Agriculture is 20 to 50 percent less labor-intensive and thus contributes to reducing greenhouse gas emissions through lower energy inputs and improved nutrient use efficiency. At the same time, it stabilizes and protects soil from breaking down and releasing carbon to the atmosphere**.**

Indigenous conservation agriculture has value not only for the culture in which it evolves but also for agricultural researchers and planners motivated to improve conditions in rural localities integrating indigenous knowledge into climate change policies can lead to the development of effective adaptation strategies that are cost-effective, participatory and sustainable.

Natural resource conservation is a fundamental concern for many developing countries where non-labor inputs in agriculture are insignificant and agricultural land the basis for the endurance of the vast majority of the population in an urban and rural area (Barbier, 2003) Indigenous technical knowledge is a new focus in development circles. Growing numbers of scientists and organizations are recognizing that it offers cheap, locally adapted solutions to development problems, or that it can be bonded with scientific knowledge to boost productivity and living standards. But, most indigenous knowledge is not written down it is held in people's heads, passed down from one generation to the next by word of mouth. Indigenous knowledge refers to the perception that farmers have about their natural and social environment, which they use to adopt, and develop technologies to their local context. Indigenous practices are aimed at impressive local priority problems. Although they survived the challenges of changing biophysical and socio-economic environments through continuous responsive changes and adaptations, indigenous practices are not perfect. Today, indigenous knowledge is seen as pivotal above all in discussions on sustainable resource use and balanced development (Brokensha et al. 1980; Compton 1989; Gupta 1992; Niamir 1990; Warren 1990). Indigenous traditional local farmers knowledge in the rural area is assumed that as a contrast to the views of many earlier theorists, who saw traditional knowledge and institutions as obstacles to development.

## 2. LITERATURE REVIEW

Indigenous knowledge is the local knowledge – knowledge that is unique to a given culture or society. IK contrasts with the international knowledge system generated by universities, research institutions and private firms. It is the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities. (Warren 1991) 'Indigenous' people refer to a specific group of people occupying a certain geographic area for many generations. They possess, practice and protect a total sum of knowledge and skills constitutive of their meaning, belief systems, livelihood constructions and expression that distinguish them from other groups (Dondolo, 2005: Hoppers, 2005; Nel, 2005; Masoga, 2005) Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area. The immediate and intimate dependence of local people on natural resources resulted in the accumulation of indigenous knowledge that helped people to adapt and survive in the environments in which they live. It is local knowledge that is unique to a given culture or society and the base for agriculture, health care, food preparation, education, environmental conservation and a host of other activities (Thomas, 1995). Indigenous knowledge is a body of knowledge built up by a group of people through generations of living in close contact with nature and it is cumulative and dynamic. The complex knowledge, beliefs, and practices are generally known as indigenous knowledge develops and changes with time and space. Hence, such knowledge includes time-tested practices that develop in the process of interaction of humans with their environment (Alcorn, 1984).

Indigenous knowledge is a locally owned and managed resource can be particularly effective in helping to reach the poor since indigenous knowledge is often the only asset they control, and certainly one with which they are very familiar. Utilizing indigenous knowledge helps to increase the sustainability of development efforts because the indigenous knowledge integration process provides for mutual learning and adaptation, which in turn contributes to the empowerment of local communities. Since efficiency, effectiveness, and sustainability are key determinants of the quality of development work, attaching.

Rural people have an intimate knowledge of many aspects of their surroundings and their daily lives. Over centuries, people have learned how to grow food and to survive in a sometimes difficult environment. They know what varieties of crops to plant, when to sow and weed, which plants are poisonous and which can be used for medicine, how to cure

diseases and how to maintain their environment in a state of equilibrium. This "indigenous knowledge" is a valuable resource for development it can be equal to or superior to the scientific know-how introduced by outsiders.

