Journal of Agricultural Science & Crop Research

Research | Vol 2 Iss 1

Assessment of Possibilities to Establish Model Agricultural Technology Village in Melekoza and Basketo Districts of SNNPRS, Ethiopia

Endrias Oyka*

Southern Agricultural Research Institute, Arba Minch Center, Arba Minch, Ethiopia

***Corresponding author:** Oyka E, Southern Agricultural Research Institute, Arba Minch Center, Arba Minch, P.O. Box, 2228, Ethiopia, Tel: +251916137234; Email: endoyka@gmail.com

Received: November 20, 2021; **Accepted:** December 22, 2021; **Published:** December 29, 2021

Abstract

This study was aimed to assess possibilities to establish a model technology village in selected Melekoza and Baketo districts in SNNPR. The study focused specifically on assessing major existing technologies, farmers' technologies' demand and their perception on existing technology demonstration approaches and finally tried to identify the convenient area to technology village establishment. The study used 191 household survey and six focus group discussions with different key informant's interviews to collect raw data. The study tried to identify major agricultural technologies which are found in study area based on their categories like cereals, pulses, root and tubers, spices, fruits and vegetables and livestock technologies such as cattle, shoat, poultry, bees and natural resource management systems. The study tried to identify the major challenges which are hindering the agricultural production and productivity in study area. The main challenges include diseases, pests and luck of improved technologies for most of agricultural technologies. As study identified farmers have demand on different agricultural technologies, mainly include disease resistance sesame varieties, introducing improved cattle breeds (Jersey and Holstein Frisian which is bull but not sexed semen) Borena breed, poultry breed (cockock, dual purpose); improved forages (legumes forages), introduction and demonstration of multipurpose tree seedlings, constructing modern irrigation schemes and demonstrating improved agro forestry practices. Farmer's training center (FTC) is the most known technology demonstration approach among others in study area. Around 88% of respondents participate in FTC. FTC is better than other approaches because: it is open to all farmers to participate in any demonstration. However, FTC has many challenges and should be solved for technology demonstration. In study area, there is very limitation on mechanization of agriculture. The survey result showed that availability problem (76%) or lack of mechanization tools is important reason not to use mechanized agriculture in the area. Based on identified potentials, constraints and other demographic criteria, the study forwarded solutions and identified technology village sites which are suitable for technology demonstration.

1. Introduction

Ethiopia is a country following agriculture development lead industrialization (ADLI) policy where more than 85% of the total population are farmers living in rural part of the country depending on agriculture. Agriculture covers 45% of the total GDP and 90% of the total export. Ethiopia is an exemplary and leading country in Africa in production of some agricultural products. For instance, the country is leading in coffee production in Africa and 5th in the world. It is ranked first in honey production in

Citation: Oyka E. Assessment of Possibilities to Establish Model Agricultural Technology Village in Melekoza and Basketo Districts of SNNPRS, Ethiopia. J Agric Sci Crop Res. 2021;2(1):113.

Africa where 24% of Africa's honey comes and it is 9^{th} in the world. Ethiopia is again leading in Africa in live cattle production and 10^{th} in the world although the cattle of Ethiopia are low in quality. It is a home for Teff, Enset and Duren wheat.

Due to this, growth of agriculture is a major driver of poverty reduction in rural Ethiopia. As a result, the government of Ethiopia has planned to increase agricultural productivity through demonstration of agricultural technologies among other strategies. However, the current rate of technology adoption is low compared to the efforts of various governmental and non-governmental organizations working in agriculture.

According to Ayinalem et al., [1], from the total crop area, on average nearly 50% of the land is covered by fertilizers and 20% by pesticides whereas the area covered by improved seed is less than 10% and irrigation is nearly 1% respectively. Even though the supply of improved agricultural technologies that help increase agricultural production and productivity has increased overtime, but still falls short of the target set in order to transform smallholder agriculture. This is attributed to the approach being used to technology demonstration [1].

In mid-April 2008, ECOSOC held Special Session on the Food Price Crisis. Combination of short- and longer-term causes were identified for the crisis. In order to tackle this crisis, SG produced Comprehensive Framework for Action (CFA) in July 2008 which encompasses Agricultural technology innovation and diffusion mechanism, particularly to small holders, as a key to boosting yields' productivity sustainably [2]. Availability of area specific technologies at farmers' vicinity can improve their production and productivity conditions and impacts daily life. Means of such meaningful engagement with stakeholders by prior understanding of social settings assist village institutions/society towards enhanced adoption of technologies [3].

