Southern Agricultural Research Institute

# Agricultural Production Constraints in Agricultural Growth Program II Woredas in SNNPR



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# Preface

One of the five components of the Agricultural Growth Program II (AGP-II) is the research component coordinated by the Ethiopian Agricultural Research Institute. The research component of AGP-II has, in turn, four subcomponents: technology adaptation and generation, pre-extension demonstration and participatory research schemes, source technology multiplication and/or maintenance; and capacity development to enhance the above sub components. The South Agricultural Research Institute (SARI) is one of the six research institutes in the country benefiting through the AGP-II project since January, 2016. The project is implementing in 35 weredas that have been identified as the AGP-II project command areas for the Southern region.

This document on 'Agricultural Production Constraints in Agricultural Growth Program II Woredas in SNNPR' is the outcome of a survey conducted at the end of 2016 and beginning of 207. It was launched as an important part of the planning process, intended to ensure effective implementation of the project component by achieving the specific and broader objectives set under the research sub components. This study has diagnosed the agricultural production constraints and technology demand of beneficiary small holder farmers of the project command areas in collaboration with key stakeholders at regional, zonal, wereda and kebele levels. The survey also mapped the farming and livelihood systems in the target areas. It identified the key priorities constraining agricultural production and food security in the project weredas.
Hence, this study report could be considered as an important contribution not only for the implementation of the AGP-II research component but for the research system of SARI in the other parts of the region with similar agro ecology. It is a useful reference on the demand for agricultural technologies in the region.
Finally, I would like to extend my sincere gratitude to the World Bank and other partner donors supporting the AGP-II through the Ministry of Agriculture and Livestock Resources of FDRE, and to the Ethiopian Institute of Agricultural Research for supporting SARI through the AGP-II research component in general and for funding this survey in particular.

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# 1. Introduction

In Southern Nation Nationalities and Peoples Regional State (SNNPR), 90% of the total population depends on agriculture as a source of food, cash income, as industry inputs row material and for export. SNNPR is a large region in Ethiopia (about 112,323.19 sq. km) accounting for more than 10% of the country's surface area (CSA) estimated population of 18 million (CSA, 2006). It is overwhelming rural population, with only 8% living in urban areas. The region is divided into 14 administrative zones, 133 woredas, and 3512 kebeles. SNNPR contains a huge variety of ethnic groups – as many as 56 with their own languages, cultures, beliefs, traditions, rituals and social identities living togather.

The region encompasses both densely populated, intensively cultivated agricultural highlands (including high levels of coffee production) and pastoral lowland areas. These very different environments present different challenges for resource management.

A traditional, subsistence farming system is the main livelihood in the region, especially in the highland areas, with farmers managing both crops and livestock. Because of its diverse agro-ecologies, climates, soil types and cultural practices, the region is the home to many varieties of food crops, in particular maize, wheat, tef barley, root crops and enset and livestock resources for milk, meat, egg, fish and honey production and used as draught power plough (*maresha*) in the region. The Agricultural Growth Program (AGP-II) is operating in 157 and 35 woredas in the country in SNNPRS respectively. Its operation is being conducted based on the objectives of the second growth and transformation program (GTP-II). The research component of the AGP-II (component II) provides support to the agricultural research system with the objective of developing/generating 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. Four sub-components are addressed by the research system. These include: technology generation and adaptation in crop, livestock and natural resource, agricultural information and value addition of selected commodities in socioeconomics research, pre extension demonstration and popularization of the adapted technologies, source technology

multiplication/production, and capacity development to support the above sub-components. The sub components and each activity under them address three cross cutting issues: gender, climate, and nutrition.

South Agricultural Research Institute (SARI) through its 6 research centers has been conducting a total of 209 research activities approved so as to address production constraint problem in 35 Districts/Woredas in the region. Of these 86 research activities selected from pipeline technologies and other 123 research activities iniated after production constraint asssesment in the project woredas. All activities were developed based on GTP II. From these, 97 were crop research activities, 47were designed to improve the production, productivity of livestock and the remaining 49 activities aimed to improve the natural resource management, and to reduce degradation of fragile soil and ecosystems improvement 16 activities socioeconomic research activities. In addition, there are 101 activities associated with source technology multiplication and pre extension demonstration and popularization of elite technologies are under implementation. Totally 310 activities were implemented and of these about 120 were completed and other activities are in good progress based agricultural prodoction consraint assesments idenfied.

In crop production: crop pests (disease, insect pest and weed), lack of improved seed, lack of improved technology, high soil acidity in high land areas, decline of soil fertility, lack of awareness on crop pests and their managements, shortage of land and lack to access in modern irrigation schemes were the major constraints raised by farmers and identified through field observation. In livestock production the major problems identified are: shortage forages, improved breeds, animal health (livestock diseases and parasites) and management.The identified natural resource (soil, water, forest) management constraints and practices are reported under four categories: soil fertility management, soil and water conservation, small-scale irrigation management, and forestry and agro-forestry management.

To ensure effective implementation of the project and achieve the specific and broader objectives, diagnosing the agricultural production constraints and technology demand of beneficiary small holder farmers of project command areas, together with key stakeholders, is the most important part of research planning. Conducting research on the constraints identified by researchers, farmers, and extension workers would have a significant contribution towards solving the problems and technology adoption. Therefore, South Agricultural Research Institute (SARI) with concerned stakeholders has exhaustively

undertaken survey to identify agricultural production constraints in all project woredas. Base up on the result of the assessment research, pre extention demonstration (PED) and source technology multiplication activities were proposed and on implementation.

## 2. Rationale of the Study

Of the five components of AGP II, Component 2 represents agricultural research. This Component embraces the following four sub-components:

1. Technology adaptation and generation;
2. Pre-extension demonstration and participatory research schemes;
3. Source technology multiplication; and
4. Capacity development to enhance technology adaptation and generation, pre extension demonstration and source technology multiplication (maintenance)

The component is devoted to support the adaptation and generation of improved and innovative technologies to enhance agricultural productivity and commercialization of small-scale farmers. In order to generate appropriate technologies that are easily adoptable, environmentally friendly, technically viable, economically feasible, and gender responsive, a study was conducted and information was generated on the prevailing status of agricultural production, constraints and available opportunities.

This report, therefore, presents the findings of the study and provides recommendations proposed to address the constraints. The information generated will fundamentally serve as the basis for making informed decisions on subsequent steps, such as planning research activities for technology generation, adaptation, demonstration, promotion, and dissemination, and capacity development. The information will also be used as a baseline with which end line findings will be compared after termination of second phase of AGP.

## 3. Objective of the Study

The objective study is to assess and document agricultural production constraints and demand for technologies, to characterize the farming systems

and identify the intervention areas in order to solve the constraints of crop, livestock, and natural resource management and important agricultural information in the 35 woredas other woredas with similar agroecological zones in the of the region to achieve desired goals of the project.

# 4. Methodology

The study was conducted using qualitative survey methods including PRA tools and other participatory approaches were adopted to collect primary information from the farming community and staffs of zone and woredas Agriculture Offices. A team of professionals drawn from different fields of specializations conducted the whole study including data collection. Also informal survey method with a checklist agreed with all RARIs and EIAR at national level was used. It considered data from different sources. Primary data were obtained from key informants at kebele level, DAs and Focus Group Discussion (FGD). Whereas secondary data were collected from documents of the relevant offices mainly from Woreda Office of Agriculture and Natural Resources Development Office (WOAN), Woreda Livestock and Fishery Resource Development Office (LFO), previous research reports, Zone Agriculture and Natural Resources Development Department (ZAND), Zone Livestock and Fishery Resource Development Department (LFD), Data collected from AGP II Coordination Unit of the region, CSA, Region Finace and Eceonomy Development Burea (BoFED) etc.
Prior to field survey, a multidisciplinary team of researchers representing Crop, Natural Resources Management, Livestock, and Socio-economic Research disciplines from each of the six agricultural research centers (Hawassa, Areka, Jinka, Bonga, Arbaminch, and Worabe) were given detailed orientation and discussions made on data collection and analysis.

After the orientation, the research teams in their respective research centers made a discussion on the checklist to have a common understanding before starting the survey. Communication and discussions were made with stakeholders especially Woreda AGP II technical committee members on the issue and then selected 89 representative kebeles from 35 'AGP II Woredas' based on agro–ecology and production potentials. Key informants (mainly experts from different offices) and identified farmers from different social groups (male, female, youth) group were selected for group discussion by research team and experts from woreda farm and natural resource and livestock and fishery offices. The established group separately figured out the

agricultural production systems and constraints of their kebeles and Woredas. Total of 267 key informant groups 6,054 farmers (2,749 males, 1,337 females and 1968 youths both female and male) were participated in the study (Table .1).

Moreover, other PRA tools such as observations, transact walk, triangulation, and pair wise ranking were also used to identify and prioritize major agricultural production and productivity constraints, potentials, and demands of farmers. The data/information collected from different sources was analyzed using different techniques. Qualitative data was narrated whereas quantitative data was summarized using simple descriptive techniques such as percentage. The data was organized at each center and validated at 10 AGP II suppoted zones by stakeholders from woredas and zones at seven clusters. Finally, the document was exhaustively reviewed at regional level with management members of the institute and research centers in the presence of researchers and summarized by the team organized at institute level.

Table 1. Number and social class of farmers participated in the group discussions across the six research centers

| Research center | No. of woreda | No of kebele | No. of interviewees | No of participant farmers by gender | | | |
|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Youth | Total |
| Hawassa | 7 | 14 | 56 | 441 | 189 | 378 | 1008 |
| Areka | 3 | 9 | 9 | 45 | 45 | 45 | 135 |
| Jinka | 3 | 20 | 60 | 1363 | 383 | 735 | 2481 |
| Bonga | 11 | 22 | 66 | 396 | 264 | 330 | 990 |
| Arba Minch | 2 | 6 | 18 | 144 | 96 | 120 | 360 |
| Worabe | 9 | 18 | 54 | 360 | 360 | 360 | 1080 |
| Total | 35 | 89 | 263 | 2749 | 1337 | 1968 | 6054 |

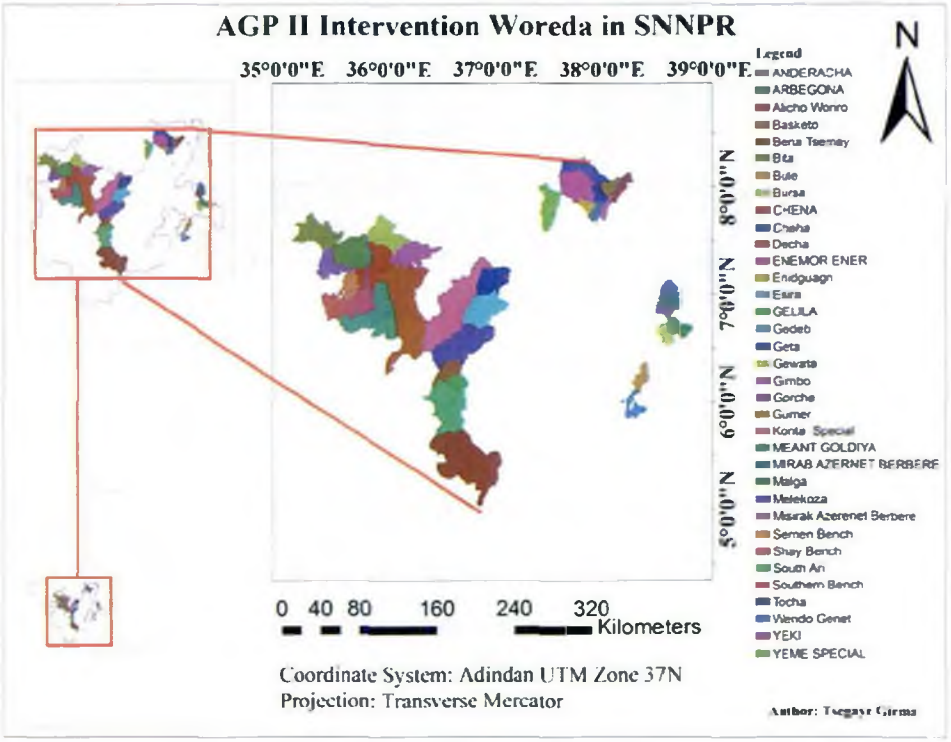


**Figure 1: Locations of AGP woredas in SNNPRS**

**Figure 2. Focal group discussion Debube Ari and Benathemy woredas (Jinka ARC)**

**Figure 3 . Focal group discussion with women Youth group Melo koza woreda Gergeda keble (Arbaminch ARC)**

## 4.1. Description of the study areas

Southern Agricultural Research Institute (SARI) has six research centers) that support 35 woredas. Thirty-two woredas are found in 10 zones [Sidama (5), Gedeo (2), Gurage (5), Silte (3), Kafa (5), Sheka (2), Bench Maji (4), Gamo Gofa (1), South Omo (3), and Dawuro ) (2)] and the remaining 3 woredas are special woredas (Yem, Konta and Basketo). The specific locations of 35 'AGP woredas' together with their administering research centers (indicated in Figure.1 and table 1.

