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Assessment of Indigenous Knowledge Usedto Control Pests and to Reduce Risks of Pesticides in Wolaita and Dawuro Zones

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Abstract
The research aimed at an assessment of indigenous knowledge used to control pests and the effect of using pesticides on the environment was done in Wolaita and Dawro zones in Southern Ethiopia. From both zones a total of 7 weredas, 33 kebeles and 165 respondents were selected and ethino-biological information was collected using pre-designed semi-structured interview items, guided field work technique and participant observation. Data was analyzed using both qualitative and quantitative methods (of Martin, 1995 and Cotton, 1996). Among the 165 respondents, 156(94.54%0 were males. 70(42.42%) of the informants were found between 21and 40 years of age,73(44.24%0 between 41& 60 ,21(12.73%)were from 61to 80 and only 1 (0.61%) of them were above 80. Regarding their educational status 113(68.48%) had an educational level from grade 1-12. As of the main crops are concerned, the main seed crops in the study area are wheat, barley, pea and bean are dominant in dega and weina dega agroecology and maize, teff sorghum and haricot bean are in kola. Apple and pear are dominant fruits in dega and weina dega while tomato, orange mango and banana are dominant in kola. A rodent such as mole rats are causing series problems and therefore farmers are continually developing varies strategies, a trap developed locally to control them. Weeds such as Dodder /Cuscuta campestris and Oxalis regnellii can be controlled by picking/uprooting and burning, crop rotation and regular visiting/follow up (Early Weeding/Timely farming, hoeing/cultivating 3-4 times, weeding). Some plants like Persicaria senegalensis, Veronica aruensis and Pscnostachys abyssinica are used as biological control of some insects, disease, etc and some of insect such as lady birds (lady bugs)-Coccinella septempunctata in Gasa chare Kebele of loma woreda, Dawuro zone are found when they are feeding on aphids (Brericoryne brassicae),so they are serving as biological control. Most of them (95%) do not use pesticide; instead, they use indigenous knowledge that does not require any expense/financial source. The efficacy of intercropping, the combination of animal dung and urine for curing of enset wilting disease and planting of Pscnostachys abyssinica 'Olomua' in the enset crop field activities should be encouraged.
Keywords: Crops, Dawuro, Indigenous Knowledge, Pests, Wolaita

1. INTRODUCTION

A pest is a species that interferes with human activities, property, or health or is objectionable. Pests include many species of insects, ticks, mites, and other arachnids; nematodes and other parasitic worms; weeds and other undesired plants; fungi, bacteria, viruses and other harmful microorganisms, and some vertebrates such as certain birds and rodents (Miriam, 2012). Large number of insects may be external or temporarily internal pests of man and other animals. Most have alternate hosts which compounds problems of their eradication. Insect parasites generally weaken their hosts and make susceptible to attacks of disease causing organisms. Others as a result of feeding may cause irritation or sores which may be infected.

The global losses due to various categories of pests vary with the crop, the geographical location and the weather. Despite the plant protection measures adopted to protect the principal crops, 42.1 % of attainable production is lost as a result of attack by pests. However, if no control measures were used to protect crops, the figure would be 69.8% (Miriam, 2012).

To minimize the detrimental effects of these pests' people are obliged to use different pesticides. Majority of the modern synthetic insecticides have detrimental effects on beneficial insects including natural enemies of crop pests. It is necessary to have some knowledge on the safety of different insecticides to the natural enemy complex occurring in a given ecosystem.

Many insecticides when used in agro ecosystems target insect pests along with beneficial or natural enemies. Insecticides should not only suppress the insect pest population but also be safe to their natural enemies. Application of pesticides to crops that are in bloom can kill honeybees which act as pollinators (Cornell University, 2007). Hence, it is imperative to screen the insecticides before incorporating them into the insect pest management programme. Screening is imperative to safeguard the beneficial from the hazardous effects of insecticides (George and Ambrose, 2004). Some beneficial insects have economic value that acts as biological control agents, may be exposed to the insecticides which are indiscriminately used to control the insect pests and consequently their physiological and behavioral functions get affected. Information on the impact of insecticides on the non-targeted beneficial is imperative for the researchers as well as farmers to select the most suitable insecticide (s) with least damage to beneficial (George and Ambrose, 1999).