Agricultural Technology village is a wider model area or village which is full of modern and improved agricultural technologies established with the objective of demonstrating and introducing the farming community with scientific, commercial, intense and simple, socialized, Organized, cost-wise and integrated agricultural technologies and production systems. It is a village where all types of agricultural technologies and cost-wise production system are being taught, introduced and demonstrated [4].

Establishing model technology village, where various improved agricultural technologies (crop, livestock and natural resource management practices) can be demonstrated is believed to be very important. It can greatly impact the current adoption rate of improved technologies and invoke farmers to be initiated to work as per the different scientific methods of production being implemented within the technology village [2].

Knowing this importance, southern agricultural Research Institute commenced to establish technology village around its centres with the help of AGP program. The program is operating in 157 woredas of Ethiopia and 49 woredas in SNNPRS in line with the second growth and transformation program (GTP-II) of the country and the region. The research component of the AGP-II (component II) provides support to the agricultural research system to enhance technology supply with the objective of developing and promoting agricultural technologies for inclusive and sustainable market-oriented smallholder agricultural growth in potential areas of the country in a manner that addresses the needs of women and youth.

2. Problem Statement

Ethiopia is a country following agriculture development lead industrialization (ADLI) policy where more than 85% of the total population are farmers living in rural part of the country depending on agriculture. However, Ethiopia isa country with backward agricultural production system where farmlands are still being ploughed by pair of oxen and by human labour using digging materials; less than 1% mechanized farming [1]; and no technology village to demonstrate and disseminate improved agricultural technologies. The available farmers training centres are very narrow with lots of technology deficiency, less capacity, placed in inconvenient niches and poor setup.

Since 1993, ADLI strategy aimed at attaining food self-sufficiency in the short-term and bringing structural transformation of the economy in the long-term as its priority agenda. To this end, the new extension program (Participatory Demonstration, Training and Extension System) is being used as a policy instrument to bridge the gap between low agricultural productivity and the potential productive capacity of the sector. In line with national interest, one of the mandates given to SARI is transfer of agricultural technologies. To achieve this goal, SARI has designed and implemented technology transfer programs to demonstrate improved crop, livestock and NRM technologies through pre-scaling up, Pre-Extension demonstration and large-scale demonstration/cluster approaches.

Even though several modern technology packages were demonstrated and introduced in southern Ethiopia over the past two decades by these approaches, the demonstrations were restricted to small plots of land, location and commodity specific approaches. As a result, the adoption and diffusion of these technologies have not been satisfactory and comprehensive at regional level.

Though technology village is believed to improve production and productivity by supplying and demonstrating improved agricultural technologies, there is no evidence that indicate about trials made to establish technology village in southern Ethiopia. Due to this, no study was conducted to assess available possibilities to establish technology village.

Therefore, it was found necessary to assess available possibilities that favour the establishment of technology village prior to the work of establishment and this study was conducted to fill this gap.

3. Objectives of the Study

3.1 General objective

The general objective of this study is to assess all possibilities to establish a model agricultural technology village in Basketo and Melekoza districts.

3.2 Specific objectives

The Specific objectives were

- To assess major types of crops, livestock, and NR technologies available in the study area
- To assess farmers' technologies demand in the study area
- To assess farmers' and experts' perception on the existing technology demonstration approaches
- To identify the convenient area to technology village establishment

4. Methodology

This study employed participatory approaches to collect primary information from the farming community and experts from woreda and keebele. The formal and informal survey methods were used by preparing check lists to collect required raw data. Primary data were obtained from farmers, key informants at kebele and woreda level, focus group discussion with selected members and kebeles's development agents (DAs)while secondary data were collected from documents of relevant offices principally from woreda offices of Agriculture and Natural Resource Development offices. The study totally was undertaken in AGP-II woredas of Arba Minch agricultural research mandate areas (Basketo special woreda and Melekoza woreda).

4.1 Description of the study areas

4.1.1 Melekoza woreda

Melokoza woreda is located in Gofa Administrative Zone in the southwest part of Ethiopia. Laha is the administrative center of Melokoza woreda and it has 39 kebele (37 rural and 2 peri-urban). Melokoza is 405 km away from Hawassa, the regional capital and 661 km from Addis Ababa, capital city of Ethiopia.

The district's altitude ranges from 505-2500m.a.s. l; average annual rain fall is 1125 mm with minimum 750 mm and maximum 1500 mm and average temperature is 21.3ºC with minimum 15.1ºC and maximum 27.5ºC. The total population of the district is 152,502. Among these, 75,194 are male and 77,308 are female. The total household of the district is 28,936 from whom 3,077 are female headed and 25,859 are male headed. The general features of Melokoza district map are described below in [FIG. 1].