On average, the woredas are 391 km and 434 km far from Hawassa and Addis Ababa cities, respectively. The nearest AGP woreda to Hawassa is Wondogenet (23k.m) which is located in Sidama while the farthest is Yeki (884 km) which is found in Sheka zone. The average population of 'AGP woredas' is 118,696; minimum and maximum from Anderacha (28,792) and Debub Ari Woreda (254,883), respectively. The value is different with reference to households; minimum and maximum number from Semen Ari (10,095) and Debub Ari (42,455), respectively. The average area of the AGP woredas is 72, 877.50 ha, while the smallest and the largest AGP woredas respectively are Wondo Genet (10,106ha) and Decha woreda (308,684 ha). All 'AGP II woredas' have 962 kebeles with the average number of 27 kebeles per each. The woreda with smallest kebele number is Wondo genet (15 kebeles) while the largest number of kebele are found in Enemore Ener (71 kebeles). All relevant information is presented in Fig 1 and Table 2.

Figure 4. Focus group discussion during production constraint assessment at Menite Goldia, She Bench and Semen Bench woredas ( Bonga ARC)

Figure 5. Review at regional level with SARI staff and Center management members at institute

Table. 2., Demography, weather, and agro-ecology distance from capital towns of woredas across zones

| Zone | Cluster districts | Distance | | Population (000) | | | HH Size | | | No. Of Kebeles | Altitude | | Mean Annual Temp (°C) | Mean Rainfall (mm) | Agro ecology (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hawassa | A.A | Male | Female | Total | Male | Female | Total HHs | | Min | Max | | | Dega | Woyna dega | Kolla |
| Sidama | W/Genet | 23 | 298 | 96.62 | 91.94 | 188.55 | | | | 15 | 1704 | 2600 | 16.0 | 1,400 | 33 | 67 | 0 |
| | Malga | 26 | 301 | 65.79 | 63.27 | 129.06 | 21397 | 1203 | 22600 | 23 | 1900 | 2800 | 17.2 | 1,400 | 78.3 | 21.7 | 0 |
| | Gorche | 44 | 319 | 63.09 | 61.27 | 124.36 | 20985 | 6474 | 27459 | 23 | 2600 | 3800 | 19.5 | 1,200 | 75 | 25 | 0 |
| | Arbegona | 77 | 352 | 80.35 | 80.61 | 160.96 | 16750 | 854 | 17604 | 41 | 2000 | 3336 | 18.0 | 1,950 | 89 | 11 | 0 |
| | Bursa | 98 | 373 | 60.94 | 61,08 | 122.02 | 18094 | 957 | 19051 | 41 | 2000 | 3200 | 12.2 | 1,400 | 30 | 70 | 0 |
| Gedeo | Bule | 127 | 387 | 62.73 | 61.97 | 124.70 | 26210 | 1547 | 27757 | 33 | 1950 | 2650 | 19.0 | 1,600 | 70 | 30 | 0 |
| | Gedeb | 160 | 435 | 84.53 | 84.19 | 168.72 | | | | 16 | 1950 | 2650 | 18.5 | 1,545 | 67.5 | 32.5 | 0 |
| Silte | Mirab Azernet | 223 | 258 | 32.27 | 38.53 | 70.79 | 41195 | 44628 | 85823 | 21 | 2500 | 3277 | 17.5 | 1,500 | 100 | 0 | 0 |
| | MisirakAzernet | 205 | 216 | 26.82 | 32.63 | 59.44 | 26772 | 32526 | 59298 | 18 | 2030 | 2778 | 24.5 | 1,567.5 | 60 | 40 | 0 |
| | Alicho Wuriro | 210 | 198 | 49.36 | 59.19 | 108.56 | 12691 | 3847 | 16538 | 27 | 2560 | 3262 | 16.0 | 1,050 | 100 | 0 | 0 |
| Gurage | Enemorena Ener | 465 | 192 | 93.74 | 104.56 | 198.30 | 88828 | 99238 | 188066 | 71 | 800 | 3400 | 19.0 | 1150 | 16.3 | 57.39 | 26.34 |
| | Gumer | 260 | 215 | 44.30 | 50.41 | 94.71 | 47453 | 54039 | 101492 | 20 | 2700 | 3178 | 13.85 | 1300 | 100 | 0 | 0 |
| | Endegagn | | 221 | 26.88 | 30.93 | 57.81 | 8180 | 2200 | 10380 | 18 | 2200 | 2800 | 13.8 | 1,300 | 71.5 | 29.5 | 0 |
| | Cheha | 272 | 216 | 67.81 | 70.41 | 138.23 | 22238 | 2819 | 25057 | 43 | 900 | 2812 | 17.0 | 1,268 | 20 | 65 | 15 |
| | Geta | 327 | 240 | 38.68 | 42.69 | 81.37 | 35455 | 51020 | 86476 | 18 | 2400 | 3000 | 21.0 | 1,205 | 100 | 0 | 0 |
| | Yem sp. woreda | | 243 | 48.53 | 48.10 | 96.64 | 16350 | 1542 | 17892 | 35 | 991 | 2934 | 21.0 | 1,500 | 49.3 | 26.9 | 23.8 |
| Kafa | Decha | 737 | 486 | 76.19 | 76.25 | 152.45 | 18260 | 1402 | 19662 | 60 | 507 | 2200 | 20.0 | 2,000 | 7 | 46 | 47 |
| | Chena | 740 | 530 | 93.05 | 95.67 | 188.71 | 18351 | 3334 | 21685 | 44 | 1005 | 2500 | 22.0 | 1,356 | 15 | 85 | 5 |
| | Gimbo | 722 | 442 | 53.68 | 54.18 | 107.86 | 13,789 | 2,299 | 16,088 | 31 | 1300 | 2500 | 25.0 | 1,025 | 10.3 | 74.4 | 15.3 |
| | Gewata | 740 | 546 | 42.09 | 43.19 | 85.29 | 11963 | 1700 | 13663 | 30 | 1550 | 2450 | 20.0 | 2,000 | 22 | 75 | 3 |
| | Bita | 815 | 543 | 43.61 | 44.49 | 88.10 | 12,420 | 912 | 13,332 | 26 | 1300 | 2500 | 14.0 | 1,850 | 85 | 15 | 0 |
| Bench Maji | Debub Bench | 868 | 593 | 63.37 | 65.80 | 129.17 | 23,200 | 3460 | 26,660 | 29 | 501 | 2500 | 20.0 | 1,900.5 | 15 | 80 | 5 |
| | Shey Bench | | 555 | 66.78 | 72.97 | 139.75 | 16362 | 2939 | 19c3 01 | 21 | 1400 | 2485 | 15.8 | 1,173.8 | 0 | 99 | 1 |

| Zone | Cluster districts | Distance | | Population (000) | | | HH Size | | | No. Of Kebeles | Altitude | | Mean Annual Temp (°C) | Mean Rainfall (mm) | Agro ecology (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hawassa | A.A | Male | Female | Total | Male | Female | Total HHs | | Min | Max | | | Dega | Woyna dega | Kolla |
| | Semen Bench | 877 | 587 | 61.61 | 64.56 | 126.17 | 16690 | 2917 | 19607 | 31 | 1300 | 2700 | 21.5 | 1,241 | 3 | 95 | 2 |
| | Menit Goldia | | | 51.40 | 53.39 | 104.78 | 21,685 | 747 | 22432 | 32 | 600 | 2400 | 21.3 | 1,241 | 3 | 95 | 2 |
| Sheka | Yeki | 884 | 609 | 84.17 | 80.00 | 164.17 | 2751 | 17782 | 20533 | 22 | 1500 | 2200 | 18.8 | 1900.5 | 15% | 15% | 70% |
| | Andiracha | 936 | 661 | 14.45 | 14.34 | 287.92 | 3415 | 715 | 4130 | 16 | 1500 | 2200 | 20.5 | 1850 | 85 | 15 | 0 |
| Dawuro | Esera | 347 | 539 | 38.99 | 38.17 | 38.99 | 10772 | 1647 | 12419 | 31 | 900 | 2600 | 26.0 | 1,800 | 24 | 45.2 | 30.8 |
| | Tocha | 247 | 499 | 62.38 | 59.87 | 122.24 | 14618 | 1668 | 16286 | 36 | 650 | 2850 | 28.5 | 1,450 | 44.1 | 19.5 | 36.4 |
| | Konta sp. Woreda | 367 | 460 | 53.42 | 55.20 | 108.62 | 17823 | 5940 | 20265 | 46 | 900 | 2300 | 25.5 | 1,745 | 6 | 54 | 40 |
| Debub Omo | *Debub Ari* | 720 | 810 | 125.83 | 129.05 | 254.88 | 23959 | 18496 | 42455 | 48 | 500 | 3000 | 18.8 | 1,100.5 | 30 | 65 | 5 |
| | Semen Ari | 372 | 602 | 39.40 | 40.22 | 79.62 | 8319 | 1776 | 10095 | 33 | 900 | 3200 | 16.5 | 1,500 | 54.5 | 8.32 | 37.14 |
| | Bena Tsemay | 475 | 739 | 31.71 | 30.92 | 62.63 | 13342 | 4592 | 17,934 | 32 | 526 | 1645 | 23.1 | 388 | 0 | 1 | 99 |
| Gamo Gofa | MeloKoza | 398 | 661 | 70.59 | 71.34 | 141.92 | 25859 | 3077 | 28936 | 39 | 501 | 2500 | 21.3 | 1,125 | 29.7 | 32.43 | 37.84 |
| Basketo | Basketo | 360 | 626 | 34.12 | 33.67 | 67.80 | 24586 | 2506 | 27092 | 31 | 780 | 2200 | 21.0 | 1,200 | 1 | 45 | 54 |
| Average | | 391 | 434 | | | 130.78 | 16704 | 3972 | 20676 | 32 | 1558 | 2797 | 19.7 | 1451 | 46 | 39 | 14 |
| Minimum | | 23 | 198 | | | 59.298 | 2751 | 854 | 10095 | 15 | 500 | 1553 | 12.2 | 1025 | 0 | 0 | 0 |
| Maximum | | 884 | 739 | | | 219.708 | 26210 | 18496 | 42455 | 71 | 2700 | 3800 | 28.5 | 2000 | 100 | 99 | 100 |

# 5. Farming Systems

Most farms owned by smallholders are fragmented and who mainly practice crop–livestock mixed farming system. Rain fed agriculture dominates and some areas have traditional supplementary irrigation practice for the production of certain crops in cases of rainfall shortage and for vegetables in dry 'season. The rainfall distribution and intensity vary spatially tending to decrease from southwest to other parts of the region, and lowlands where subsistence farming is a typical feature. Even though, mixed farming system dominates in the region, pastoral and agro-pastoral systems are practiced in few areas of the project woredas.

Diversified crops are cultivated in the three main agro-ecologies—high land, mid land and lowland. The main distinguishing feature of the cereal cropping systems is that nearly most crops are produced from seed. The crops are mainly cereals, pulses and oil crops, root and tuber crops (enset, cassava, potato, sweet potato, taro, yam, etc.) and vegetables. Mono cropping, inter cropping, crop rotation and relay intercropping predominantly practiced in the assessed Woredas. Fallowing is also the other system, which is practiced majorly in the lowland areas to restore soil fertility. Two major cropping seasons were identified; *'Belg'* (short rainy season) and '*Meher'* (longer rain season). Crop production is totally rain fed due to limited access for irrigation. Among cereal crops, maize is the most important *Belg* season crop. The frequency of tillage for maize, tef, wheat, and linseed is four times though depend up on soil type and availability of oxen. Sorghum and barley are planted at third, common bean; field pea and faba bean at second tillage. Maize; Irish potato; sweet potato and carrot are planted using row planting system with recommended seed rate and the rest of major crops are planted by broadcasting with farmers seed rate but in these days because of agricultural extension program intervention, wheat, barley and tef are being planted in row in some areas of the project woredas.

Some farmers grow agro forestry and forest trees in their farmland especially in Gedeo, Sidama, Dawro, Gamo Gofa, and most of southwestern zones (Kafa, Bench Maji, and Shaka Zones). In order to maintain soil fertility, farmers apply organic fertilizers ('manure') on home garden but apply only inorganic

fertilizers on other farmlands. Farmers have access to inorganic fertilizers through their respective woredas Office of Agricultural. Pulses (field pea, faba bean, and common bean) are used in the cropping pattern as soil fertility improving crops. Seeds of major crops are obtained from local market except maize and some vegetables. Perennial crops, such as enset, coffee, chat, and *gesho* are also important for soil conservation systems.