Repeated application also leads to loss of biodiversity. Many pesticides are not easily degradable, persist in the soil, leach to ground water and contaminate, whose impact may endure for decades and adversely affect soil

conservation (Kellogg, 2000). Study made by Cornell University (2007) indicates widespread application of pesticides can eliminate food sources that certain types of animals need, causing the animals to relocate, change their diet, or starve. The effects of pesticides on human health are more harmful based on the toxicity of the chemical and the length and magnitude of exposure (Lorenz and Eric, 2009).

Generally there is impact of pesticides on other non-target species. Unconsidered agricultural practices can harm butterfly populations, bees, human health: potent nerve toxins, which can result in cancers, permanent damage to essential organs and environmental impact through contamination of soil and water effects on non-target organism because of unsafe usage, unsafe storage and unsafe disposal of pesticides.

Because of such and other effects, it is better to control pests using other safe methods instead of chemicals. The appropriate way to make effective and sustainable methods can be obtained from the local people. Ethiopia is a country in which very diversified and ancient people rich in local and indigenous knowledge is living. Indigenous knowledge (IK) is the knowledge accumulated during the historic experiences of a group of people that adapted to social, economic, environmental, spiritual and political changes through generations. For instance over centuries, indigenous peoples of different localities have developed their own specific knowledge on plant resources, use, management and conservation (Cotton, 1996). According to Zeleke W/Tensay and Wondwossen Mekonnen (2002), indigenous knowledge refers to the complex set of knowledge developed around specific conditions and existing in indigenous populations and communities of a particular geographic area. The knowledge of farmers is an important resource for the development of sustainable agriculture and the conservation of genetic material (Zemede Asfaw, 2001a). In recent times, indigenous knowledge became the solution of health, agriculture, environment, sociology, anthropology and other aspects for economic, social and political problems.

Indigenous knowledge is the local knowledge – knowledge that is unique to a given culture or society. 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)

As Flavier *et al.* (1995), it is the information base for a society, which facilitates communication and decision-making. Indigenous information systems are dynamic, and are continually influenced by internal creativity and experimentation as well as by contact with external systems.

Louise Grenier defines indigenous knowledge as '... the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area

In the emerging global knowledge economy a country's ability to build and mobilize knowledge capital, is equally essential for sustainable development as the availability of physical and financial capital (World Bank, 1997).

Indigenous knowledge is developed and adapted continuously to gradually changing environments and passed down from generation to generation and closely interwoven with people's cultural values. It is also 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.

Today, many indigenous knowledge systems are at risk of becoming extinct because of rapidly changing natural environments and fast pacing economic, political, and cultural changes on a global scale. Practices vanish, as they become inappropriate for new challenges or because they adapt too slowly. Many practices disappear only because of the intrusion of foreign technologies or development concepts that promise short-term gains or solutions to problems without being capable of sustaining them. Indigenous knowledge is part of the lives of the rural poor**;** their livelihood depends almost entirely on specific skills and knowledge essential for their survival.

Louise Grenier(1988) defines indigenous knowledge as ' the unique, traditional, local knowledge existing within and around the specific conditions of women and men indigenous to a particular geographic area.

Traditional knowledge has been defined as "a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview (Acharyya *etal.* 2008).