Indigenous knowledge is an important part of the lives of the poor. It is an integral part of the local ecosystem. IK is a key element of the "social capital" of the poor; their main asset to invest in the struggle for survival, to produce food, to provide for shelter or to achieve control of their own lives. Indigenous knowledge also provides problem-solving strategies for local communities and helps shape local visions and perceptions of environment and society

It is important to note, however, that not all indigenous practices are beneficial to the sustainable development of a local community; and not all IK can a priori provide the right solution for a given problem. Typical examples are slash and burn agriculture and female circumcision. Therefore, before adopting IK, integrating it into development programs, or even disseminating it, practices need to be scrutinized for their appropriateness just as any other technology. In addition to scientific proof, local evidence and the socio-cultural background in which the practices are embedded also need consideration in the process of validation and evaluation.

Indigenous practices can generally adapt in response to gradual changes in the social and natural environments, since indigenous practices are closely interwoven with people's cultural values and passed down from generation to generation. However, many IK systems are currently at risk of extinction because of rapidly changing natural environments and economic, political, and cultural changes on a global scale. Practices can disappear, as they become inappropriate for new challenges or because they adapt too slowly. Moreover, many local practices may also disappear because of the interference of foreign technologies or development concepts that promise short-term gains or solutions to problems without being capable of sustaining them.

An understanding of indigenous knowledge and customs can help the development planner to establish a more flexible position to suggest project alternatives or innovative mitigate measures, in order to avoid involuntary damage to the ecosystem or culture. Conservation Agriculture is a farming system that maintains a permanent soil cover to assure its protection, avoids soil tillage, and cultivates a diverse range of plant species to improve soil conditions, reduce land degradation and increase water and nutrient use efficiency. It enhances biodiversity and natural biological processes above and below the ground surface for improved and sustained crop productivity.

## 3. RESEARCH METHODOLOGY

**Description of the Study Area**

The study were conducted into three different agro-ecological district of Oromia region namely Walemera which is found in the western part Shewa Oromia region 21Km from Addis Ababa capital city of Ethiopia and situated 8° 54' 59.99"N to 38$^{o}$ 34' 59.99"E with an altitude of 2390 masl. Degeme the second district located at the northern Shewa part of Oromia 98Km far from Addis Ababa and situated 9$^{0}$ 48$^{0}$N 38$^{0}$ 44"E with an altitude of 2738masl Wonchi the third district was found in the southwest Shewa Oromia 156 km far from Addis Ababa situated 8$^{0}$ 32N 37$^{0}$58" E and an altitude of 2063masl all districts was purposively selected for the study.

**Sample size, sampling procedure and data collection**

Multi-stage sampling methods were employed includes observations, interviews, focus group discussions and document analysis. As a first step, three districts were selected purposefully because of considering research cost, time, human resource, accessibility, and availability of transport facilities into account, Using structured interview schedule, and quantitative primary data were gathered from121women & male house heads from three districts. Qualitative data were collected through discussion with focus group.