Livestock farming system plays major role: a store of wealth, gives a variety of products for sale or home consumption such as milk, meat, butter, skin, and hides), an insurance against times of famine, draught power plough (*maresha*) has replaced the hoe in many areas, as source of fuel dung and manure for soil improvement and for transportation. The degree of integration among crops, livestock, and trees varies considerably from place to place. Livestock comprise cattle, sheep, and goats. Sheep tend to predominate at higher altitudes and areas of higher rainfall, and goats in the lowland areas.

Livestock feed is obtained from communal grazing lands, which are relatively extensive in the south and southwest parts of the region, crop residues and stubble grazing in the central and eastern zones of the region. In the south, there are seasonal movements of livestock with lowland herds moving up to the relative mid lands in the dry season for searching grazing areas. Livestock occur in all farming systems where cattle are integral part of most of them.

Increasing smallholder farmer production through the adoption of modern agricultural technologies and practices is a key verge for meeting productivity targets. As technological advancements have zoomed in recent decades, farmers in the AGP-II woredas of SNNPR have taken advantage of introduction to streamline their farming operations and maximize outputs. Enhancements to increase agricultural production and productivity should focus on appropriate use of farmland, agricultural technologies, and practices. The outbreaks of crop and livestock disease and pest in the areas are controlled by weeding on time, using different chemicals, and vaccinating the animals.

## 5.1. Seed and seed systems

Seeds are obtained from neighboring farmers, farmers own seed or from the government. Kale, enset, coffee, eucalyptus and other seedlings such as avocado, mango and other fruit trees were obtained from Keble Agriculture and Natural Resource nurseries, neighboring farmers or own saved seed. The sole source of improved seeds for maize, wheat and other seeds is Office of Agriculture and Natural Resource. However, potato, beetroot, carrot, head cabbage, tomato, faba bean, and field pea could be obtained from either market or neighboring farmers. The respondents in some woredas indicated that one of the most important problems farmers face is use of varieties outside their recommended agro-ecology.

## 5.2. Land use pattern

Demographic change has led to ever-decreasing farmland area per household and expansion of agriculture into marginal lands. Climatic extremes have been further aggravating the situation in large parts of the region. Analysis also showed that agriculture nowadays has reached its maximum extension on suitable lands and expanded more and more into marginal lands threatening biodiversity in forests. Table 3 depicts the land use pattern of AGP II woredas covered by SARI. The total area coverage of AGP II woredas is 2,880,768 ha. Average area of woredas' is 82,307.7 ha whereas annual and perennial crops cover average land is 34,345.5 ha of which 16,875.5 ha is covered by annual and 18,237.9 ha perennial. The smallest and the largest cultivated land is found in Endegagn (9,139.1 ha) and Debub Bench Woredas (113,598.5 ha) respectively. The woredas with the largest and smallest cultivable land respectively are Minit Goldia (43,671.2ha) Bule (84 ha) Woreda where the average cultivable land size is 10,530 ha. With regard to forestland, Anderacha Woreda of Sheka Zone has the largest forestland (84,180 ha) and Bule Woreda of Gedeo Zone has the smallest forestland (135 ha). The average forest area of AGP II woredas is 18,288.83 ha. The woredas with the largest and smallest grazing land are Bena Tsemay Woreda of South Omo Zone and Gedeb Woreda of Gedeo Zone, respectively. The AGP woreda with the largest and smallest uncultivable land are Bena Tsemay and Arbegona Woredas, respectively. Among the 35 AGP woredas, 24 woredas have irrigated land, where the largest and smallest irrigated land is found in Wondogenet Woreda of Sidama Zone

and Endegagn Woreda of Gurage Zone. Generally, the data on land use pattern of AGP woredas coincides with the southwest part of the region is known for forest (Anderacha), south part of the region particularly South Omo is known for livestock rearing/grazing (Bena Tsemay) and the central zone is known for crop production, for example, Arbegona and Basketo special Woredas.

Table 3. Land use pattern of the AGP Woredas

| Zone | Woreda | Total area (ha) | Cultivated land | | | Cultivable land | Forestland | Grazing land | Uncultivable/ Waste land | Social and other | Irrigated |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Annual | Perennial | Total | | | | | | |
| Sidama | W/Genet | 10106 | 2808.3 | 7297.7 | 10106 | 93 | 2928.4 | 556.6 | - | 1018.8 | 7901 |
| | Malga | 18177 | 7645 | 3229 | 3993 | 899 | 838 | 1751 | 451 | 112 | 1859 |
| | Gorche | 18956 | 6185.6 | 6500.4 | 12686 | 469.9 | 1511.7 | 2785 | 143.7 | 1252.6 | 1129 |
| | Arbegona | 36000 | 14949 | 9891 | 24840 | 165 | 4871 | 5622 | 125 | 377 | |
| | Bursa | 23625 | 8658 | 6853 | 15511 | 629 | 1201 | 636 | 765 | 510 | |
| Gedeo | Bule | 27293 | 12,832 | 9259 | 22,091 | 84 | 135 | 708 | 188 | 1107 | 1004.1 |
| | Gedeb | 30909 | 12,756 | 16,372 | 29,128 | 402 | 386 | 244 | 83 | 457 | 2509 |
| Silte | MerabAzrenet | 18894 | 11,147.4 | 2267.3 | 13414.7 | 377.9 | 2267.3 | 2834.1 | 188.94 | 3211.9 | 150 |
| | MesirakAzmet | 19404 | 2878 | 8002 | 10880 | 1352 | 5220 | 1644.9 | 287.02 | 1639 | 6115 |
| | Alichiworino | 26645.2 | 18668 | 5598 | 24268 | 1486 | 174.2 | 3818 | 243 | 2332 | 5560 |
| Gurage | Enemoreener | 191564 | 7150 | 18593 | 107584 | 24788 | 6647.3 | 26340 | 4968 | 44136 | 12449 |
| | Gumer | 23555 | 10548 | 1542.7 | 12090.7 | 1349.7 | 1058.81 | 8161.1 | 494 | 401 | 900 |
| | Endegagn | 11376 | 8030.1 | 1109 | 9139.1 | 1890 | 266.9 | 864 | 567 | 8324 | 61 |
| | Cheha | 57310 | 11,916 | 3579 | 15,495 | 29059 | 1330 | 2249 | 2136 | 675 | 2552 |
| | Geta | 14629 | 8032 | 2406 | 10438 | 2406 | 646.47 | 966 | 4023 | 908 | 5000 |
| | Yem sp. | 72450 | 18867.5 | 3055 | 21922.5 | 88389 | 174.2 | 171170.6 | 88389 | 57977.6 | 4350 |
| Kafa | Decha | 308684 | 7300 | 13500 | 20800 | 11957 | 40641 | 2400 | 13819 | 12879 | - |
| | Chena | 90192 | 27744 | 15203 | 42947 | 4018.2 | 34746.5 | 6142 | 4724.9 | 1500.8 | 3100 |
| | Gimbo | 88129 | 10,177 | 30,531 | 40708 | 1064 | 28,240 | 855 | 7257 | 3737 | 1704 |
| | Gawata | 91530 | 10594 | 8128 | 18722 | 523 | 40641 | 2746 | 13819 | 2128 | 4500 |
| | Bita | 105,055 | 17,617 | 29,737 | 47,352 | 3799 | 37,678 | 997 | 450 | - | 3100 |
| Bench Maji | Debub Bench | 255099 | 49,595 | 64003.5 | 113,598.5 | 8927 | 26764.9 | 9375 | 7422 | 89012 | 315 |
| | Shay Bench | 45,267 | 27,064 | 1,878 | 28942 | 750 | 7,746 | 370.25 | 150 | 7,309 | 1758.5 |
| | Semen Bench | 92,165 | 2875 | 13,552 | 16,427 | | 22,458 | 2525 | | 24,871 | |
| | Menit Goldia | 165,700 | 53185.2 | 4917.45 | 58102.6 | 43,671.2 | 26,908.3 | 36,522 | 1087.5 | 1664 | |
| Shaka | Yeki | 59,021 | 20,476.5 | 30,417.5 | 50894 | - | 9484.9 | 644.5 | 762.5 | 5112.6 | 1500 |
| | Anderacha | 102003 | 19,476 | 35,880 | 55,356 | 1122 | 43,308.8 | 1779.4 | 4565 | 1073 | 1427.6 |

| Zone | Woreda | Total area (ha) | Cultivated land | | | Cultivable land | Forestland | Grazing land | Uncultivable/ Waste land | Social and other | Irrigated |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Annual | Perennial | Total | | | | | | |
| Dawuro | Esera | 95582.5 | 20354.5 | 8250.35 | 28604.8 | | 38506.5 | 11001.4 | 9009.1 | | |
| | Tocha | 66691.9 | 23973 | 13676 | 37649 | | 21774.7 | 5472 | 1796.2 | | |
| | Konta sp. | 210167.9 | 33750.6 | 9384.3 | 43134.9 | 14095.7 | 8942 | 17988 | 2223 | 137880* | |
| Debub Omo | Debub Ari | 82113.7 | 19768.1 | 101881.9 | 28436.5 | 17688.6 | 6447.45 | 1520 | 1520.6 | 12,000 | |
| | Semen Ari | 15000 | 2700 | 17700 | 11771.5 | 13000 | 23000 | 11000 | 11000 | 2163 | |
| | Bena Tsemay | 254,907 | 16,355.2 | 96266.3 | 112,621.5 | 12101.2 | 95,511.8 | 77,128.8 | 32570.9 | 1923.5 | |
| Gamo Gofa | MeloKoza | 110642 | 47103.9 | 31884.1 | 78987.9 | 34101.1 | 67818.3 | 6885 | 16135.9 | 473.7 | 2500 |
| | Basketo sp. | 41925 | 17465 | 5985 | 23450 | 5771 | 9036 | 103 | 565 | 3000 | 197 |
| **Total area** | | **2,880,768** | **590,645** | **638,329.5** | **1,202,092** | **326,428.5** | **619,310.4** | **425,804.7** | | | |
| **Average** | | **73,372.4** | **16,875.5** | **18,237.9** | **34,345.5** | **10,530** | **17,694. 6** | **12,165.85** | | | |
| Minimum (Wondogenet) | | 10,106 | | | | | | | | | |
| Maximum (Andrecha) | | 308,684 | | | | | | | | | |

# 6. Irrigation potential

The SNNPRS is endowed with very vast irrigable land and abundant surface as wells as ground water potential. The resources are mostly found in the lowland areas of the region (about 56% of the total). Farmers, Government and NGOs, develop irrigation schemes in the region. Those irrigation structures, developed by farmers are traditional ones, constructed using labor-intensive works without proper study and design. These irrigation schemes are practiced in the region some 100 years back, for example, Amaro sp. Woreda in fragmented plots, which are not far from river banks. They are used to produce perennial crops such as coffee, banana, and enset. The number of such traditional irrigation schemes increased since the last 40 years as the region experienced drought and famine because of erratic rainfall.

Modern irrigation schemes appear to be started along with the establishment of state farms (e.g. Bilate and Arbaminch). All these schemes were medium scale and constructed and owned by the Government. Since 1975 E.C international organizations such as, AFD, FAO, IFAD and others started to support technically and financially for the establishment of small-scale irrigation schemes, The Government has also constructed many irrigation schemes and handed over to farmers. Generally, 330 traditional and modern irrigation schemes are so far constructed in the region according to reoports of BoFNR.

The total potential irrigable land of the region is estimated to be 1.15 million ha. There are 300 perennial rivers, five lakes, and ample ground water resources. However, the potential land under construction is 6% of the total potential irrigable land. As data shown in Table 3 for 24 AGP II woredas about 7164. 2 hectar of land is irrigated currently. This shows that large amount of the resource is still unutilized due to the following constraints.

- Inadequate skilled workforce;
- Inadequate inputs and extension service;
- Poor planning, designing and construction; and
- Lack of appropriate technology

## 6.1. Problems of irrigated agriculture

### Traditional schemes

Though the traditional schemes are more sustainable than the modern ones, erosion hazards, less capacity and durability are the main problems of these irrigations. Thus, much more time and labor should be allocated during each planting season to maintain damaged structures as result of floods. Some traditional irrigation schemes are abandoned due to maintenance problem.

### Modern schemes

Some modern schemes are easy to handle, suitable to use and are functioning with few problems. However, some of these schemes are either irrigating a small proportion of the command area or non-functional.