So the main intention of this paper was to bring the age long indigenous knowledge accumulated in Wolaita and Dawro zone farmers to modern farming, sorting it, doing and initiating others to do varied researches on their respective fields confirm, modify and use it. Therefore, this indigenous knowledge is very much environmentally friendly and not harmful to human beings and has to be assessed and augmented to control pests and to reduce risks of pesticides usage. This study gives awareness about the types of pests and reveals appropriate system of controlling the pest species those that attack crops in the field and stored for the people who live in thematic area.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The two study areas are the thematic zones of the university: Wolaita and Dawro. They are two of the 14 zones

found in Southern Nations, Nationalities and Peoples Region(SNNPR) of Ethiopia

Wolaita zone lies in altitudinal range from 700-2950mts above sea level. It is bordered with Hadiya and Kembata zones in Northern side, Southern side with Gamo Gofa, in Western side with Dawro zone and in the Eastern direction with Sidama zone. It covers 438371 ha of land, and has 1717680 total populations. The agro ecological zone contains Dega, woina dega and Kola with average rain fall between 900 and 1200 m.m and the temperature is between 27 and 31 ºC. Sodo is the major town located 330 kms, South of Addis Ababa on the way to Arba Minch across Hosana. It is 175 km away from the regional capital, Hawasa (Fig. 1).