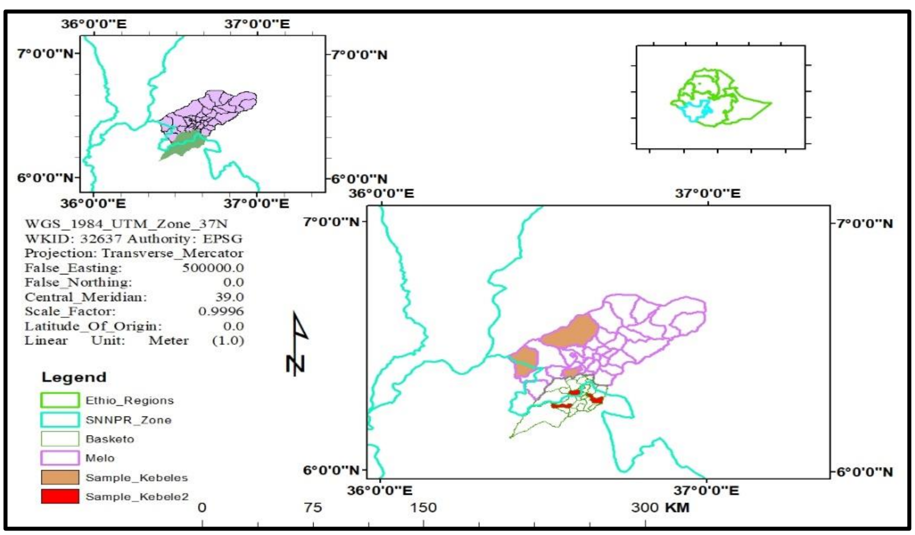

FIG. 1. **Map of Basketo and Melekoza districts Source: EFDRE ETHIO_GIS data 2016.**

4.1.2 Basketo special woreda

Basketo special district is also located in Gofa zone in the southwest part of Ethiopia (adjacent to Meleokza district). The district is located 367 km away from Hawassa (capital city of SNNPR region) and 626km away from Addis Ababa (capital city of the country, Ethiopia). The total household of the woreda is 27092 (2,506 female headed and 2,4586 males headed) and total population is 74,050 (37,221 male and 36,729 female). The altitude of the woreda ranges from 780-2200m.a.s.l.; average annual rain fall of the district is 1200 mm (minimum 1000 mm and maximum 1400 mm) with average temperature of 21ºC (minimum and maximum temperature of 15ºC and 27ºC, respectively). The total land coverage of the district is 105750.75 ha of which19250 ha is covered by annual and perennial crops, 2250 ha grazing land,491.75 ha forest land, 103 ha water body, 566 ha bare land and 83090 ha others. The soils of the district classified as 18% clay, 52% loam and 30% sandy in all agro ecologies (woreda office of agriculture and natural resource management, WOANRM,2019).

4.2 Types of data collected during study

Major types of crop varieties grown in the area; major types of livestock technologies; major types of natural resources management practices; technology demand of farmers; the existing method/approaches used to introduce agricultural technologies and farmers' perception; types and capacity of technology demonstration sites used by various organizations to introduce agricultural technologies; experience of the study woreda if any in technology village establishment; characteristics of sample kebeles for technology village establishment (the land size, accessibility, soil type, slop, productivity, what it demands, livestock potential, etc); challenges/constraints in technology village establishment…etc.

4.3 Sampling procedure and sample size determination

The study was conducted in Melokoza Woreda which is found in Gofa Zone and Basketo special woreda, Southwest part of Ethiopia. The areas were purposefully selected based on AGP-II working districts. Both districts have three agro ecologies (high land, midland and low land). However, the midlands and high lands have relatively similar agro-ecologies.

For this study, Kebeles from all agro ecologies were selected from both districts and followed by three stage sampling procedures. First-, each Kebele was categorized as high land, mid land and low land. Secondly, from each agro-ecology, one kebele was selected based on suitability for technology village establishment (the land size, accessibility, centeredness, soil type, topography, agro-ecology, productivity, crop, livestock and natural resource potential, technology adoption experience, etc). Finally, households from sampled kebeles were selected randomly based on proportion to size of households in each Kebele using lists of farmers with the help of development agents (DAs). Maximum of three experts (as key informant) from each kebele were selected as samples for this study and One FGD per each kebele was organized and members included youths and females as well.

After complete lists of sampling frame, households were selected from prearranged lists using simple random sampling based on the Probability-Proportional-to-Size (PPS). Accordingly, from Melekoza woreda (Banka, Tafa and Salayish mender 03 kebeles) and from Basketo special woreda (Motikesa Arzeka, Sasa Makesa and Angila 03 kebeles) were selected.