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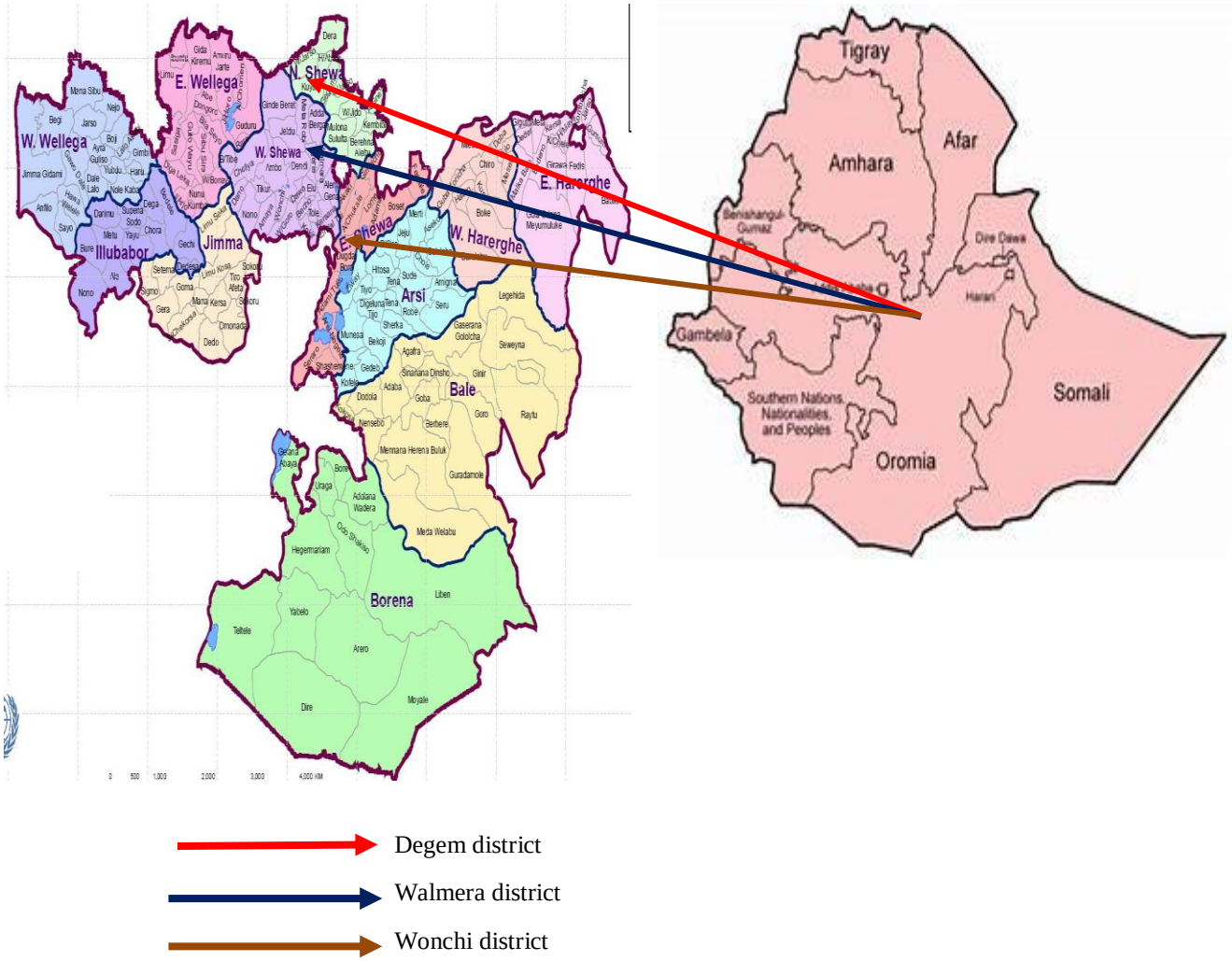


**Figure 1: Study site map**

## 4. RESULTS AND DISCUSSION

In order to know farmers indigenous knowledge on conservation agriculture assessment was done to describe some knowledge systems that are still utilized in those selected districts. They may be common practice in many parts of Ethiopia as shall be seen in certain sections of this paper while some systems have undergone change over time,

From a total of 121 respondents 93.4% were male and 6.6% female the education status of the respondents were 25.6% illiterate 14% can read and write 24.8% grade 1-4(primary education) 28.1% grade5-8(Junior education) 7.4% grade 9-12(Secondary education) the maternal status of the respondent were 1.7% single 96.7% married 1.7% divorce

**Age** is one of the household characteristics important to describe households and can provide a hint as to age structure of the sample respondent and has controversial sides in terms of new technology adoption and neglecting of indigenous knowledge of farming practice. Older farmers could be fast adopters of new agricultural technologies because they have enough indigenous farming experience in the field of agriculture. On the other hand, because of risk averting nature older farmers are more conservative than younger farmers to adopt new agricultural technologies by rejecting their own indigenous farming experience. Assessment conceders age ranged from 15 to >55 years. 4.1% of the respondents were age between 15-25 years, 11.6% between 25-35 years, 20.7% between35-45, 43.8% between 45-55 years and 19.8% of the respondents have more than 55 years of farming experience (Figure 2)