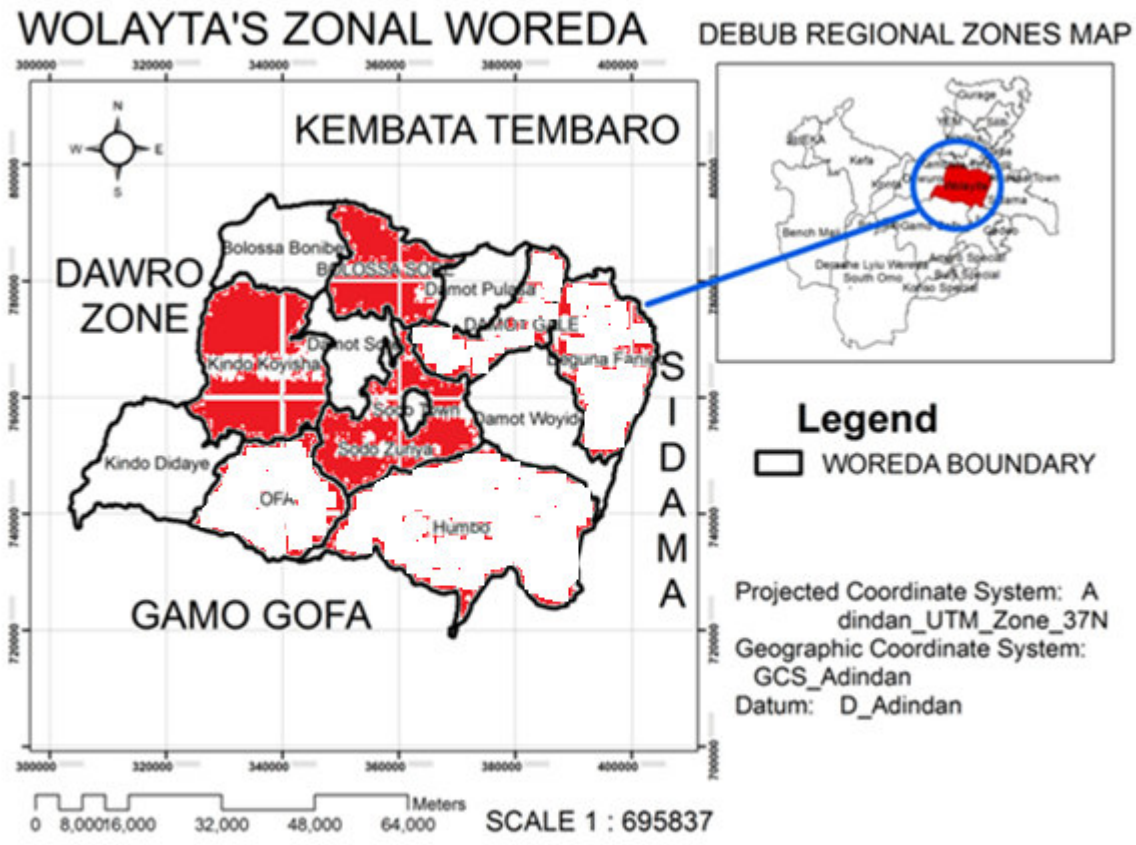

Figure 1.The study area in Wolaita zone

Dawro zone is located at 6.59^0 -7.34^0 N of latitude and 36.68^0 -37.52^0 E of longitude and at altitudinal range between 550-2820 meters above sea level. It is bounded with Hadiya Zone in the North, Kembata & Tembaro Zone in the Northeast, .Wolayta Zone in the East, Gamo Gofa Zone in the South, and Konta special Woreda in the West within SNNPR and Jimma Zone in Oromya Region. It is also found in between Omo River from North to South and Gojeb River from Northwest to North. Tarcha is the main town about 507 kms Southwest of Addis Ababa across Shashemene and Wolayta, 282 Kms away from Awassa, town of SNNPR and 140 km from Jimma. It has an area of 466,082 ha. It has about 587,605 people according to the projected CSA final report of 2005 E.C. (Fig.2).

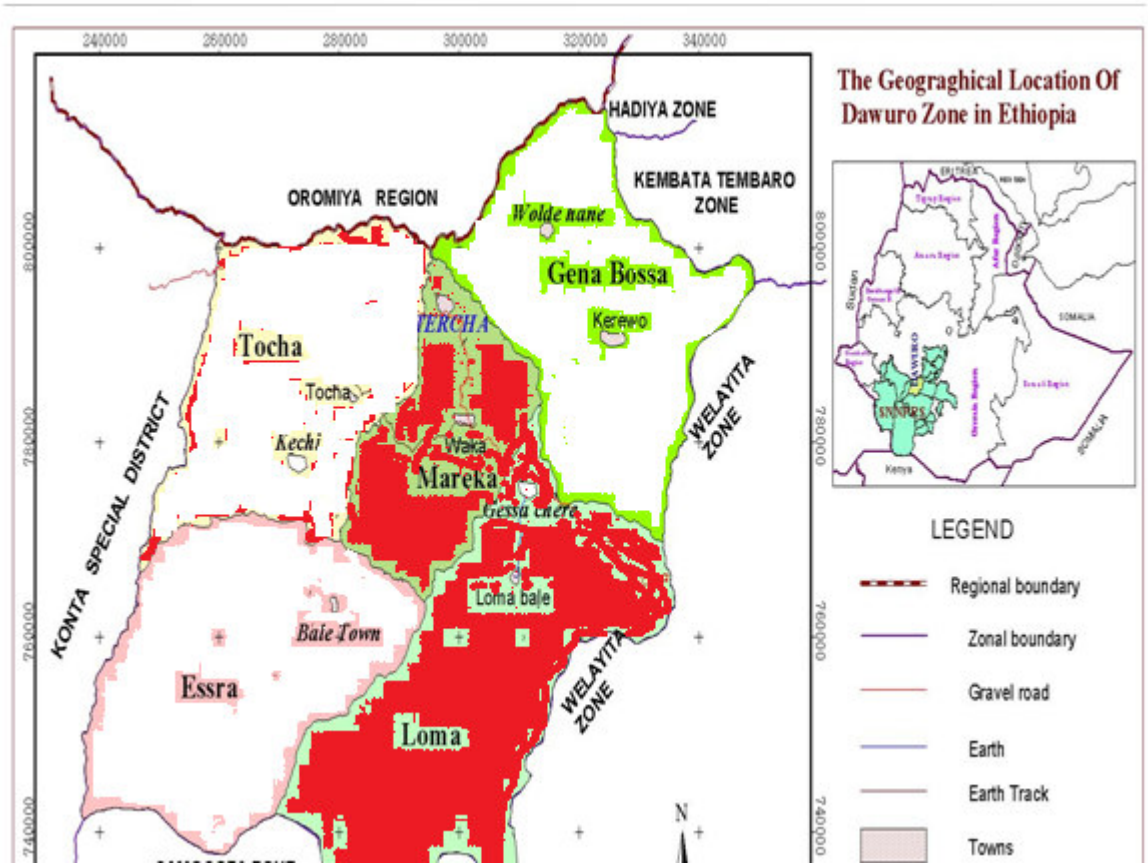

Figure 2. The study area in Dawuro zone

2.2. Methods of Data Collection

2.1.1. Sample size and sampling technique

Qualitative and quantitative approaches were applied using the research techniques known as guided field walk, use value matrix, free listing, priority ranking and preference-ranking (Martin, 1995; Cotton, 1996) to gather data sets. Ethno biological data, interviewing by administering semi-structured questions through questionnaires and personal interviews to respondents enabled the collection of primary data. Secondary data about the study area was obtained from government offices, development agencies and non- governmental organizations.