### Contribution of AGP II to irrigation scheme

To support on investment for small-scale irrigation water management, the planning process was bottom up approach that is based on beneficiaries' interest (communities demand driven). The design and the construction of SSI is either force account or contract out. The regional Irrigation Construction and Scheme Administration Agency is responsible for the feasibility study, design, construction, and supervision of SSI.

### Water resource potential of AGP woredas

The water resources, area coverage, and the status of the irrigation schemes are presented in Tables 4 to 6. Accordingly, there are different water resources and some of the constructed irrigation schemes are functional (1631 ha) while others are semi-functional (291 ha). New potential-irrigation schemes are 12318 ha.

Table 4. Existing water resources and area coverage

| Water source | Area (ha) |
|---|---|
| River diversion | 22573.7 |
| Spring | 2022.9 |
| Hand dug well and shallow well | 17130.9 |
| Total | 41,727.4 |

Table 5. Functional irrigation schemes

| Zone | Woreda | Name of irrigation scheme | Type of irrigation | Command Area (ha) |
|---|---|---|---|---|
| Sidama | Wondo Genet | Worka Wonth1 | Modern River | 1200 |
| Gamo Gofa | Melokoza | Yista | Modern River | 80 |
| Gurage | Cheha | Gotem | Modern River | 100 |
| South Omo | Debub Ari | Kaysa | Modern River | 100 |
| South Omo | Bena Tsemay | Gisma | Pump | 136 |
| Yem | Yem | Zabe | | 15 |
| Total | | | | 1631 |

Table 6. Semi-functional irrigation schemes

| Zone | Woreda | Name of irrigation scheme | Type of irrigation | Command area (ha) | |
|---|---|---|---|---|---|
| | | | | Designed | Actual |
| Sidama | Wondo Genet | Shimento | Modern River | 255 | 60 |
| Gurage | Enemor | Wunki | Modern River | 100 | 60 |
| Gurage | Enemor | Winke river | Modern River | 100 | 60 |
| Gurage | Geta | Fuchare | Modern River | 30 | 15 |
| Basketo | Basketo | Bazira | Modern River | 50 | 20 |
| Basketo | Basketo | Sanko | Modern River | 168 | 76 |
| Total | | | | 703 | 291 |

Table 7. Under construction-irrigation schemes

| Zone | Woreda | Name of irrigation scheme | Type of irrigation | Command area (ha) |
|---|---|---|---|---|
| Dawuro | Tocha | Yarda | Modern river | 60 |
| Gurage | Gumer | Abesuja | Modern river | 100 |
| Gurage | Enemor | Zeker | Modern river | 95 |
| Silite | M/Azemrt | Woira | Modern river | 58 |
| Silite | M/Azemrt | Guracho | Spring | 30 |
| B/Maji | Shey Benech | Kashu | Modern river | 70 |
| Kefa | Gimbo | Gesha | Modern river | 200 |
| Basketo | Basketo | Osno | Modern river | 400 |
| Total | | | | 1013 |

Table 8. Potential-irrigation schemes

| Zone | Woreda | No. of schemes river and spring | Area (ha) |
|---|---|---|---|
| Silite | Alicho Wuriro | 23 | 291 |
| Silite | Misraq Azarnat Berbere | 13 | 3908 |
| Sidama | Arbegona | 58 | 963 |
| Sidama | Bursa | 17 | 405 |
| Sidama | Gorche | 16 | 191 |
| Sidama | Malga | 9 | 648 |
| Dawro | Esera | 13 | 252 |
| Gedeo | Bule | 57 | 760.9 |
| Gedeo | Gedeb | 18 | 572 |
| Kefa | Gewata | 75 | 1354 |
| Kefa | Chena | 58 | 513 |
| Bench Maji | Shewa Bench | 14 | 304 |
| Bench Maji | Semen Bench | 40 | 197 |
| Sheka | Yeki | 16 | 865 |
| Basketo Special | Basketo Special | 36 | 595.9 |
| Yem | Yem | 43 | 498.2 |
| Total | | 506 | 12318.01 |

Table 9. Irrigation schemes (AGP Woredas)

| Status | No. of AGP woredas | No. of irrigation schemes | Total area (ha) |
|---|---|---|---|
| Functional | 6 | 6 | 1631 |
| Semi-Functional | 4 | 6 | 703 |
| Under Construction | 7 | 8 | 1013 |
| New Potential | 16 | 506 | 12318 |
| Total | 33 | 526 | 15665 |

# 7. Livelihood Systems and Household Economy

## 7.1. Socio-cultural settings and resource endowments

Different ethnic groups of the southern people have their own social and cultural values such as their own food preparing style, dancing, dressing, etc. As common to most parts of the country and the region, respondents indicated that there is strong socio cultural system among the communities in all agro ecologies. The *idir, equb, debo* systems and village elderly, religious leaders to settle some social conflicts is also numerous. These social settings are vital for cooperation among the members of the society. They are also essential to sustain the culture and address any ill behavior emerging among the community, enable the societies to successfully implement their day-to-day activities, live peacefully with their neighbors, help each other in good and bad days, bless the generation to become fruitful in their endeavors, etc.

## 7.2. Social institutions

Farmers' credit and saving cooperatives, general cooperatives and a number of other cooperatives are established to supply necessary inputs and other services. There are also a number of religious institutions like churches and mosques. Public institutions like 1st and 2nd cycle primary schools exist in many of the kebeles. The senior high school is located in the capitals of most woredas.

**NGO's and donor-funded projects**: In these areas, AGP, CASCAPE, and other few NGO's are working to improve the livelihoods of the rural community.

**Private institutions**: Private drug stores, clinics, or private livestock health clinics are giving service in some woredas.

## 7.3. Farm household and survival strategies

Most respondents in mid altitude areas stated that there was no food shortage, drought and water shortage. However, some respondents indicated that they purchase some food items from market occasionally in times of food shortage.

**Major income sources:** The key informants elaborated that crops account for 50% of the income from selling cereals, pules, oil crops, root and tubers, fruits, vegetables, coffee and spices. Livestock account for 30%, (livestock products like butter and milk and selling live animals/small and rarely large ruminants), forest products account 5%, off farm income accounts for 10%, wage, mining and remittance from relatives account for 5%. However, when the actual income of the farmers considered, the key informants stated that some households lack money to buy improved seeds, fertilizers, and pesticides during cropping months.

**Input and credit supply:** Farmers have access to fertilizers and seed inputs from respective woreda Office of Agriculture and Natural Resource, cooperatives organized in their kebeles and financial loans from Omo and other microfinance institutions. However, farmers complained that they did not have sufficient money and when they get money, the interest rate was very high to get credit from Omo Micro Finance.

**Market and road infrastructures:** Village markets exist in some of the kebeles or neighboring kebeles. The main open market, however, is found in the capitals of the woredas. All-weather road accessibility is limited in some mid and high land woredas. The key informants also stated that there is good intervention of government to interlink all seasonal roads between woreda capital and kebeles or between kebeles. Transportation is mentioned as a problem in the rainy season and this leads them to sell their crops at cheaper price.

## 7.4. Cross-cutting issues in daily life

**Gender role and decision making:** Key respondents indicated that the main farming activities of females in the areas are home garden activities such as enset processing and manuring, cabbage and other vegetable cultivation and manuring, watering vegetables, fuel wood collection, decorticating house, child

raising, food processing, poultry, milk and butter management and selling are the activities of women. Conversely, land preparation, weeding and cultivation, planting perennial crops such as wood/shade trees, coffee and enset, tree cutting, house construction and cow and oxen, cereals and pules—if large in amount—are carried out by males. However, these days most of the decision-making on resources is done by mutual consultation among family members particularly the husband and wives and in some cases, the elder child is involved. The experience of dominance of males is gradually decreasing by consultation and agreement.

**Nutrition:** As most of the AGP II woredas are highlands and mid highlands, the dominant and most preferred food in the areas are *kocho* (product of enset), maize, barley wheat, potato, and common bean. The following are some of the most preferred food items by farmers:

- Enset *kocho* prepared with kale, potato and meat was the first choice;
- Foods prepared from barley and maize was the next preference; and
- Foods prepared from potato was the third one

Although farmers prefer these food items, some ought to sell butter, egg, milk, and kale to get money to purchase kerosene, food oil, and salt required for the family.

**Means of controlling animal and crop pests:** Farmers use different plant leaves like *laflafo* on animal's physical body to prevent external parasites. For internal animal parasites, farmers give to their animals some traditional plant medicines such as *cayisa*, and *gara* by blending with salt. To prevent crops disease and pests they use weeding, different chemicals like Ethiosalfan, Maltaion, and Ethiolatin.

### Climate smart agriculture

There is natural forest cover especially in the southwest and southern parts of the region. Key informants also indicated the existence of indigenous trees on farmlands and hedgerows. Woody species of trees grow in agro-forestry systems with enset and coffee and some fruit trees help to sequester carbon on the woody biomass. The cover of perennial crops like coffee and enset is increasing from time to time at the expense of cereals and pulses. The enset

and coffee culture is purely organic as all the fertilizer inputs are compost, twigs, and leaves of shade trees or farmyard manure. The organic agriculture managed by a number of highland dwellers is a great climate smart initiative. The massive soil and water conservation campaign carried out every February and March enabled physical and biological soil and moisture conservation structures to reduce erosion and stabilize the environment.

**Nutrition diversification** Increasing production and consumption for a range of diverse nutrient dense food; and diversification of crop, fruit and livestock production plays role in rural areas studied. Improving post- harvest handling, preservation and processing to improve availability of good nutritional quality and safe food and developing and multiplication of seeds of high nutritional value to improve nutritional status is obsrved indiscussion with focus group including human health agents in AGP II kebles. Based on this some of AGP II activities addressed nutrition to meet objective of this initiative strategically address the nutrition problem in the project woredas.

Table 10 completed research activities addressing cross cutting issues

| | Completed | Gender sensitive | Nutrition sensitive | Climate sensitive | multipurpose |
|---|---|---|---|---|---|
| Crop technologies | 23 | 4 | 4 | 6 | 9 |
| Livestock technologies | 7 | 3 | 2 | 2 | - |
| Natural resource technologies | 16 | - | - | 14 | 2 |
| Total | 46 | 7 | 6 | 22 | 11 |

# 8. Agricultural Production Potential and Constraints

The survey was conducted from August 2016 to January 2017 with the objective of identifying agricultural production and productivity constraints in AGP II Woredas. The survey team was organized representing Natural Resources Management, Crop, Livestock, and Socio-economic Research disciplines of each research center. The production potential of each woreda and problems hindering the production and proposed interventions for each commodity are indicated under each sub components in the following sections.

## 8.1. Potentials and Constraints in Crop Production

### 8.1.1. Cultivated crops

Diversified crops are grown in the surveyed areas of AGP- II intervention woredas of SNNPRS. Major crops grown in the high land areas are cereals (maize, malt barely, food barley, wheat), pulses (faba bean and field pea), oil crop (linseed), root and tubers (enset and Irish potato), fruits (apple), vegetables (kale, carrot, head cabbage, beetroot, onion, and garlic). Enset and food barely were widely cultivated crops among others.

In the mid altitude areas cereals (maize, wheat, tef sorghum, barley, finger millet and rice), pulses (common bean, faba bean, pigeon pea, mung bean and field pea), oil crops (linseed, ground nut and sesame), root and tuber crops (enset, taro, sweet potato, cassava, Irish potato, yam and taro), fruits (avocado, banana, mango, papaya, and pineapple), coffee, spices ( ginger and turmeric) and vegetables (kale, head cabbage, onion, beet root, garlic, pepper, tomato, carrot and pumpkin) and industrial crop (sugar cane), are cultivated.

In the lowland areas, cereals (maize, sorghum, tef and pearl millet), pulse (common bean, groundnut, cow pea and mung bean), oil crops (sunflower, sesame), root and tuber crops (taro, sweet potato, cassava, and enset), fruits (avocado, banana, mango, lemon, orange, pineapple and papaya) coffee, spices (korerima, ginger, turmeric, black cumin and white cumin),vegetables (cabbages, onion, beet root, garlic, hot pepper, tomato and carrot) and fibber crop (cotton) are grown.

Among the aforementioned crops, pear millet, ginger, korerima turmeric, ground nut pigeon pea cow pea, taro, yam, cassava and Tania are widely grown in the mid and lowland areas of Debub Ari, Benastsemay and Semen Ari Woredas of South Omo Zone, Melokoza woreda of Gomogofa Zone and Basketo special Woreda, Shey Bench, Semen Bench and Debub Bench of Bench-Maji Zone (Shey Bench, Semen Bench and Debub Bench) and Yeki Woredas of Sheka Zone. Black cumin, white cumin, fenugreek, and sunflower are widely cultivated crops in Semen and Debub Ari lowland and mid land agro ecologies. Rice is exclusively cultivated in Melokoza, Basketo, Gimbo, and Yeki Woredas.