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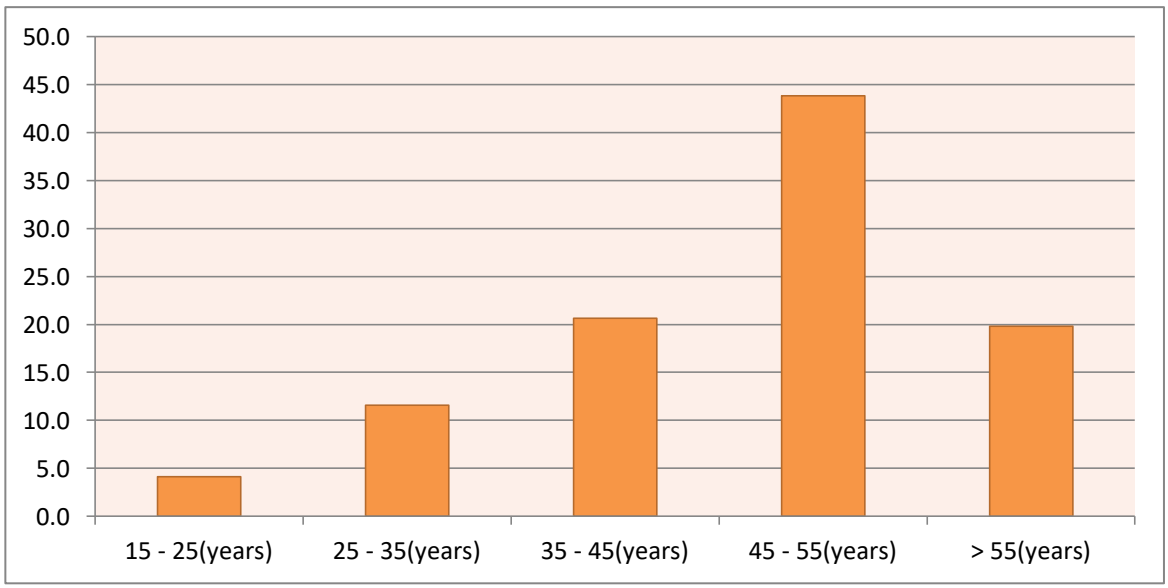
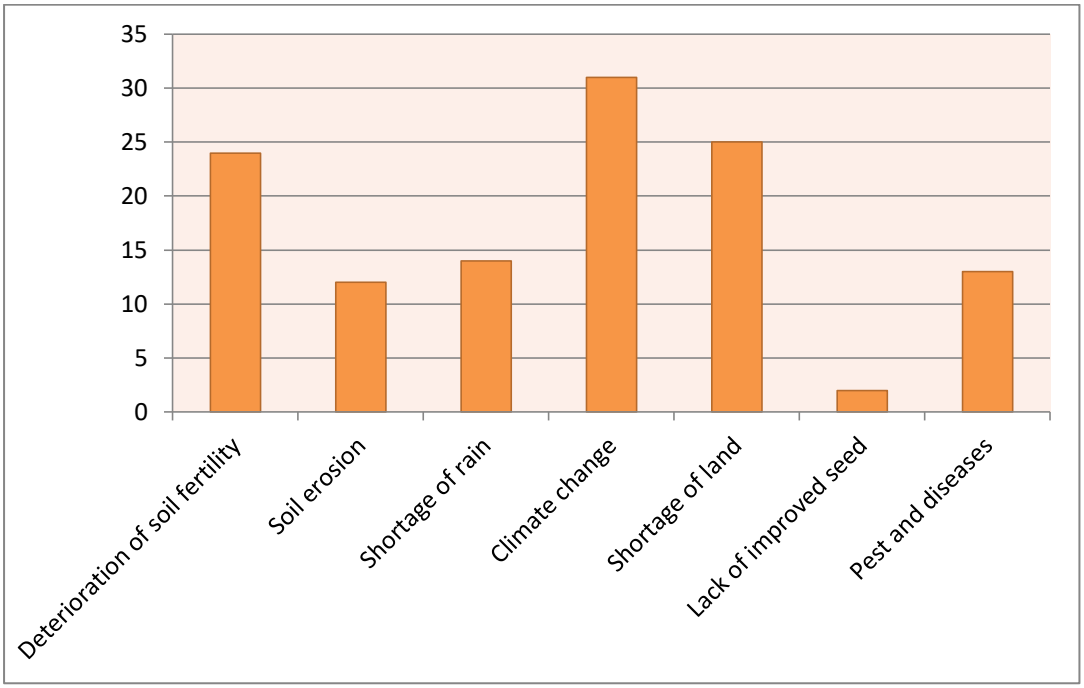
**Figure 2**