From 12 districts and 3 town administrations of Wolaita zone, we were obliged to select only 4 districts and therefore, Boloso bombey, Damote sore, Ofa and Kindo kosha were selected by consulting zonal administrative office and agricultural department of Wolaita zone. From 5 districts and one town administration of Dawro, districts namely, Loma, Tocha and Mareka were selected by the help of zonal administrative office and agricultural department of Dawro zone. From these, a total of 165 respondents were selected purpose fully from 35 kebeles for ethno biological data collection based on availability of traditional healers and different agro-climatic zone (*Dega*, *Woina Dega* and *Kola*) of the region identified with the assistance of Woreda and local authorities, elders and knowledgeable persons to gather diversified information on the management, use and conservation of medicinal plants and associated indigenous knowledge.

The selection of key informants was made using systematic random sampling (the person whose name will be repeatedly mentioned by at least three to five encountered people as a knowledgeable person in the area was selected as a key informant). The selection of knowledgeable people was based on unstructured interviews with the randomly encountered members of the society.

2. 2.3. Ethno-biological data collection

The ethno biological information was collected from a randomly sampled environments and households (home garden owners) and traditional healers as informants on medicinal plants selected systematically and conveniently from the two zones' sites based on their availability, willingness and practical knowledge. Informant selection was made with the help of local administrators, local people including elderly persons and Non-Governmental Organization (NGO).

Semi- structured interviews were administered and conducted with single informant and that allowed expressing personal viewpoints freely without being interrupted following Martin (1995). Interviews were administered in the local language both Dawro and Wolaita languages.

Preference ranking was included in pre-designed semi-structured interview items. Then after, based on Martin (1995), data was obtained by asking the key group informants to arrange items in the order of preference individually. Each person arranged the items according to personal preference, perceived importance in the community. This order of preference was crosschecked with data obtained from interviews. Finally, other criteria like local economic importance, species scarcity and cultural significance of the species importance in the community was asked to add descriptive information.

Guided field walk technique was used after taking information through semi-structured interview. The home garden owner was asked for permission to make a study tour in his/ her garden, with him / her and with the field assistant. The observation was made; occasional interaction was made by using unstructured interview, raising some questions and taking notes.

Participant observation technique was used to add new information and strengthen information collected through interview, observation and discussion. The important information and conditions that was difficult to jot down at a time was taken either in the form of sound recording or images. Thus, observation and survey on plant use, social activities, and ecosystems, and using image and sound recording of volunteer informants' complemented information gathered in other ways.

2. 2.4 Voucher specimen collection

Data was collected from December 2013 to November 2014. The type of plant found was collected with its local name, number of individuals of each type and habit of the plant was recorded and each was given a collection number, pressed, dried and voucher specimens were identified using published volumes of flora of Ethiopia and Eritrea.

Pests were collected using tools such as insect net, killed using chemicals such as toluene or acetone, pinned and labeled with date and place of collection and the plant on which they were feeding. The collection was identified using keys.

2.3. Data Analysis

Ethno biological data was analyzed using both qualitative and quantitative methods following Martin (1995); Cotton (1996) and the spreader excel sheet was used. Preference ranking was analyzed based on Martin (1995), by entering in data matrix the responses of the key group of informants, arranged, ranked and summed for all respondents.

3. RESULT AND DISCUSSIONS

3. 1. Demographic Information of the Respondents in the Study Area

Most of the selected kebeles were from Woinadega agro-ecology and 58% of the respondents' age lies above 40 years. Most of them (65%) are non-educated or had basic education; hence accumulated indigenous knowledge on agricultural practices.