For sample size determination, the factors of sample size determination such as costs, time, budget and available human resources were considered, and formula of Yamane (1968) was used as follows:

n=N/(1+N 〖(e)〗^2)

Where n = the sample size

N= Total number of households in the study area

e= the error term and 10% (0.1) was taken.

n(melekoza)=3014/ (1+3014 〖 (0.1)〗^2)=97 n(melekoza)=1531/ (1+1531(0.1) ^2)=94

n(melekoza)+n(basketo)= 191

The sample size of the study was drawn from the lists of sampling frame of the respective kebeles using Probability Proportional to Size (PPS).

TABLE 1. **The Sample Frame and Sample Size Are Summarized In The Following Table**

Name of woreda	**Name of kebele**	**Total household Population size**	**The calculation of allocation factor, $a_i = Ni/N$**	**Sample size from each kebele $n_i = (N_i/N)n$**
Melekoza	Banka	$N_{1\ melokoza}$=1118	$a_1 = N_{1melokoza}/N_{melokoza}$=0.37	n_1=35
	Salayish mender 03	$N_{2melokoza}$=438	$a_2 = N_{2melokoza}/Nmelokoza$=0.15	n_2=15
	Tafa	$N_{3melokoza}$=1458	$a_3 = N_{3melokoza}/Nmelokoza$=0.48	n_3=47
		$N_{melokoza}=N_{1melokoza}+N_{2melokoza}+N_{3melokoza}$=**3014**		$n(melekoza) = 97$
Basketo Special woreda	Angla 03	$N_{4baketo}$=301	$a4 = N_{4basketo}/N_{basketo}$=0.18	18
	Sasa Makesa	$N5_{basketo}$=728	$a5 = N_{1melokoza}/N_{melokoza}$=0.48	45
	Motikesa	$N_{6mbasketo}$=502	$a6 = N_{1melokoza}/N_{melokoza}$=0.33	31
		$Nbasketo=N_{4baketo}+N_{5basketo}+N_{6mbasketo}$=***1531***		$n(basketo) = 94$
			$n(total)$	**191**

Source: woreda and kebele Agriculture Offices and own calculation

4.4 Methods of data collection

The data from primary data sources were collected using data collection instruments such as observation, key informant interview, focus group guide questions and household survey [FIG. 2]. During observation, different types of available agricultural technologies, demonstration sites, available site for technology village establishment, and previously used methods of agricultural technology demonstration were observed. A focus group was organized, and focus group guide questions was set and used to collect data from the group to have a clue in the overall scenario. The composition of focus group included model farmers, youths, female and kebele leaders in each kebele and focus group discussion had 8-12 members. Check lists were used to collect data from agriculture experts working in the study *woreda* to have the overall outlook on the available technologies, the needs of beneficiaries, capacity and challenges of existing demonstration sites, knowhow of technology village, previous experience in technology village establishment, and available convenient area/village for technology village establishment in the study district. Interview method was employed to collect data from farmers using structured questionnaires.

FIG. 2. **Data Collection Methods (a.) Focus group discussion. (b.) Household survey.**

4.5 Method of data analysis

At the end of collection of all necessary data, the analysis was conducted using descriptive statistics. Descriptive statistics such as mean, percentages and frequency tables were employed to summarize the different data types. More of narrative and picture-based explanations were used to analyse the data which are real and on the ground. The analyzed data include major types of agricultural technologies available in the area; farmers' agricultural technologies' demand (interest); farmers' and experts' perception on existing demonstration approaches and identification of technology villages (sites) based on different criteria.

5. Results and Discussions

Sample of 191 household heads were used in this study. Among total respondents, (99%) was male heads and only 1% was female. The average age of the participated respondent was 35 years old and average educational level of respondent was 4. 25% of respondent had no formal education. The average land holding size of respondents in study area was 2.3 ha and mean farming experience of respondents was 19 years.

5.1 Agricultural production potential and constraints in the area

The study was conducted with the objective of assessing and/or identifying major types of crops, livestock and natural resource management technologies available in the study areas; farmers' technology demands and perception of existing technology demonstration approaches by developing different data collection tools like formal questionnaire to undertake household survey, focus group discussion, key informant interview and personal observations. The technology potential, problems holding back and forwarded interventions are indicated as follow.