Sub-Saharan Africa (SSA), soil degradation is the most serious bio-physical constraint limiting crop and livestock production (FAO/World Bank, 1998). Soil fertility degradation, pest and diseases are a serious problem which has significantly contributed to the low agricultural productivity in Ethiopia. Dramatic decline in soil fertility, crop pest and disease has been noticed throughout the country by reducing crop production per unit area farmers also recognized the problem by day to day farming activities assessment also investigated that 25.6% of respondents agree that climate change affects the crop production 20.7% reported that shortage of farm land was serious problem and 19.8% of the respondents be in agreement that deterioration of soil fertility were problem of the farming systems (Figure 3).farmer were applied their Owen knowledge to elevate the problems related to declining of soil fertility which result total crop lost or reduction of yield in the investigated districts farmers.

**Figure 3**



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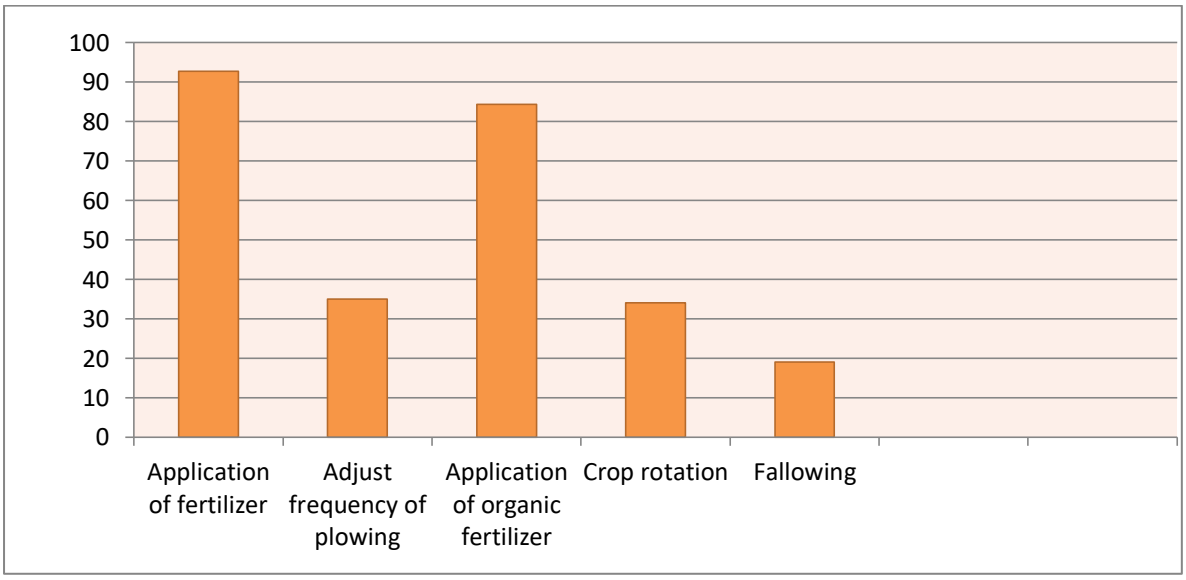
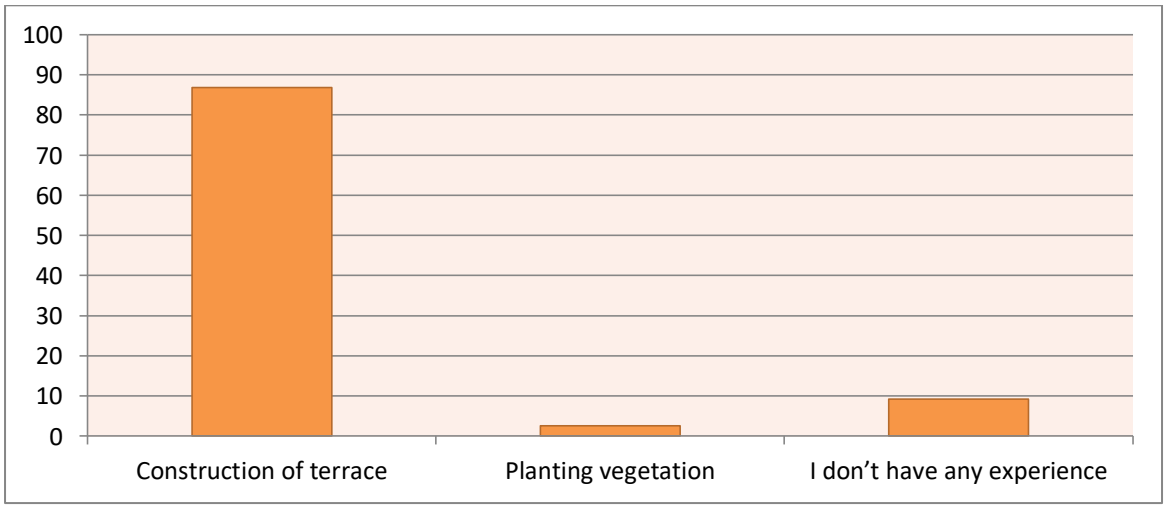
Indigenous peoples in Ethiopia have developed and applied a number of farming techniques and activities which take place during different farming seasons and periods and passed them from one generation to the next. There are some indigenous cultivation practices, which conserve soil and water to improve soil fertility for crop production in the area. Fallowing, crop rotation, shifting cultivation, minimum tillage, organic fertilizer usage and residue managements are some of the practice which this assessments gave emphasize to discuss. Based on the information collected from the study districts 92.67 % of the respondent were applied inorganic fertilizer 84.3% of the respondents use organic fertilizers like FYM (farm Yard Manure) and Compost where as crop rotation and fallowing are practices where farmers adopted from their ancestors long years in the past but the result of the study shoes that only 19% so this practice is diminishing and theory of the past. (Figure 4)