Cotton is cultivated in Debub Ari whereas sesame is cultivated in all mid and lowland area of the intervention Woredas except Gedeo and Sidama zones. Chickpea is widely cultivated in Gurage and Silte Zones.

The major constraints, which affect crop productivity in each woreda, were discussed with the beneficiary farmers. Accordingly, the following production constraints were identified and prioritized. Pests (weed, insect, and disease) were identified as biotic constraint limiting crop production and productivity

### 8.1.2. Productivity of crops

The productivities of crop varieties vary across locations (Table 11). Among cereal crops, for instance, the average productivity of improved maize varieties ranged from 27 to 76 q/ha in Gimbo (Kafa) and Misraq Azernet (Silte Zone) Woredas, respectively. However, the productivity of local maize varieties varied from 8 q/ha in Chena (Kafa) to 35 q/ha in three woredas (Debub Ari, Cheha and Enemorina Ener). The yield variation for improved varieties of bread wheat ranged from 13 to 58.3 q/ha in Semen Ari and Mirab Azerinet woredas, respectively. However, the productivity of local bread wheat varieties varied from 10 q/ha in two Woredas (Konta and Esera) to 38 q/ha in Alicho Wuriro. In addition, the productivity of improved varieties of tef ranged from 8.3 q/ha in Bena Tsemay woreda to 37 q/ha in two woredas (Misirak Azerinet and Alicho Wuriro). However, the productivity of local varieties of tef ranged from 2.5 q/ha at Melokoza to 15 q/ha at two woredas (Misirak Azerinet and Alicho Wuriro).

The productivity of pulse crops varied with location and type of varieties produced. Improved varieties of faba bean performance ranged from 13 q/ha in Semen Ari Woreda to 25 q/ha in Melokoza Woreda. Unlike the improved varieties, the productivity of local varieties ranged from 4 q/ha at Basketo to 20 q/ha at Mirab Azerinet and Gimbo Woredas. On the other hand the productivity of improved varieties of field pea ranged from 8 q/ha in Semen Ari Woreda to 30 q/ha in Endegagn Woreda, whereas, the productivity of land races ranged from 2.7 q/ha in Melokoza to 30 q/ha in Misrak Azerinet Woreda.

Regarding root and tuber crops, the productivity of improved varieties of potato ranged from 80 q/ha in Shey Bench Woreda to 400 q/ha in Menit Goldia Woreda, whereas, the productivity of local varieties ranged from 8 q/ha in Melokoza and Basketo woredas to 250 q/ha in Semen Bench. The highest productivity of improved and local varieties of sweet potato were 340 (Melokoza) and 210 q/ha (Tocha, Esera and Konta), respectively.

Table 11. Productivity (q/ha) comparison of local and improved varieties for different crops in different AGP woredas

| Crop | Maji | | | | | | | | Sheka | | | | Kafa | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mentigoldiya | | Shey Bench | | Semen Bench | | Debub Bench | | Yeki | | Andrach | | Chena | | Decha | | Gewata | | Gimbo | | Bita | |
| | local | Impr. | Local | Impr. | Local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. |
| Maize | 20 | 47 | 27 | 45 | 28 | 50 | 28 | 50 | | 32 | | 40 | 8 | 20 | 20 | 28 | | 23 | 23 | 27 | | |
| Bread wheat | 15 | 30 | 14 | 30 | 17 | 28 | | - | | | | | 6 | 40 | 12 | 14 | 20 | 25 | 16 | | | |
| Tef | 8 | 20 | 12 | 35 | 8 | - | | | | | | | 2.5 | | 5 | 6 | 0 | 8 | 8 | | | |
| Food barely | | | 28 | - | | - | | | | | | | 6 | 8 | 8 | 8 | 12 | 20 | 10 | | | |
| Sorghum | 23 | | 9 | - | 23 | | 24 | | | 30 | | | 8 | | 21 | | 12 | | 20 | | | |
| Rice | | | | | | | | | | 35 | | | | | | | 0 | 0 | 15 | | | |
| Finger millet | | | | | | | | | | | | | | | | | | | 10 | | | |
| Faba bean | 9 | 16 | 8 | 17 | 8 | 15 | | | | | | | 7 | 20 | 7 | | 8 | 14 | 20 | | | |
| Field pea | | | 13 | 22 | 7 | 12 | | | | | | | 5 | | 7 | | 8 | 10 | | | | |
| Common bean | | | | | | | 10 | | | | | | | | | | 0 | 10 | | | | |
| Sesame | | | | | 4 | | | | | | | | | | | | 0 | | | | | |
| Sweet potato | | | | | | | | | | | | | | | | | 160 | | | | | |
| Potato | 250 | 400 | 40 | 80 | 250 | 245 | | | | | 200 | | 60 | 250 | | | 52 | | 24 | | | |
| Cassava | | | | | 500 | | | | | | | | | | | | | | | | | |
| Mango | | | | | 205 | | | | | | | | | | | | 0 | | | | | |
| Avocado | | | | | | | | | | | | | | | | | | | | | | |
| Banana | | | 650 | | | 192 | 185 | | | | | | | | | | 10 | | | | | |
| Coffee | 8 | 12 | 6 | 8 | | | | | | 24 | | 15 | | | | 10 | 20 | 0 | | | | |
| Hot pepper | | | | | | | | | | 15 | | | | | | | | | 6 | | | |
| Korerima | | | 8 | | 8 | 14 | 8 | 15 | | | | | | | | | | | | | | |
| Ginger | 250 | | | | | | | | | 360 | | | | | | | | | | | | |
| Turmeric | | | | | | | | | | 60 | | | | | | | | | | | | |
| Onion | | | 85 | 120 | | | | | | | | | | 250 | | | | | | | | |
| Tomato | | | 105 | 155 | 250 | | | | | | | | | 260 | | | | | | | | |
| Garlic | | | | | | | | | | | | | 50 | | | | | | | | | |
| Cabbage | | | | | | | | | | | | | 360 | | | | | | | | | |

| Crop | Gurage | | | | | | | | | | Silte | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Endegagn | | Enemorina Ener | | Cheha | | Geta | | Gumer | | Mirab Azenet Berbere | | Misraq Azenet Berbere | | Alicho wuriro | | Yem I | |
| | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. | local | Impr. |
| Maize | 32 | 60 | 35 | 45 | 35 | 56 | | | | | | | | 76 | | | 25 | 70 |
| Bread wheat | 30 | 45 | 36 | 40 | 36 | 40 | 20 | 55 | 20 | 32 | | 58.3 | 36 | 53 | 38 | 48 | 20 | 55 |
| Tef | 10 | 20 | 10 | 10 | 10 | 16 | | | | | | | 15 | 37 | 15 | 37 | 10 | 20 |
| Food barely | 26 | 48 | | | | | 20 | 25 | 20 | 25 | | 39 | 25 | 40 | 40 | 60 | 25 | 32 |
| Sorghum | | | | | | | | | | | | | | | | | 15 | |
| Faba bean | 16 | 20 | | | | | 15 | | 10 | | | 22 | 20 | | 14 | 19 | 19 | |
| *Field pea* | 18 | 30 | | | | | 12 | 21 | 10 | 15 | | 18 | 30 | | 18 | 20 | 12 | 21 |
| Potato | 250 | 400 | | 350 | | 350 | | 200 | | 350 | | 450 | | | 300 | 350 | | |
| Mango | | | | | | | | | | | 25 | | | | 25 | | 25 | |
| Avocado | | | | | | | | | | | | 25 | | | 25 | | 25 | |
| Banana | | | | | | | | | | | | 25 | | | 25 | | 25 | |
| Onion | 150 | 250 | | | | | | | | | | | | | 150 | 180 | | 280 |
| Tomato | 175 | 279 | | | | | | | | | | | | | 190 | 200 | | |

### 8.1.3. Major Constraints of crop production

Crop pests (disease, insect pest and weed), lack of improved seed, lack of improved technology, high soil acidity, decline of soil fertility, lack of awareness on crop pests and their managements, shortage of land and lack access to irrigation were the major constraints raised by farmers and identified through field observation. The detail of the constraints and possible solutions are described below.

#### 8.1.3.1. Major pests

Crop production was constrained by different pests including weeds, insects, diseases, and vertebrate animals (Table 12). The major pests are described below against the major crops affected by them.

**Enset:** Weeds were reported to be among the major constraints of enset production in the surveyed areas. About 40 % of the surveyed woredas consider weed as the most important constraint in Enset production. For instance, in the surveyed woredas of Sidama zone, broad leaf and grass type weeds were common. In Shey Bench Woreda, grass weeds considered as the major constraint. In some woredas, mealy bag was reported as major insect pests, however, most of the woredas did not report as major problem (Table 12). In the majority (80%) of surveyed woredas, enset bacterial wilt disease was reported as a major enset biotic constraint except some woredas in the western zones. Among the vertebrate pests, mole rats were reported as important pest affecting enset production in some selected woredas.

**Maize:** Broad leaf and grass weeds were important constraints particularly in Dauro, Konta and some woredas in Bench Maji zone. Important weeds in Yeki woreda were *Gizotian scabra* and *Bidens pilosa*. In addition, the production of maize is constrained by several insect pests in most of assessed woredas. Depending on the location and agro-ecology, the main insect pests affecting maize were stalk borer, weevil, aphid, cut worm, and termite. Among disease pests, Maize Lethal Necrosis Disease (MLND) was the most distributed one across woredas in the region especially in the last two years other maize diseases included, smut, ear rot, leaf blight, rust and gray leaf spot. Vertebrate pests affecting maize in different woredas were mole rat, rats, porcupine, monkey, and birds.

**Sorghum:** Some weeds such as striga, some grasses, and broad leaved were reported as constraint in few woredas. The Insect pests affecting production of sorghum in some woredas were aphid, weevil, stalk borer, grasshopper, and black beetle. Common sorghum diseases include head smut, powdery mildew, anthracnose, and rust. The most common vertebrate pests indicated were birds, mole rats, and monkeys.

**Barley and wheat**: Weeds were constraints for production of barley and wheat in many surveyed areas of Sidama and Dauro Zones, Konta special Woreda, and some woredas in Bench Maji Zone (Menit Goldia, Shey Bench, and Semen Bench Woredas). Both crops are affected more or less by similar insect pests including such as shoot fly, brown wheat mites, ladybird beetle, grasshopper, and weevil. Relatively, barley shoot fly was more distributed across several woredas. Rust diseases are the major diseases affecting barley and wheat in several woredas. Smut was also reported as major problem in some AGP-II intervention woredas.

**Potato:** Weeds were relatively more important in several surveyed woredas of Sidama zone. In the remaining zones and woredas weed is not mentioned as the major constraint of potato production. Major insect pests affecting potato production in different woredas were spotted leaf beetles, weevil, cut worms, red ants, and termites. Among these insect pests, red ants had wide coverage across several woredas. Disease is also reported in almost all surveyed woredas. The most important diseases potato the surveyed woredas were late blight, early blight, and bacterial. Besides, lack of access to fungicides to control late blight disease and wilt resistant potato varieties were mentioned by farmers.

**Faba bean and field pea:** The productions of faba bean and field pea were constrained by weeds in many woredas of Sidama and Dauro zones, Konta special woreda and some woredas in Bench Maji zone (Menit Goldia, Shey Bench, and Semen Bench). *Bidens pillosa* is the most common weed in Menit Goldia, Shey Bench and Semen Bench. Broad leaved and grass weeds are problematic in Sidama zone. For both crops, aphids were the major insect pests in several woredas. Other important insect pests identified were pod borer for both crops and weevil for faba bean. Chocolate spot and fusarium wilt were among the most important diseases that persist on faba bean. Powdery mildew

was also important disease on field pea in several woredas.

**Sesame:** Major insect pests that attack sesame at Melo Koza, Basketo, Debub Ari, Bena Tsemay, Semen Ari, Shey Bench, Semen Bench and Menit Goldia woredas were aphid, wave worm, mealy bug, seed bug and cricket. The other insects (leaf miner, seed borer) and unidentified flower disease were reported as major problem in Tocha, Esera and Konta woredas. Similarly, unidentified diseases that cause leaf blight and wilt of sesame were also mentioned in some sesame growing areas.

**Coffee:** Coffee is the major cash crop in the woynadega (mid altitude) area of the surveyed woredas. The biotic constraints in coffee growing areas were diseases such as fusarium wilt, coffee berry disease (CBD), coffee leaf rust, and bacterial blight of coffee (BBC) and insect pests (Leaf miner and stem borer). Among all, coffee wilt and CBD were found to be the major diseases, which affect coffee production almost in all coffee growing areas. Insect pests of coffee such as leaf miner and stem borer are distributed in some coffee growing woredas and reported as minor pests.