5.1.1 Agricultural potentials (available) in study area

Various types of crops are grown in identified study areas. Crops grown in the high and mid land areas include: cereal crops (maize: BH140, BH540), teff: local, sorghum: local), wheat: local, Danphe), barley: local, pulse crops (faba bean: local), field pea: local, tegegnech), common bean),root and tubers (enset: local, sweet potato: local), Irish potato: local), cassava: local), taro: local, yam: local), coffee: local, spices (ginger: local, korerima: local), fruits and vegetables (banana: local, avocado: local, head cabbage, onion: local, red bombe, garlic:local)).

The low land study area crops include: cereal crops (maize: BH140, teff: local, sorghum: local, rice: unspecified and/or local)), pulse crops (common bean: local, mung bean: local), ground nut: local), oil crops (sesame: not specified and/or local), root and tubers (cassava: local), coffee: local)), fruits and vegetables (banana: amboha, mango: local, onion, tomato, lemon: local).

As survey result shows, the production of main crops include maize, teff and sorghum covers 85.9%, 25.1% and 11.5% respectively. According to the focus group discussion conducted during survey season, they produce maize for both home consumption and as cash crops. The remaining crops sesame, korerima and coffee used as cash crops.

Livestock technologies available in study area vary depending on agro-ecologies of the area. The major livestock technologies available in the area include cattle: local, sheep: local, goat: local, poultry: local, SASO, honeybee: almost local and very few improved hives, Germen and Kenya hives and donkey: local. Major livestock feed sources are livestock grazing on natural pasture (either communal or private across all agro-ecologies). In addition to this they browse their livestock in the crop land fields after harvesting and provide crop residues [FIG. 3] and this has the negative effect on crop land. A little amount of desho and elephant grasses are improved forage types used by few farmers in the study areas.

FIG. 3. **Livestockbrowse in the Crop Field.**

Other potentials of livestock technologies includeaquaculture or fishponds in Tafa, salayish mender 03 and angla 03 kebeles [FIG. 4. a] but fishponds in angla 03 and salayish 03 need maintenance while fish pond in Tafa kebele is well managed and ready for any demonstration approach. In some areas of high land, indigenous livestock, especially small ruminants are very productive. For example, in highland areas of Tafa kebele, Melekoza Woreda, indigenous sheep [FIG. 4.] bare very productive (just at once gives birth up to three lambs)

FIG. 4. **(a.) Fishpond (tafa kebele, melekoza woreda) (b.) Sheep (very productive, tafa kebele).**

There are some interventions by AGP-II program on agricultural activities, especially livestock activities in study area. For example, construction of house for livestock fattening for unemployed youths [FIG 5. A]; construction of strong metal crash (fence) to provide cattle sexed semen services and to treat their health-related problems [FIG 5 b]; construction of irrigation schemes which enhances both crop and livestock production and productivity; maintaining and fencing model farmers' training centers (FTCs), constructing marketing centers for exportable cash crops (sesame, coffee) both in Melekoza and Basketo special woredas, maintenance and reserving livestock forages.

(a) Livestock flattening house. **(b) Crash**

FIG. 5. **Agricultural Growth Supported Activities.**

5.1.2 Constraints of agricultural technologies

The major constraints hindering crops' productivity in identified kebele include diseases, insects, and weed. Fall army worm is attacking crops mainly maize and sesame. As survey result prove, about 56% of respondents were complaining different diseases as challenge that hindering crops' product and productivity, specially fall army warm on maize and sesame cultivation. Due to regular occurrence of disease on sesame and decreasing of price from time to time, farmers are shifting to other crops cultivation. As discussion conducted with farmers (in focus group discussion) and key informant interview, Lack of improved seeds, poor quality seed, high input price and delaying of inputs (fertilizers, seeds, chemicals) in production seasons, poor post-harvest handing and management [FIG. 6.] and lack of processing technologies (for enset and milk), high soil acidity and decreasing soil fertility, termite [FIG. 7. b], very sloppy topography to use irrigation water (mid and high land areas) and lack of agronomic practices (57% of respondents broadcasting method of planting their crops) for main crops like maize, sorghum, kore Rima, sesame [FIG. 7. a.] are other limiting factors in crop cultivation in identified study areas.

FIG. 6. **Poor Agronomic Practices of Sorghum Cultivation**.