**Figure 4**




Soil erosion is one of the biggest worldwide environmental problems country like Ethiopia have not a land use policy problem of erosion was highly intensified fast population growth, cultivation on steep slopes, clearing of vegetation, and overgrazing are the main factors that speed up soil erosion in Ethiopia. Findings of this study also identified the mechanisms farmers use to control erosion 86.8% of the respondents were constructed terrace to protect their crop land from erosion 2.5% were control erosion by planting vegetation around their farm land and 9.14% were don't have any experience to control erosion from their crop land(figure 5).

**Figure 5**



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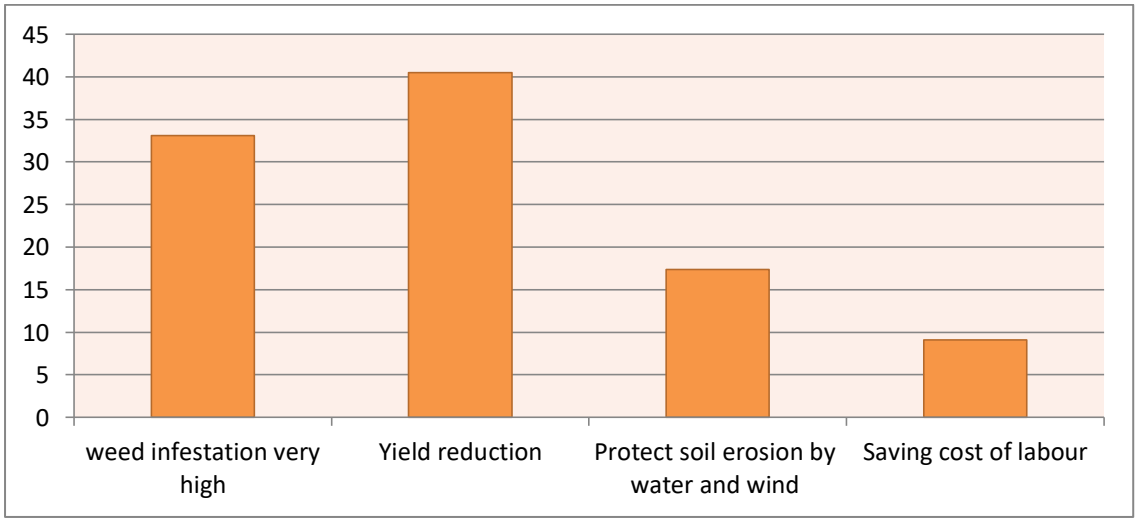
Whenever inappropriate land use and management practices are adopted, soils are exposed to degradation. Soil degradation can be caused by the type of agricultural activities and practices such as land use, crop grown and management practice adopted (PACA, 2010). In the investigated three districts Soil fertility degradation was a serious problem which has significantly contributed to the low agricultural productivity Ethiopian farmers have awareness about problems associated with soil degradation and exercise indigenous (traditional) knowledge for the conservation at the farm level (Melissa vantine and sven verlinden, 2003 ) to improve the soil fertility status. Fallowing of crop land, crop residues management, organic fertilizer application and crop rotation are some of activities which in the study area farmers were adopted from their ancestors as a means of improving the fertility status of crop land. In response to the question 82.8%of the total respondents were replied that fallowing their crop land was a means to improve the fertility of their farm land to get good crop yield an average of three continuous years farmers fallow (crop free) their farm land.

The term conservation tillage has been used in a more flexible way to refer to any tillage system which conserves or reduces soil, water and nutrient loss or which reduces draft power requirements for crop production (Steiner, 1998). According to Rockström et al (2001), conservation tillage is any tillage system that conserves water and soil while saving labour and traction needs. In response to the question 45.5% of respondent agree that plowing with minimum tillage has expressed by reducing crop yield, 33.1% reflected minimum tillage has negative impact on yield high weed infestation 17.4% reflected that minimum tillage has positive impact on controlling soil erosion and 9.1% agree that it save cost of labour and time(figure 6).