**Ginger**: The production of ginger was constrained by diseases and insect pests. Ginger rhizome rot (wilt) caused by bacterial spp was reported as major disease in Tocha and Esera Woredas, and Konta special Woreda. Termite was also reported as insect pest attacking ginger.

**Vegetables:** vegetables (onion, kale, garlic, head cabbage, beetroot, tomato, and hot and green pepper) were among the vegetables grown across the surveyed woredas. Farmers in most of vegetable growing areas reported the biotic constraints such as diseases (bacterial soft rot, rust, and leaf blight, fusarium wilt and bacterial leaf spot,) and insect pests (red ant, aphid termite, ball worm, cut worm). Red ant was reported almost in all onion and cabbage growing areas of mid and highland areas. Ball worm was also mentioned as major pest on tomato. Unidentified vegetable disease was mentioned in surveyed woredas of Gurage zone. Rust disease on garlic was reported as major production constraint in Sidama and Gurage zones.

**Fruit**: Fruit trees—avocado and mango—were found in almost all surveyed woredas. Oranges were also reported in some woredas. At avocado, mango,

and orange growing woredas, the common reported biotic problem was unidentified fruit dropping disease that occurs when the crop is near to maturity. Anthracnose and flower abortion diseases and insect pests (fruit fly) were the common pests of mango at Melo Koza, Basketo, Debub Ari and, Bena Tsemay woredas. Fruit dropping at maturity and unidentified disease were also reported as bottlenecks for orange production in Cheha, and Enemorina Eaner woredas of Gurage Zone and Malga Woredas of Sidama Zone.

**Cotton:** major pests reported in cotton were aphid, mealy bug, crickets, and African bollworm especially in Bena Tsemay Woreda.

**Pepper**: Farmers mentioned fusarium and bacterial leaf spot, root rot and powdery mildew diseases as major problem in pepper growing areas of Tocha, Esera, Konta, Bena Tsemay, and Cheha Woredas.

Table 12. Crop pests (disease, insect, and weeds) across woredas

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Enset | Weed | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | - | - | - | - |
| | Insect | - | - | Mealy bug | Mealy bug | Mealy bug | Mealy bug | Mealy bug | - | - | - |
| | Disease | Bacterial wilt and corm rot | Bacterial wilt | Bacterial wilt | Bacterial and fusarium wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt |
| | Vertebrate | Mole rat | Mole rat | Mole rat | | | Mole rat | | Mole rat | Mole rat | Mole rat |
| Maize | Weed | | | | | Broad and grass leaf | | | *Gagaba, Teta, konsoso, togari* | *Gagaba, Teta,* | *Gagaba, Teta,* |
| | Insect | stock borer and cut worm | stock borer | stock borer and weevil | Stock borer and cut worm | stock borer and weevil | | stock borer and cut worm | Stock borer, weevil, termite | Stock borer, weevil, termite | Stock borer, weevil, termite |
| | Disease | | | | | MLND and Smut | | MLND and Smut | Rust , grain leaf spot, MLND | Rust, grain leaf spot, MLND | Rust , grain leaf spot, MLND |
| | Vertebrate | | | | Bird | | | | Porcupine, monkey | Porcupine, monkey | Porcupine, monkey |
| Sorghum | Weed | | | | | | | | *Dodo, gagaba, Dalshiya* | *Dodo, gagaba, Dalshiya* | *Dodo, gagaba, Dalshiya* |
| | Insect | | | | | | | | stock bore, beetle | stock bore, beetle | stock bore, beetle |
| | Disease | | | | | | | | Head smut | Head smut | Head smut |
| Barely | Weed | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | | | *Tufa, Adil* | *Tufa, Adil* | *Tufa, Adil* |
| | Insect | Shoot fly | Shoot fly | Shoot fly | Shootfly and | Shootfly | Shootfly | Shootfly | Shootfly | Shootfly | Shootfly |

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | cut worm | | | and cut worm | | | |
| | *Disease* | *Rust* | *Rust* | *Rust* | *Rust* | *Rust* | *Rust* | *Rust* | *Rust, leaf* blotch | *Rust, leaf blotch* | *Rust, leaf blotch* |
| Wheat | Weed | Broad and grass weed leaf | Broad leaf and grass | Broad leaf and grass | Broad leaf and grass | | | | | Broad leaf and grass | Broad leaf and grass |
| | Insect | - | - | | | | | | Unspecified insect | Unspecified insect | Unspecified insect |
| | Disease | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust |
| Tef | Weed | Broad leaf and grass | Broad leaf and grass | | Broad leaf and grass | | | | Amarantus | Amarantus | Amarantus |
| | Insect | | Un identified | | Un identified | | | | Lady bird | Lady bird | Lady bird |
| | Disease | | Un identified | | Un identified | | | | Leaf rust | Leaf rust | Leaf rust |
| Rice | Disease | | | | | | | | Smut | Smut | Smut |
| Potato | Weed | Broad leaf and grass weed | Broad leaf and grass weed | | Broad leaf and grass weed | Broad leaf and grass weed | Broad leaf and grass weed | | | | |
| | Insect | Red ant | Red ant | Red ant | | Red ant | Red ant | Red ant | | | |
| | Disease | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt | Late blight, bacterial wilt |
| Sweet potato | Insect | | | | | Virus | | | Butter fly, weevil | Butter fly, weevil | Butter fly, weevil |
| | Disease | | | | | Virus | | | Virus | Virus | Virus |
| | Vertebrate | | | | | | | | Mole rat | mole rat | mole rat |
| Cassava | Vertebrate | | | | | | | | Porcupine | | |

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Faba bean | Weed | Broad leaf and grass weed | Broad leaf and grass weed | Broad leaf and grass weed | Broad leaf and grass weed | Broad leaf and grass weed | | | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* |
| | Insect | Aphid | Aphid | Aphid | Aphid | Aphid | Aphid | | Aphid, pod borer, termite | Aphid, pod borer, termite | Aphid, pod borer, termite |
| | Disease | Fusarium wilt and flower dropping | Fusarium wilt and flower dropping | Chocolate spot and rust | Flower dropping | Chocolate spot and rust | Chocolate spot and rust | Fusarium wilt | Chocolate spot | Chocolate spot | Chocolate spot |
| Field pea | Weed | No weeding | Broad leaf and grass | | Broad leaf and grass | | | | Striga | Striga | Striga |
| | Insect | Aphid | Aphid | Aphid | Aphid | Aphid | Aphid | | | | |
| | Disease | Powdery mildew | Powdery mildew | Powdery mildew | Powdery mildew | Powdery mildew | Powdery mildew | | | | |
| Common bean | weed | | | | | Bean stem maggot | | | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* |
| | Insect | | | | | BSM, cut worm | BSM, cut worm | BSM, cut worm | Aphid, pod borer, termite, BSM, cut worm | Aphid, pod borer, termite, BSM, cut worm | Aphid, pod borer, termite, BSM, cut worm |
| | Disease | | CBB, BBC | CBB, BBC | | CBB, rust | CBB, rust | CBB, , rust | CBB, rust | CBB, , rust | CBB, rust |
| Mung bean | Weed | | | | | | | | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* | *Dalshiya, tongara, Tsata* |
| | Insect | | | | | | | | Aphid, pod borer, termite | Aphid, pod borer, termite | Aphid, pod borer, termite |
| Sesame | Insect | | | | | | | | Leaf minor, seed borer | Leaf minor, seed borer | Leaf minor, seed borer |
| | Disease | | | | | | | | Leaf blight, | Leaf blight, | Leaf blight, |

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | flower disease | flower disease | flower disease |
| Coffee | Weed | | | | | | | | | | |
| | Insect | | | | | | | | Stem borer | Stem borer | Stem borer |
| | Disease | CBD andcoffee wilt | CBD and coffee wilt | CBD, BBC and wilt | CBD andcoffee wilt | CBD | CBD | | CBD, root rote | | |
| Apple | Insect | Aphid | Aphid | | Aphid | | | | | | |
| | Disease | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | | | | |
| Avocado | Insect | | | | | | | | Fruit fly, termite | Fruit fly, termite | Fruit fly, termite |
| | Disease | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit dropping at maturity | Fruit rotting, flower abortion | Fruit rotting, and dropping, flower abortion | Fruit rotting, and dropping, flower abortion |
| Mango | Insect | | | | | | | | Fruit fly, termite, scale insect | Fruit fly, termite, scale insect | Fruit fly, termite, scale insect |
| | Disease | | | | | Fruit dropping at maturity | | | Fruit rotting, and dropping, anthracnose, flower abortion | Fruit rotting, and dropping, anthracnose, flower abortion | Fruit rotting, and dropping, anthracnose, flower abortion |
| Banana | Disease | | | Bacterial wilt | | Bacterial wilt | Bacterial wilt | | Bacterial wilt and weevil | Bacterial wilt and weevil | Bacterial wilt and weevil |
| Orange | Disease | | | | Fruit dropping at maturity | | | | | | |
| Cabbage | Insect | Red ant, | Red ant, | Red ant | Red ant, | Red ant | Red ant | | | | |

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | aphid and termite | aphid and termite | | aphid and termite | | | | | | |
| | Disease | Unidentified seed disease | Unidentified seed disease | Bacterial soft rot | Un identified seed disease | Bacterial soft rot | Bacterial soft rot | | | | |
| Kale | Insect | Red ant and *aphid* | Red ant and *aphid* | | Red ant and *aphid* | Red ant *and aphid* | | | | | |
| | Disease | Rust | Rust | | Rust and un identified | | | | | | |
| Beet root | Weed | | | - | | | | | | | |
| | Insect | Red ant and aphid | Red ant and aphid | Red ant | Red ant and aphid | Red ant | Red ant | | | | |
| | Disease | No disease | No disease | Bacterial soft rot | - | Bacterial soft rot | Bacterial soft rot | | | | |
| Carrot | Insect | Red ant and *aphid* | Red ant and *aphid* | | Red ant and *aphid* | | Termite | | | | |
| | Disease | | | Unidentified white spores on leaves near maturity | | Unidentified white spores on leaves near maturity | Unidentified white spores on leaves near maturity | | | | |
| Tomato | Insect | Red ant and aphid | Red ant and aphid | | Red ant and aphid | Insect attack at fruiting | | | Boll worm, termite | Boll worm, termite | Boll worm, termite |
| | Disease | Un identified disease | Un identified disease | | Un identified disease | Late and early blight | | | *Fruit rot, leaf* disease | *Fruit rot, leaf* disease | *Fruit rot, leaf* disease |
| Onion | Insect | Red ant | Red ant | | Red ant | Red ant | Red ant | | Red ant | Red ant | |

| Crop | Pest | Arbegona | Bursa | Gorche | Malga | Wondo Genet | Bule | Gedeb | Tocha | Esera | Konta |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Disease | Rust | Rust | Leaf disease | Rust | Rust | Rust | | | | |
| Garlic | Disease | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust |
| Pepper | Disease | | | | | Fusarium wilt and bacterial leaf spot | | | Root rot, leaf blight | Root rot, leaf blight | Root rot, leaf blight |
| Ginger | Insect | | | | | | | | Termite | Termite | Termite |
| | Disease | | | | | | | | Rhizome rotting (bacterial) | Rhizome rotting | Rhizome rotting |