In low land parts of both Melokoza and Basketo special woreda, most people are resettling from different parts of the country and road and transportation were mentioned by them as major problems to sell their crop products. The average distance to travel from farm gate to woreda market takes more than 3 hours in this area. Lack of modern post-harvest handling technologies like warehouse and stores for different products and awareness problem result in loose of seed quality. Respondents in low land were complaining that the security issue was very serious and first priority problem in the area. They reported that the bandits around border were killing them and taking away their animals. They also explained that they couldn't cultivate and manage their crops in the field and already stopped taking their livestock to rangeland area due to security problems.

a**. Maize Post Harvest Handling (In the Field)** b. **Termite in the maize field**

FIG. 7. **Maize Post Harvest Handling in Study Area (Source: Observation During Survey Season).**

There are a number of problems reported by study area farming communities and different experts which threatens production and productivity of livestock in study area. Lack of technological inputs (improved breeds of cattle, shoat) and improved forage technologies, diseases, failure of synchronization (sexed semen technology) due to long distance travelling and other unknown problems are limiting production and productivity of livestock in study area. As survey result shows, about 92% of respondents were complaining the livestock disease (አባሰንጋ፤ አባጎርባ፤ገንዲ, fly) problems in study area. Though there is some improved poultry breed (SASO) in the area, it does not resist diseases and other external exposures. Therefore, it needs the introduction and demonstration of new poultry breed technology which performs well to the existing agro ecologies. Hides and skins in study area totally ignored. No market at all for hides and skins. Therefore, it is mandatory to give special attention on post-harvest handling and promoting market linkage for hides and skins. Lack of value addition practices for all livestock products (dairy, honey) including crop commodities (sesame, avocado etc) hinders farmers from obtaining better income from their products.

Natural resources related issues either enhancing agricultural production and productivity (if managed in good manner) or hindering other ways. This study was carried out to identify major constraints related to natural resources which contribute agricultural production. According to assessment undertaken and information obtained from focus group discussion with farmers and experts, different natural resources management challenges were identified. Soil fertility is decreasing from time to time due to deforestation, erosion (wind, water (topographic effect)). Soil acidity is the major challenges of high land areas of the identified study area and contributing negatively to high land crops' cultivation. Lack of awareness on the use of fertilizer with recommended level also limiting the productivity of crop cultivation. Almost all of respondents were using chemical fertilizer not as recommended by experts. Furthermore, lack of sustainable water sources is limiting farmers from cultivating crops during dry seasons. Lack of improved seedlings to develop productive agro forestry system is also other challenges identified by respondents.

5.1.3 Farmers demand to agricultural technologies

As forwarded by farmers during focus group discussion, some possible solution or crop technology demand include conducting research on disease specially fall army warm, introducing and demonstrating improved seeds for cereal crops (maize: BH540, wheat and barley which are disease resistance and rice); spices(ginger which is disease resistance, coffee which kafa variety); oil and pulse crops(sesame which is disease resistance, Mung bean, common bean which is red wolayta); fruits and vegetable(apple which is crispina variety, banana from Arba Minch area, tomato from Ziway area); root and tuber(taro which is Boloso-1 type); enset and milk processing technologies.

They also reported that documentation and popularization of indigenous (for locally existing crops) should be undertaken. For example, locally existing sesame is more productive than improved one. However, there is dilemma to say about its history (some farmers say it is Wellega type, others say Gonder type and others say Melekoza, Basketo etc). Therefore, it is researchable issue and should be identified and recorded for beneficiaries. Similarly, local teff is more productive than improved one (kuncho) and should be documented by researchers.

Based on livestock production constraints, farmers and experts forwarded the following interventions as solution for government and other stake holders. These include: introducing improved cattle breeds (Jersey and Holstein Frisian which is bull but not sexed semen for mid and high land areas, Borena breed, Debub omo (key afer and hammer) they resist disease and drought for low land areas); poultry breed (cockock, dual purpose); improved forages (legumes forages); identifying and demonstrating highly nutritive feeds from locally available materials; solution for livestock disease and parasite treatment technologies, introducing improved honey bee hives (Germen and Kenya); building agro-processing industry (for both crop and livestock commodities), documenting indigenous sheep and community based breed improvement system, especially high land areas (Tafa kebele).

To overcome challenges few natural resource management practices have been undertaking in study area like terracing (32%), soil band (35%) and water ways, irrigation schemes [FIG. 8.], are used in degraded lands. Physical soil and water supported with biological stabilizer is not common in study. Most of farmers use chemical fertilizer (66%) to enhance soil fertility and have less awareness on other organic way of enhancing soil fertility in study area. This shows that the interventions are needed to defeat challenges related to natural resource management and some of them were mentioned by farmers and experts as solutions like introduction of lime technology, timely provision of inorganic fertilizer, introduction, and demonstration of multipurpose tree seedlings, constructing modern irrigation schemes anddemonstrating improved agro forestry practices.