**Figure 6**




Crop residues left on the ground can protect the soil from erosion and improve soil fertility through adding organic matter to the soils. In actual practice 41.8% respondents confirmed that they left over crop residue on farm land. While 57.4% of respondents use crop residues as a fodder for animals and sold to generate income for the family. Chi-square test also shows that there is significant difference ($\chi2=54.233^{a}$, p=0.000) between farmers exercising fallowing but there is no significant difference ($\chi2=2.983^{a,}$ p=0.668) in using placing of crop residue on farm plot (Table 7) .

**Table 7**

Fallowing and crop residue management

| Activities | N | yes | No | Yes% | No% | $\chi2$ | P= value |
|---|---|---|---|---|---|---|---|
| Fallowing | 121 | 101 | 20 | 82.8 | 16.4 | | |
| Total | 121 | 101 | 20 | 82.8 | 16.4 | 54.223 [a] | 0.000 |
| Crop Residue | 121 | 70 | 51 | 41.8 | 57.4 | | |
| Total | 121 | 70 | 51 | 41.8 | 57.4 | 2.983 [a] | 0.084 |

, *** ($\chi2=54.233^{a}$, p=0.000) Significant NS ($\chi2=2.983^{a}$, p=0.684) Not significant

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Crop rotations as systems in which different crops are grown sequentially on the same field in alternate seasons or years Humberto and Ratan (2008), The use of crop rotation is another widespread phenomenon in the study area where cereal crop like barely, wheat, maize, and tef rotate with legumes crop like faba bean, field pea and chick pea also farmers believe that crop rotation is used to promote the fertility of the soil, reduce erosion, control pests and minimize financial risks that may emanate from crop failure. In relation to crop rotation as means to conservation agriculture 94.3% responded that farmers in the study area implemented farmers indigenous knowledge of rotating cereal crops by leguminous crop to maintain fertility status of their crop land 4.9% of the respondents appeared to be indifferent. Chi-square test also shows that there is significant difference ($\chi2=98.233^{a}$, p=0.000) between farmers exercising crop rotation on farm plot(Table 8).