Table 13. Continued

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Enset | Weed | | | | | | | Grass weeds | | | | |
| | Insect | | | Mealy bug, mole rat | | Mealy bug | | | | | | |
| | Disease | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | | Bacterial wilt | | | | BW, corm rot |
| | Vertebrate | | | Mole rat | Mole rat | Mole rat | | Mole rat | | | | |
| Maize | Weed | | | | | | Broad leaf and grass weeds | Broad leaf and grass weeds | Broad leaf and grass weeds | Broad leaf and grass weeds | Gizotia scarab, Bidense pilosa, | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | amimosa, grass | |
| | Insect | Stalk borer, weevil, aphid | Stalk borer, weevil, aphid | Stalk borer, aphid, weevil, cut worms, rice black beetle, termite | Stalk borer, termite, weevil, grain midges, | Stalk borer, rice black beetle, weevil | Stalk borer , termite, mole rat | Stalk borer, Termite | Stalk borer , Termite | Stalk borer, Termite | Stock borer weevil | Stalk borer, aphid, weevil |
| | Disease | MLND | MLND | MLND, smut, ear rot | MLND | Blight, MLND, smut | Leaf blight, Smut | Smut | Leaf blight, Smut | Leaf blight; Smut, virus | MLND | Leaf color changes, stem dryingand breaking |
| | Vertebrat e | | | mole rat, rodent | mole rat, rodents | mole rat, rodents | | | mole rat | Mole rat | | |
| Sorghum | Weed | | | | | | | - | Striga, grass weeds | Striga, grassy and broad leaf | *Gizotia scarba,Biden seplosa,mimo sa*,grass | |
| | Insect | Shootfly, termite, aphid | | Stalk borer, weevil, | Grain midges, aphid, weevil, stalk borer, locust | Weevil, rice black beetle | Striga, grass weeds | - | | | Stalk borer, weevil | |
| | Disease | Head smut, | | Head smut, anthracnose | Head smut, | Head smut, Anthracnose | Anthracno se, smut, | Anthracn ose, | Anthracnose, Smut, head | Anthracnose, Smut, | Fungal disease | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | powdery mildew, | | | anthracnose, rust | | head smudge | Smut | smudge | | | |
| | Vertebrate | Birds | | mole rat, bird | birds | Bird, rodents | Bird | Bird | Bird | Bird | Bird, monkey | |
| Barely | Weed | | | Broad leaf and grass | | | *Ageratum conizoidus, cynodon Spp, Bidens pilosa* | *Ageratum conizoidus, cynodon Spp, Bidens pilosa* | *Ageratum conizoidus, cynodon Spp, Bidens pilosa* | | | |
| | Insect | Shootfly | Shootfly | Brown wheat mites, Weevil | | Black pest, Rice black beetle | lady bird, grass hoper | Lady bird | lady bird, grass hoper | | | |
| | Disease | Rust | Rust | Rust, Smut | | Rust, smut | Yellow rust, stem rust | Yellow rust, stem rust | Yellow rust, stem rust | | | |
| Wheat | Weed | | | | | | *Ageratum conozoidus, cynodon Spp, Bidens pilosa* | Ageratum, *Bidense pillosa* | *Ageratum conozoidus, cynodon Spp, Bidens pilosa* | | | |
| | Insect | Weevil, shoot fly | Weevil, shoot fly | Brown wheat mites | | Black pest | Lady bird | lady bird | lady bird | | | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Disease | Rust | Rust | Rust, Smut | | Rust | Yellow rust, stem | Yellow rust, | Yellow rust and stem rust | | | |
| Tef | Insect | Shootfly, grass hopper | Shootfly, grass hopper | Brown wheat mites | Leaf cutter and locust | Cricket, rice black beetle, black flying insect | Lady bird | lady bird | Lady bird | | | |
| | Disease | | | Smut, rust | Rust | Unknown disease, rust | False smut, stem rust | head smut | smudge, stem rust | | | |
| Rice | Weed | | | | | | | | | | Gizocia scarba, Bidense pilosa, mimosa, grass | |
| | Disease | - | - | | | | | | | | Rust | |
| | Vertebrate | | | | | | | | | | Bird, monkey | |
| Finger millet | Insect | | | | Locust, Stalk borer | | | | | | | |
| | | | | | Smut, grain midges | | | | | | | |
| | Vertebrate | | | | Birds, rodents | | | | | | | |
| Potato | Weed | | | Broad leaf and grass | | | - | - | - | Parthenium, amaranthus | | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Insect | Tuber worm and rotting, termite | Tuber worm and rotting, termite | Spotted leaf beetles, weevil, cut worms | | Red ant | Termite | Termite | Termite | Red ant, Termite | | |
| | Disease | Early and late blight | Early and late blight | Early and late blight, bacterial wilt | | Blight | late blight | late blight | late blight | late blight | | Late blight |
| | Vertebrate | | | mole rat | | mole rat | | | | | | Vertebrate |
| Sweet potato | Insect | Worms | Worms | Weevil, cut worms | White worm, cut worm, weevil | Weevil, | | | | | | |
| | Disease | Blight | Blight | | | | | | | | | |
| | Vertebrate | | | Porcupine, mole rat | Mole rat | Porcupine, mole rat | | | | | | |
| Faba bean | Weed | | | | | | *Bidense pillosa* | *Bidensep illosa, Amarant hsSpp.* | *Bidense pillosa* | | | |
| | Insect | Aphid, pod borer, weevil | Aphid, pod borer, weevil | Aphid, pod worms | | Aphid, pod borer | grass hoper | - | Grass hoper | | | |
| | Disease | Chocolate spot, root rotting, rust | Chocolate spot, root rotting, rust | Fusarium I wilt | | Flower dropping disease, wilt | Chocolate spot | Chocolat e spot | Chocolate spot | | | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field pea | Weed | | | | | | *Bidensepil* | Bidensep | *Bidensepillos* | | | |
| | Insect | Aphid, pod borer | Aphid, pod borer | Aphid, pod worms | | Aphid | Grass hoper, aphid | Aphid | Grass hoper | | | |
| | Disease | Rotting | Rotting | Fusarium wilt | | Flower dropping disease | Chocolate spot | Chocolat e spot | Chocolate spot | | | |
| Common bean | Weed | | | | | | | | | Bidensepillos a | | |
| | Insect | BSM, leaf holler, pod borer, aphid, weevil | BSM, leaf holler, pod borer, aphid, weevil | Leaf cutters, pod worms, aphid | Pod worms, aphid and leaf cutter | Weevil | | | | Grass hoper, Termite | | |
| | Disease | CBB | CBB | Common bacterial wilt | CBB | CBB | | | | Chocolate spot | | |
| | Vertebrat e | | | Porcupine | | | | | | | | |
| Mung bean | Insect | Aphid, worms, pod borer | Aphid, worms, pod borer | | | | | | | | | |
| Cow pea | Disease | | | | Grain midges | | | | | | | |
| Ground nut | Insect | | | Bruchid, white grub | White grub, weevil | | | | | | | |
| | *Vertebrat* e | | | *Mole rat*, porcupine | *mole rat* | | | | | | | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pigeon pea | Insect | | | | Grain midges | | | | | | | |
| Sesame | Weed | | | | | | *Bidenspillosa Galisongaparviflora* | *Bidenspillosa, Gallisongaparviflora* | *Bidenspillosa ,Gallisongaparviflora* | | | |
| | Insect | Aphid, termite, wave worm, storage pest | Aphid, termite, wave worm, storage pest | Aphid | Aphid, mealy bug, seed bug, and cricket | Aphid | - | - | - | | | |
| | Disease | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Wilt | leaf blight | leaf blight | Leaf blight | | | |
| Sun flower | Disease | | | | Grain midges | | | | | | | |
| Cotton | Insect | | | | Aphid, mealy bug, crickets, African boll worm | | | | | | | |
| Coffee | Weed | | | | | | - | - | - | Grass weed | Bidenseplosa , mimosa, grass | |
| | Insect | | | | Coffee | | - | - | - | Leaf | - | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | stem weevil | | | | | skeletonizer | | |
| | Disease | Stem disease, CBD | Stem disease, CBD | CBD,Fusariun lwilt, leaf rust, stem weevil | CBD | CBD, wilt | CBD | CBD | CBD | CBD, leaf rust, leaf blight | Coffee wilting disease | CBD |
| Apple | Disease | | | scab | | Powdery mildew | | | | | | |
| Avocado | Insect | | | | | | | | | | | Leaf andfruit scale |
| | Disease | Rotting | Rotting | Anthracnose, Phytophtora | | Flower and fruit disease | | | | | | |
| Mango | Weed | | | | | | | | | | Gizotia scarba, Bidenseplosa , mimosa, grass | |
| | Insect | Fruit fly | Fruit fly | Fruit fly | Fruit fly | Fruit fly | white scale | white scale | white scale | white scale, fruit rot | | |
| | Disease | Anthracno se, rotting | Anthracno se, rotting | Anthracnose, angular leaf spot, | Anthracn ose | Anthracnose | - | - | - | | Fruit spoilage, darkening, fruit scale | |
| | Vertebrat e | | | | | | | | | | Monkey and ape | |
| Banana | Weed | | | | | | | | | | *Gizotia scarba, Bidense* | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | *pilosa*, mimosa, grass | |
| | Insect | | | Mole rat | | | | | | | | |
| | Disease | Bacterial wilt | Bacterial wilt | Banana bacterial wilt/ Fusarium wilt | Bacterial wilt | Bacterial wilt | | | Fusarium wilt, bacterial wilt | | Wilting disease | |
| | Vertebrate | | | | | | | | mole rat | | Monkey and ape | |
| Cabbage | Insect | | | Aphid, cabbage looper | Aphid | Aphid, red ant | | | | | | |
| | Disease | | | | | Head blight | leaf blight | early blight | | | | |
| Kale | Disease | | | | | | leaf blight | | leaf blight | | | |
| Beet root | Insect | | | Mole rat, cut worms | | | | | | | | |
| | Disease | | | Blight | | | | | | | | |
| Carrot | Insect | | | | | | | | | Aphid, red ant, cutworm | | |
| | Disease | | | | | | Powdery mildew | Powdery mildew | Powdery mildew | Powdery mildew | | |
| Tomato | Insect | | | Tomato fruit worms | Tomato fruit worm, red spider | | | | | Aphid, red ant, cutworm | | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mites | | | | | | | |
| | Disease | | | Blights | Blights | Blight, wilt | early blight, leaf blight, powdery mildew | early blight, powdery mildew | | Powdery mildew | | |
| | *Vertebrate* | | | *Bird* | *Bird* | | | | | | | |
| Onion | Insect | Root worm | Root worm | Crickets, cut worms | | Black worm on seedling | | | | Aphid | | |
| | Disease | Bacteria, wilt | Bacteria, wilt | Rusts, Botrytis leaf blight | Rusts, leaf blight | Rusts, leaf blight | | | Powdery mildew | Powdery mildew | | |
| | Vertebrate | | | Moderate | Mole rat | Mole rat | | | | | | |
| Garlic | Disease | | | Botrytis leaf blight | | | | | | | | |
| Pepper | Insect | | | Aphids, cut worms | | | | | | | | |
| | Disease | Fruit rotting | Fruit rotting | Common bacterial wilt | Bacterial wilt | Wilt | , leaf blight, powdery mildew | blight, powdery mildew | leaf blight, powdery mildew | Aphid, Powdery mildew | | |
| Ginger | Weed | | | | | | | | | | Gizotia scarba, Bidense pilosa, mimosa, | |

| Crop | Pest | Melo Koza | Basketo | Debub Ari*1 | Bena Tsemay *2 | Semen Ari | Menit Goldia | Shey Bench | Semen bench | Debub bench | Yeki | Andracha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | grass | |
| | Disease | Rotting | | | | Bacterial wilt | | | | | Bacterial wilting | |
| | Vertebrate | | | | | Mole rat | | | | | | |
| Korerima | Disease | | | | | Bacterial wilt, foliar disease | | | | | | |
| Moringa | Insect | | | Aphid | Aphid, cabbage looper | | | | | | | |
| Pumpkin | Insect | | | | squash vine borer | | | | | | | |
| Turmeric | Weed | | | | | | | | | | Gizotia scarba, Bidense pilosa, mimosa, grass | |
| | Disease | | | | | | | | | | Rust | |

***Similar weed problems across crops***

**1**Debub Ari:** Seksi, Amaranthus, kuskutaspp, Bermuda grass, G. scabra, Commelinabenghalensis, Cynodondactylon*

**2**Bena Tsemay Mid land:** Amaranthus, Commelinabenghalensis, Cyprus, Lantanacamara*

**2**Bena Tsemay Lowland:** Amaranthus (hukuma), Cyprus, Accathonspermumhispidum (Mugr), Trbuluster restris, Calotropis gigantean, Echinochloacolona and Withaniasomnifera*