Other natural resources management technology interventions forwarded by respondents (farmers and experts) include: promoting water harvesting, especially for dry seasons; introducing and demonstrating improved different agro-forestry practices (wanza vs coffee, wanza vs korerima, shoala vs korerima and/or coffee and others); focusing on community based forest management practices; introduction of water pump in affordable price; providing strong attention to natural resources management practices; introduction and demonstration of exotic trees; awareness creation on mixed plantation; demonstration of improved compost preparation from different locally available materials to enhance soil fertility.

FIG. 8. **Irrigation Scheme Constructed Agp-Ii in Study Area.**

5.1.4 Agricultural Mechanization in study areas

Agricultural mechanization is the use of any mechanical assist in agricultural production. These could include simple hand tools, animal drawn or sophisticated mechanically powered agricultural machines. The sources of energy for these mechanization include humans, animals and engine or electrical power respectively and the productivity of each level depends on the power source. As literature indicates [5], humans being inefficient one can hardly cultivate a hectare of land per season, whereas animal powered technology is of no use beyond three hectares whereas mechanical powered technology is good enough to cultivate a minimum of 40 hectares.

In study area, there is very limitation on mechanization of agriculture. The survey result shows that availability problem (76%) or lack of mechanization tools is important reason not to use mechanized agriculture. As data obtained from focus group discussion, household survey and transit observation indicate, farmers in lowland area use animal and human power and in mid and high land areas they use more of human power (mostly hoe) for agricultural activities. Farmers in mid and low land areas were explaining that they do not use agricultural mechanization like tractor due to very sloppy topography and small farmland size. Not only crops but also no agricultural mechanization for animal production and even for post-harvest handling. However, there is maize thresher [FIG. 9] only in two or three kebeles' FTCs (farmers' training centers) but not started providing services yet.

Based on the area agriculture potential, farmers forwarded some agricultural mechanization interventions. These include: teff raw planter; thresher for sesame, maize and wheat; harvester (sesame, wheat, teff); processors for enset (kocho, bula); processors for dairy products like milk churners and other technologies; and honey processors.

FIG. 9. **Maize Thresher (Available Only in Two to Three Kebeles Perworeda).**

5.1.5 Perception of farmers and experts on existing technology demonstration approaches

Currently, the government has designed and implementing different approaches to demonstrate newly released and adopted agricultural technologies in order to transfer to farming communities including in study area. Some of agricultural technology demonstration approaches available in study area include pre-scaling up, pre-extension demonstration (PED), clustering, farmers training center (FTC), model farmer, farmers research and extension group (FREG) and participatory variety selection (pvs) approaches. However, the degree of farmers' participation on these approaches differs for different farmers in study area. As study shows also each approach has its own positive and weak sides.

The TABLE 2. below shows the extent of farmers' participation on different agricultural technology demonstration approaches.

TABLE 2. **Agricultural Technology Demonstration Approaches.**

Demonstration approaches	**Responses**	
	N	**Percent (%)**
Pre-scaling up	2	1.4
Pre-extension demonstration (PED)	10	6.8
Clustering	4	2.7
Farmers' training center (FTC)	128	87.7
Model farmers	58	39.7
Farmers' research and extension group	4	2.7
Participatory variety selection (PVS)	14	9.6
Others	4	2.7

As per the responses of farmers and experts, each of the approaches has its own quality and problem. For example, farmers training center (FTC) is the most known technology demonstration approach in study area. Around 88% of respondents participate in FTC. As respondents' perception, FTC is better than other approaches since it is open to all farmers to participate in any demonstration. Many (more than one) technologies can be demonstrated at one season since it has large land size. It is the area where people (farmers) adhere together for different social, economic and political affairs and can easily access to whatever is available or demonstrable in the area.

Despite of these, currently there are some challenges facing to FTC. For example, experts were complaining that the budget is the most serious challenge for FTC (demonstrations, maintenance, not mechanized). As observation shows [FIG. 10], most of FTCs are not running their missions. There is no experiment or demonstration plot. Experts (development agents) plant different crops (cash crops) for fundraising but not for demonstration purpose since they lack budget. Other problems explained by farmers include shortage of experts, especially animal health experts, lack of regular follow up and demonstration, experts are not easily access able at any time. Farmers get training and demonstration from local government experts. This shows that NGOs, research institutes and universities are not demonstrating on FTCs in study area. Even though there are different challenges, majority (64%) of respondents preferred FTC as technology demonstration approach or site for upcoming time.

Clustering approach is another way to demonstrate agricultural technologies. The cluster approach the approach in which agricultural technologies are demonstrated by merging several small farms and provides small farmers an opportunity to get good profit for their produce. As study shows, clustering was considered as better next to FTC. It allows farmers to learn or share experience one from another. However, there are no clear criteria to select farmers to participate in clustering approach.