3. 2. Crops of the Study Area

The main seed crops in the study areas are wheat, barley, oat, pea, bean, lentil, check pea, flax, haricot bean, maize sorghum, and teff. **The main fruit crops** are apple, pear, tomato, avocado, mango, guava, papaya, coffee, banana, strawberry, orange, and lemon. **The main root crops:** potato, sweet potato**,** beetroot, carrot, anchote, enset, cassava, taro, yam. **The main leaf crops:** kale, cabbage, spinach, moringa. **The main spices crops:** garlic, onion, ginger and pepper (Table 1). Sugarcane is also common in mid and lowlands of the two zones.

Table1. Some of Dega Crops in the Study Area

Dega	Seed	Fruit	Root	Leaf	Stem	Tuber/Corym	Bulb
	Wheat	Apple	Potato	Cabbage	Sugar cane	Enset	Garlic
	Barley	Pear	Anchote	Kale		Potato	Onion
	Pea	Tomato	Carrot	Spinach		Ginger	
	Bean	Coffee	Beet root	Moringa			
	Flax	Mango	Taro				
	Lentil	Avocado	Yam/boye				
	Oat	Banana	S.potato				
	Chick pea	Guava	Cassava				
	Teff	Papaya					
	Haricoat bean	Lemon					
	Sorghum	Orange					
	Maize	Straw Berry					

As table 1 indicates, in many kebeles of the area, though they are assigned as dega, weina dega or kola, overlapying of crops was observed; that is dega crops have been observed in kola or vice versa. This could be

because of two reasons, the first and more convincing one is the kebele that has assigned as dega, because of its most parts can have weinadega and kola agro-ecological zones in some of its parts. The second reason could be, especially kebeles that were assigned as dega have changed to weina gega and even to kola because of expansion of desertification. Though they are categorized as dega agro-ecology due to their being at high altitude, the area has been shifted from indigenous tree types to eucalyptus and tid plantation, which were with frond/with small leaflets that aggravates the area to kola agro-ecology

For example, Yakima Kebele in Ofa woreda of Wolaita zone though it is assigned as dega,it comprises the three agro ecology categories, the Dega, Woina Dega and Kola agro-ecologies. Eyesus and Daka Yali kebeles from mareka woreda of Dawuro zone and Zaba and Gamo kebeles of Boloso Bombe woreda of Wolaita Zone are from Dega agro-ecology but are able to grow the Kola crop, maize.

3.3. Animal Pests and traditional Controlling System in the Study Area

3.3.1. Animal Pests of the Study Are

In our study, we didn't observe series insect pest infestation. Only some farmers in Boloso Bombey wereda Morocha wolana kebele were feeling un certainty of facing series damage on their maize crop seedling by Crickets (*Gryllus veletis*). But thanks to rain followed a few days the danger was over.

3.3.2. Traditional Controlling System of Animal Pests in the Study Area

Traditional animal pest controlling system

These days many of the major animal pests are not causing series treats, because either their shelter is disturbed by human encroachment or humans can keep them away easily. But a rodent such as mole rats are causing series problems and therefore farmers are continually developing varies strategies to control them. One fascinating example is a trap developed locally and for some farmers as in Zaba kebele of Boloso Bombey its efficiency is high. By combining different methods like the followings, they are trying their best to bring it under control.

In order to prevent enset and other stem, root of seed crops and root crops from **mole rate** they use: Mixture of cow dung and urine with water; traditional trapping using baits(like sugar cane, *Spilanthus mauritiana);* Watching the movement digging the ground and killing; Digging and destructing habitat letting water in to canals; Using traditional traps and killing and Sanitation around the crop and preventing shelter.

In order to protect wheat, bean, pea from **rats:** Using cat; Protecting the stand of traditional store/hut with barbed /spiny plants like thistle (*Carduus shamaecephalus)*and Mysoreth thorn(*Caesalpinia decapetala);* Clearing the environment to minimize their shelter; Local traps of different types, and Allowing flood water to their holes and killing them.

In order to prevent **armyworm (*Armygira gregaria:*** Digging channel not to pass by, Weeding and sCleaning with branches of bamboo to remove from leaf of monocots and collecting in to tunnels.