Compost changes waste materials into nutrients and rehabilitate soil nutrients (Doug et al, 2013). It is beneficial for the land and rich in nutrients in many ways, as well as a soil conditioner, fertilizers, addition of vital humus and as a natural pesticide for soil. Using compost as organic matter is highly economical and can provide both macro and micro nutrients this importance is reflected in the very high frequency with which both inorganic and organic fertilizer used to apply in the study area. But according to informants the most widely used forms of fertilizers are manure, house hold garbage and humus because of lack of capacity to buy inorganic fertilizer 86.1% of the respondents confirmed that highly inclined to use their own indigenous knowledge of fertility maintaining mechanisms. 13.1% of the respondents appeared to be indifferent. . Chi-square test also shows that there is significant difference ($\chi2=65.463^{a}$, p=0.000) between farmers adopting indigenous knowledge of applying compost on farm lands. (Table 8).

**Table 8**

| Activities | N | yes | No | Yes% | No% | $\chi2$ | P= value |
|---|---|---|---|---|---|---|---|
| Crop rotation | 121 | 115 | 6 | 94.3 | 4.9 | | |
| Total | 121 | 101 | 6 | 94.3 | 4.9 | $98.233^{a}$ | 0.000 |
| Compost | 121 | 105 | 16 | 86.1 | 13.1 | | |
| Total | 121 | 105 | 16 | 86.1 | 13.1 | $65.463^{a}$ | 0.000 |

*** ($\chi2=98.233^{a}$, p=0.000) Significant , *** ($\chi2=65.463^{a}$, p=0.000) Significant

**Focus Group Discussion**

Three focus group discussions were held by selecting farmers from those three study districts in three different days. The participants in the FGD were selected purposively. Based on this each group was composed of elders. FGD discussion revealed that farmer shows very high interest to pursue the indigenous knowledge of conservation agriculture appears from those ancestors.

Several traditional conservation farming techniques have been identified in the area to improve soil fertility. These included manuring, crop rotation, fallowing are some of activities mentioned and discussed by the farmers. In the past since farmers used to have a large number of cattle and area of land, manuring and fallowing were the major practices for soil fertility maintenance. However, due to population pressure, which resulted in reduced land holding and hence, limited grazing ground, keeping a large herd and leaving a land fallow have gradually become difficult has not got enough fallowing period and very less amount of manure applying on farm plot. Hence, the use of such practices was highly challenged. Nevertheless, some of the practices are still visible and no option to use supplements chemical fertilizer because of very expensive price of inorganic fertilizer.

## 5. CONCLUSION

Farmers in the study areas have a wealth of knowledge about their land resources, its characteristics, limitations, potentials, and management options. The study results showed that indigenous knowledge of conservation agriculture is still valuable in the community. During the past years, the world has lost its arable land, because of wrong management of crop land. Conservation agriculture is a farming system that can prevent such losses while regenerating degraded lands it promotes maintenance of a permanent soil cover, minimum soil tillage, crop rotation practices, organic fertilizer usage, fallowing and crop residue management. Conservation agriculture enhances biodiversity and natural biological processes

above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production. However, it is important to know that not all indigenous practices are sustainable and not all local knowledge can provide the right solution for a given problem. Some of the techniques in the local community have contribution to enhance climate change. Therefore, before adopting such indigenous knowledge, integrating it into development programs, practices need to be examined for their appropriateness just as any other technology. It is very clear that there is much to be learned from the indigenous knowledge systems of local people. The recommendation for Ethiopian farming system all the academics, policy makers, development partners should pay greater attention to this very useful wealth of knowledge that is in jeopardy to disappearance.

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