Also, free availability of all inputs (seed, fertilizer, chemical) to farmers leads to develop dependency among farmers. The experts also explained that farmers complain on them when inputs are given to part of farmers and not to others. Though other approaches (farmers research and extension group, participatory variety selection, pre-extension demonstration (no regular follow up), and model farmer) are more scientific, not participate or include all farmers and technologies as FTC and Cluster approach.

FIG. 10. **Crops Planted on Farmers' Training Center.**

6. Conclusion and Recommendation

The main objective of this study was to identify and establish technology village which is appropriate to demonstrate any agricultural technologies (crop, livestock natural resource management). The major agricultural technologies which are found in study area include cereals, pulses, root and tubers, spices, fruits and vegetables and livestock technologies such as cattle, shoat, poultry, bees and natural resource management systems. The main challenges which hinder agricultural production and productivity include diseases, pests and luck of improved technologies for most of agricultural technologies. Farmers have demand on different agricultural technologies, mainly include disease resistance sesame varieties, introducing improved cattle breeds (Jersey and Holstein Frisian which is bull but not sexed semen) Borena breed, poultry breed (cockock, dual purpose); improved forages (legumes forages), introduction and demonstration of multipurpose tree seedlings, constructing modern irrigation schemes and demonstrating improved agro forestry practices. Farmer's training center (FTC) is the most known technology demonstration approach among others in study area.

Around 88% of respondents participate in FTC. FTC is better than other approaches because it is open to all farmers to participate in any demonstration. In study area, there is very limitation on mechanization of agriculture. The survey result showed that availability problem (76%) or lack of mechanization tools is important reason not to use mechanized agriculture in the area. Therefore, recommendation of technology village was based on potential of those aforementioned thematic areas, land size (FTC, private, institution), accessibility (road), agro-ecology centeredness and technology adoption experience.

TABLE 11. **Recommended Technology Villages (Ranks: 5 = very good, 4 = good, 3 = fair, 2 = poor, 1= very poor)**

Woreda	Sample Kebeles where the survey was conducted	Criteria used to select model kebele (Village)						**Total markes**	**Indexx**	**Rank.**	**Name of identified village**
Melokoza		Land size	Road access	Previous technology adoption experience	Topography	Centeredness	Others				
	Tafa	4	5	4	5	5	2	25	0.41	1st	*Selamber*
	banka	3	3	3	3	3	2	17	0.28	3rd	
	Salayish mender 03	5	4	3	3	2	2	19	0.31	2nd	*mender 03*
	Total							**61**	**1**		
Basketo Special woreda	Angla 03	5	4	3	3	3	2	20	0.31	2nd	Angila konso
	Motikesa Arzeka	4	5	4	5	5	3	26	0.41	1st	Kamitera
	Sasa Makesa	4	4	3	4	3	2	18	0.28	3rd	
	Total							**64**	**1**		

As TABLE 11. shows, two technology villages are recommended as option based on agro ecologies (mid land and low land). Mid land represents both high lands and mid lands because both have relatively similar climate conditions in study area whereas the second option represents lowlands. Therefore, if resources allow, it is recommendable to use both villages. However, if there are resource limits, it is better first ranked option to be used. Therefore, based on findings, the study recommends optional technology villages with the following interventions:

- Research (by research institute or center and universities) and development (by government, non-government, universities) interventions should be done based on identified technology demands (crop, livestock, and natural resources management) Special focus should be given to disease controlling (both plant and livestock).

REFERENCES

1. Shita A, Kumar N, Sigh S. Agricultural Technology Adoption and Its Determinants in Ethiopia: A Reviewed Paper. Asia Pac J Res. 2018;1(LVV):99-104.
2. ECOSOC. Agricultural Technology for Development. Secretary-General's Report to the 64th General Assembly: Old Issue, New Context. 2015
3. Dhamale M, Mahajan A, Kinhekar AS, et al.. Reviving Technology Demonstration in Farmer's Field: An Appraisal. J Exp Biol Agric Sci. 2018;4(Spl 2):S40-S47.
4. PRC. Study on Modern Agriculture Demonstration Area Planning and Financial Support Mobilization: Technical Assistance Consultant's Report. Policies on the Construction of Modern Agricultural Demonstration Areas to Achieve Agricultural Modernization. 2015.
5. Kelemu F. Agricultural Mechanization in Ethiopian: Experience, Status and Prospects. Ethiop J Agric Sci. 2015;25(1):45-60.