In order to prevent **Ball worm**: Maize stem- Removing the infected part, fill it with top & fine soil, and wheat/root, pea/pod, Apple/root, Potato/tuber, teff/stem.

To prevent Sweet potato, haricot bean, pumpkin from **white butterfly (***Pieris rape:* Staff Writer*)*: Spraying mixing cow dung and urine on crops, Planting animal fodder (Lalab, blue clovor) around the potato plant, and Planting *Pscnostachys abyssinica* and Sits'a (local name) among the plants (enset).

In order to prevent **weevil**: Removing the comb cover. Not collecting Immature maize seeds; Wheat, bean, pea mixing with ash, storing by mixing with teff, pounded Sheep dung and mix with crop; For Seed of Maize and Haricot bean , hanging over smoke, spreading leaf of neem tree (*Azarthdica indica*) on seeds, and For maize and sorghum seed, storing the seed along with the cover outside in trees or plastering the seed with grass and cow dung.

In order to prevent **aphids**: For Cabbage& leaf of wheat, Kale/cabbage,Pea, Diluting animal dung and urine with water and spraying on the crop

In order to prevent **ants**:To prevent maize, potato/tuber planting *Persicaria senegalensis*/manikacho and to culltivate, to add ash to cultivate during dry season with a hoe; For kale/root spreading around the root liquid dung+water or+undigeted waste obtained from; slouted animals with squized liqiud inset; For onion. cabbage and kale planting *Persicaria senegalensis*/Manikacho plant and spreading ash around the plant ; To cultivate and to add ash during dry season with a hoe; *Galinsoga parviflora(Emathiya/Bizddiya)* and *Snowdenia polystachya (Maga)* mixing with ash: claering and distructing their habitat by digging.

In order to prevent **termites**: Maize, sorghum, teff by Bed formation using leaf and branches of eucalyptus(*Eucalyptus globules)*, bamboo(*Arundinaria alpina*),and kititkita (*Dodonea angustifolia);* Maize root by looking and killing queen; For root of sugar cane apply ash around the root and find and kill the queen, and For all heaped cereals find and kill the queen.

In order to prevent **locusts/Crikets:** Germinating seed of maize/maize seedling shoot and root by cleaning and weeding, Sanitation and killing and Watering.

The important lessons we have drawn from our survey regarding insect pests were: When a year is good in rain no danger of insect pest; Zone and wereda agricultural offices don't store excess pesticides in stores.

Farmers told us they buy some only when the actual damage is there; To make a study on insect pests, a research plan should be made through out the different seasons of the year not only in one or two particular seasons, and Some termite mounds are observed in maize fields of farmers in kindo kosha wereda this needs further investigation to the levels of damage and means of prevention should be sought.

3.4. Weeds / Plant Pests and the traditional Controlling Systems of Crops in the study area

3.4.1. Weeds / Plant Pests of Crops in the study area

Table 2. The known weeds in the Study area

S.N	Scientific name	Family Name	Local Name	Crops it affects
1	*Guizotia scabra var, scabra*	Asteraceae	Tuffa	All crops
2	*Guizotia scabra var. Schimperi*	Asteraceae	K'odhuwa	All crops
3	*Bidens prestinaria*	Asteraceae	Adlia	All crops
4	*Carduus chamaecephalu*	Asteraceae	Kashiyea	All crops
5	*Carduus nyassanus*	Asteraceae	Dangarsa Kashiyea	All crops
6	*Galinsoga parviflora*	Asteraceae	Ematiya/Bizdiya	All crops
7	*Ageratum conzoides*	Asteraceae	Zeisa	All crops
8	*Bidens biternata*	Asteraceae	Hantikelo	All crops
9	*Portulaca oleuracea*	*Portulacaceae*	Marguda	All crops
10	*Amarnthus hybridus*	*Amaranthaceae*	Fara chumadhiya	All crops
11	*Cynodon dactylon*	Poaceae	Sura	All crops
12	*Hygrophila auriculata*	*Acanthaceae*	Fara Aguntsa	All crops
13	*Eleusine indica*	*Poaceae*	Hits's'iya maata	All crops
14	*Parthenum argentatum*	Asteraceae	Partinia	All crops
15	*Oxalis regnellii*	Asteraceae	wanc'aje maata	All crops
16	*Cuscuta campestris*	Convolvulaceae	Imatsa maata	All crops
17	*Xanthium strumarium*	Asteraceae	Ambuka (Dorsa K'arc'ocha	All crops

Among the known exotic weeds that affected farmers crops were Dodder /*Cuscuta campestris* in Ela Bacho kebele of Loma Woreda and Gorika kebele of Tovha woreda , Dawuro zone; Some weeds in Mancha kebele of Ofa woreda and Some weeds (*Oxalis regnellii)* in boloso Sore woreda, Wolaita zone

3.4.2. The traditional Weeds / Plant Pests Controlling Systems of Crops in the study area

Farmers developed indigenous knowledge to prevent and control some weeds except newly introduced/invasive weeds via fertilizers and other foreign inputs.

In order to prevent weeds: All plants they uprooting, Early Weeding, hoeing, regular visiting; Timely farming, cultivating 3-4 times, weeding; weeding &burning, and Spraying chemicals (pesticides-herbicides).

In order to prevent enset wilting: Care on tool usage, sterilization of tools, Picking and burning the infected one/ removing infected enset, planting black berry in the farm, planting *Pycnostachys abyssinica* /olomua; Using separate tools to harvet, tighing together in fected parts, spreading ash around the root, planting plants such as *Milettia feruginea*(Zagia)and *Pycnostachys abyssinica* (Olomuwa) Intercropping barley and oats; Removing and burring or burning Neatness and care of tools; tool care ,ash spreading ,burning the infected one; Planting taro among the enet, burning the place from which the infected plant removed: planting resistant variety.Adding ash around the infected plant,planting *Pycnostachys abyssinica* /olomua/atia; tighing,rotation,removing infected ones, and Pulliung out by digging around, buring,burningboth the plant & place from where it has picked up & pouring cow dung, and tieing together the leaves keeping the neatness of tools used in cutting leaves and the farm.

3.4.2.3. Biological Control

Some plants like Manik'ac'o(Local name) *Persicaria senegalensis, Veronica aruensis and* Olomuwa/Atya *(local name) Pscnostachys abyssinica* are used as biological control of some insects, disease, etc (Mathewos Agize *et al.,* 2013a & b; Mathewos Agize *et al.,*2015) and some of insect such as lady birds (lady bugs)-*Coccinella septempunctata* in Gasa chare Kebele of loma woreda, Dawuro zone are found when they are feeding on aphids (*Brericoryne brassicae*), so they are serving as biological control.

3.5. Pesticides

Zone and wereda agricultural offices don't store excess pesticides in stores. Farmers (5%) of the respondents told us they buy some only when the actual damage is there. The techniques how to use and amount of the pesticide is determined by referring the land the farmer owned, by consultation of DAs (Developmental Agents of Agriculture) of the kebele. Most of them (95%) do not use pesticide; instead, they use indigenous knowledge that does not require any expense/financial source. The use of pesticides is correlated with education and residency: educated and the residencies nearby of towns use with road access utilize the chemical of pesticide for controlling the pests of crops.

4. CONCLUSION AND RECOMMENDATIONS

Conclusion

Our survey has confirmed that many farmers in the two zones have rich and varied indigenous knowledge in date of farming and harvesting so able to control damage that could be inflicted on their important and stable crops; use botanicals, local chemicals and local knowledge, equipment to control pests.

Recommendations

Based on research findings, the following recommendations were forwarded:

- Researchers have to be active and must do different researches on different fields of study. For example the efficacy of intercropping, the combination of animal dung and urine for curing of enset wilting disease. Planting of *Pscnostachys abyssinica* 'Olomua' in the enset crop field.
- The two zones agricultural offices can assist and arrange selected farmers to share experiences on very different matters.

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