Table 14. Continued

| Crops | Pests | Chena *1 | Decha* 1 | Gewata* 1 | Gimbo* 1 | Bita*2 | Endegagn*3 | Enemorina Eaner*4 | Cheha *5 | Geta *6 | Gumer*6 | M/Azenet Berbere*7 | MisraqAzenet Berbere*7 | Alicho Wuriro | Yem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Enset | Weed | | | | | | | | | | | | | | |
| | Insect | | | | | | | | | | | | | | |
| | Disease | | | | | BW | BW | BW | BW | BW | BW | BW | BW | BW | BW |
| | Vertebrate | | | | | | | | | | | | | | |
| Maize | Weed | | | | | | | | | | | | | | |
| | Insect | | | | | Stalk borer, wilting | | Stalk borer | Stalk borer | | | | Stalk borer | | Stalk borer |
| | Disease | | | | MLND | | MLND | | | MLND | | | MLND | MLND | |
| Sorghum | Insect | | | | | | | | stalk borer | | | | | | |
| | Disease | | | | | Smut | | | | | | | | | |
| Barely | Weed | | | | | | | | | | | | Weed | Grass | |
| | Insect | | | | | | Shootfly | Shootfly | | Shootfly | | | | | Shootfly |
| | Disease | | | | | Wilting | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust |
| Wheat | Weed | | | | | | | | | | | | Weed | Grass | |
| | Insect | | | | | | | Shootfly | | | | | | | |
| | Disease | | | | | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | Rust | |
| Tef | Weed | | | | | | | | | | | | | | |
| | Insect | | | | | | | Shootfly | Shootfly | | | | | | Shootfly |

| Crops | Pests | Chena *1 | Decha* 1 | Gewata* 1 | Gimbo* 1 | Bita*2 | Endegagn*3 | Enemorina Eaner*4 | Cheha *5 | Geta *6 | Gumer*6 | M/Azenet Berbere*7 | MisraqAzenet Berbere*7 | Alicho Wuriro | Yem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Disease | | | | | | | Rust | Rust | | | | Rust | | Rust |
| Rice | Weed | | | | | | | | | | | | | | |
| | Insect | | | | | | | | | | | | | | |
| Potato | Weed | | | | | | | | | | | | Weed | Broad leaved weeds | |
| | Insect | | | | | | red ant | red ants | | red ants | | | | | red ants |
| | Disease | | | | | | Late blight, wilt | Bact. wilt, late blight | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt | Bacterial wilt |
| Sweet potato | Weed | | | | | | | Weed | | | | | | Broad leaved weeds | |
| | Insect | | | | | | | | | Red ants | | | | | red ants |
| | Vertebrate | | | | | | | | | | | | | | |
| Faba bean | Weed | | | | | | Weed | Weed | | | | | Weed | Broad leaved weeds | |
| | Insect | | | | | | Insect | | | | | | | | |
| | Disease | | | | | | Disease | chocolate spot | | | Disease | Disease | Diseases | Diseases | Chocolate spot |
| Field | Weed | | | | | | Weed | Weed | Weed | | | | Weed | Broad | |

| Crops | Pests | Chena *1 | Decha* 1 | Gewata* 1 | Gimbo* 1 | Bita*2 | Endegagn*3 | Enemorina Eaner*4 | Cheha *5 | Geta *6 | Gumer*6 | M/Azenet Berbere*7 | MisraqAzenet Berbere*7 | Alicho Wuriro | Yem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pea | | | | | | | | | | | | | | leaved weeds | |
| | Insect | | | | | | Insect | | | | | | | | |
| | Disease | | | | | | Disease | Chocolate spot | | | Diseases | | Diseases | Diseases | Chocolate spot |
| Pigeon pea | Insect | | | | | | | | | | | | | | |
| Chick pea | Disease | | | | | | | | Disease | | | | | | |
| Coffee | Disease | | | CBD | | Wilting | | CBD | CBD | | CBD | | | | CBD |
| Apple | Disease | | | | | | | | | | Disease | | | | |
| Avocado | Disease | | | | | | | Un identified Disease | Un identified Disease | | | | | | |
| | Vertebrate | | | | | | | | | | | | | | Wild animals |
| Mango | Disease | | | | | | | | Un identified Disease | | | | | | |
| | Vertebrat | | | | | | | | | | | | | | Wild |

| Crops | Pests | Chena *1 | Decha*1 | Gewata*1 | Gimbo*1 | Bita*2 | Endegagn*3 | Enemorina Eaner*4 | Cheha *5 | Geta *6 | Gumer*6 | M/Azenet Berbere*7 | MisraqAzenet Berbere*7 | Alicho Wuriro | Yem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | e | | | | | | | | | | | | | | animals |
| Banana | Weed | | | | | | | | | | | | | | |
| | Disease | | | | | | | | Unidentified Disease | | | | | | |
| | Vertebrate | | | | | | | | | | | | | | Wild animals |
| Orange | Disease | | | | | | | Unidentified Disease | Unidentified Disease | | | | | | Diseases |
| Papaya | | | | | | | | | Unidentified Disease | | | | | | |
| Cabbage | Disease | | | | | | | | Unidentified Disease | | | | | | |
| Onion | Disease | | | | | | | | Un | | | | | | |

| Crops | Pests | Chena *1 | Decha* 1 | Gewata* 1 | Gimbo* 1 | Bita*2 | Endegagn*3 | Enemorina Eaner*4 | Cheha *5 | Geta *6 | Gumer*6 | M/Azenet Berbere*7 | MisraqAzenet Berbere*7 | Alicho Wuriro | Yem |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | identified Disease | | | | | | |
| Garlic | Disease v | | | | | | | | Un identified Disease | | | | | | |
| Pepper | Disease | | | | | | | | Un identified Disease | | | | | | Bacterial wilt |

*-1 Weeds, insects and diseases are constraints in the woredas but not specified*

**2 Insect pest of major crops in order of importance are: termite, aphid, and storage pest (weevil). Termite and stock borer attack seedling of sorghum and maize during rain shortage season. Major vertebrate pest: rat, ape, monkey*

**3 Weeds are major problems for crop production of faba bean and field pea*

**4 Weeds are major problems for crop production of faba bean, field pea, potato, sweet potato*

**5 Weeds are major problems for crop production of cereals and pulse crop productions*

**6 Weeds are major problems for crop production of faba bean, field pea, potato, sweet potato*

**7 Vegetables and fruit disease and grass and broad leaved are among major problems; weeds are major problems of faba bean, field pea, potato, sweet potato*

## 8.2. Access to improved technologies

### 8.2.1. Access to improved crop varieties

Different types of improved crop varieties were introduced to different woredas (Table 15). The number and type of improved varieties varied across surveyed woredas. Improved varieties of maize were introduced to nearly all woredas. Improved varieties of wheat, barley, tef, and potato were introduced to most of the woredas. . Even though many improved, crop varieties were introduced to surveyed woredas such as faba bean and field pea local varieties still in use. The main source of improved varieties of seeds was offices of Agriculture and Natural Resources in respective woredas.

Access to improved crop varieties remained a crosscutting constraint throughout the survey woredas. However, the extent of the constraint varies with crop types and woredas. Lack and/or shortage of improved seeds, late supply, and high price of seeds were the major problems for most of the crops. Example late supply of improved seeds of maize and wheat were reported in Arbegona, Konta, Endegagn, Enemorina Ener, Geta, Misraq Azenet Berbere, Yem and Alicho Wuriro woredas; faba bean and field pea in Enemorina Ener and Konta special Woreda. Debub Bench and Gedeb woreda farmers complain lack or accessibility or on time supply of improved variety seed for major crops.

In addition, shortages of improved varieties of food barley in the highlands of Dauro zone and Konta special woreda; maize in mid and lowland areas of Esera, Konta, and Wondogenet; tef in lowland areas of Esera Woreda; potato in Konta, Endegagn, Cheha, Geta, Misraq Azenet Berbere Woredas. Similarly, the lack of access to improved varieties was a problem for most of the major crops in Menit Goldia, Shey Bench, Semen Bench, and Debub Bench Woredas.

Moreover, supplies of improved varieties of some crops were not common at all areas. Such problems were common for barley in Konta and Bita highlands; sorghum, tef, potato and haricot bean in Konta; faba bean and field pea in several woredas including Endegagn, Enemorina Ener, Cheha, Mirab Azenet Berbere, and Yem special Woreda. Likewise, shortage of seeds of improved

varieties prevailed for most crops in Yeki, Andracha, Chena, Decha, Gewata, Gimbo, and Bita.

As perceived by farmers, cost of improved seeds of different crops, particularly for poor households, was a constraint to access improved varieties. Price of seeds of maize varieties was high to be access in Esera, Konta, and Malga Woreda farmers. The same is true with; tef at Esera, Bursa, Wondogenet and Gedeb Woredas.

The constraints related to crop varieties are:

- Most of the varieties are susceptible to different diseases. For instance, the improved wheat varieties (Digelu and Danfe) are susceptible to rust and thus farmers are shifting to barley production in Arbegona, Malga and Gorche and potato varieties (Gudene and Jalene) are affected by late blight at Gorche;
- Seeds of some crops have quality problem (impurity of seeds). For instance, maize seeds are mixed with different materials and broken seeds and have different seed size; for example, in Arbegona Bursa and Malga Woredas. Quality problems were also reported from Konta (on maize and wheat). Poor germination of seeds of particularly vegetable crops was reported in several woredas;
- Few crops have threshing problem such as the wheat variety Danfe; and
- Productivity of the varieties of many crops at farmers hand became decreasing due to repeated use and recycling of seeds in some woredas.

Table 15. Introduced varieties of major crop varities across different woredas

| Woreda | Maize | Sorghum | Wheat | Barley | Tef | Faba bean | Field pea | Haricot bean | Potato | Sweet potato | Onion | Coffee |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arbegona | BH660 | | Digalu, Danfe | | DZ var., Kuncho | Degaga | | | Gudene | | | |
| Bursa | BH660 | | Digalu, Danfe | | DZ var., Kuncho | Degaga | | | Jalene, Gudene | | | |
| Gorche | BH661 and BH660 | | Digalu, Danfe | HB1307, Sabini, Holker, Grace, Travller, Beka | | No | No | | Jalene, Gudene, Belete | | | |
| Malga | BH-660 and BH-661 | | Digalu, Danfe, Pica flour | Kulumsa, HB-1307, Sabini, Traveler, Grace, Holker, Beka | | Degaga | | Ibado,Nasir , Awassa Dume | Jalene, Gudene, Belete | | | Unspecified |
| Wondo Genet | BH 661, BH660, BH540 | | | HB-1307, Sabini, Traveler | Debrezeit | No | No | Awassa Dume, Ibado, Nasir | Jalene, Gudene, Durame | | | |
| Bule | BH 661 and BH660 | | Digalu, Danfe | HB-1307, Sabini | | Gebelcho | No | | Jalene, Gudene, Buie | | | |
| Gedeb | BH 660 and BH661 | | Degalu, Danfe | HB1307, Shege | | Degaga | No | | Jalene, Gudene, Belete | | | |
| | | | | | | | | | | | | |

| Woreda | Maize | Sorghum | Wheat | Barley | Tef | Faba bean | Field pea | Haricot bean | Potato | Sweet potato | Onion | Coffee |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tocha | BH660 | | | No | Kuncho | Degaga | | | | | | |
| Esra | BH540 | | | HB1307 | Tsedey | No | | | | | | |
| Konta | BH-660,BH-661, BH-540 | | Digalu, Danfe (Danda'a) | HB1307 | Kuncho | Degaga, Gabalcho, Messay | Tegegnech, Melke | Nasir | Gudene, Jalene | | | |
| Melo Koza and Basketo | BH140, BH540, BH661 | No | Danphe, Digelu | *Kochkocho* (local name) | Kuncho | No | Tegegnech | unspecified (Red and White) | unidentified variety | Unspecified | Red bombe | 7410 and 7210 |
| Debub Ari | Un specified | | | | | | | Unidentified | | | | |
| Bena Tsemay | Un specified | | | | | | | Unidentified | | | | |
| Semen Ari | Un specified | | | | | | | | Un identified | | | |
| Menit Goldia | Pioneer, BH-660, BH-540, BH-140 | No | Kakaba, Simba | No | Kuncho | No | | Awash-1 | Belete | | | |
| Shey Bench | BH-140 , Shone, BH-660 | No | Kakaba | | Kuncho | Gabalcho | | | Jalene, Gudene | | | |
| Semen Bench | BH-140 , Shone, BH-660, pioneer | No | Digalu | HB-1307 | Kuncho. CAR-337 | Gabalcho | Tegegnech | | Jalene, Gudene | | | |
| Debub Bench | BH-140, Shone, Pioneer | No | | | | | | No | Jalene | | | |
| Yeki | BH140 | No | | | | | | | | | | F 74, F59 BH140 |
| Andracha | BH-140, Pioneer | | | | | | | | Gudene, Jalene, Belete | | | 74140, 74110 |
| Chena | BH-660,BH-66, | | Simba, | | | | | | Un specified | | | |

| Woreda | Maize | Sorghum | Wheat | Barley | Tef | Faba bean | Field pea | Haricot bean | Potato | Sweet potato | Onion | Coffee |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BH-540, Pioneer | | Danda'a | | | | | | | | | |
| Decha | Un specified | | | | | | | | Un specified | | | Un specified |
| Gewata | Un specified | | Un specified | Un specified | Un specified | Un specified | Un specified | | | | | |
| Gimbo | BH660, BH-661, BH-540 | | Danda'a | | | | | | Un specified | | | |
| Bita | BH140 | No | | | | | | | | | | |
| Endegagn | Un specified | | Un specified | HB1307 | Kuncho | No | No | | Un specified | | | |
| Enemorina Ener | Un specified | | | HB1307 | Un specified | No | No | | | | | |
| Cheha | Un specified | No | Hidase | HB1307 | No | No | No | | Un specified | | | No |
| Geta | | | Un specified | HB1307 | | No | No | | Un specified | | | |
| Gumer | | | Un specified | HB1307 | | No | No | | Un specified | | | |
| MirabAzenet Berbere | | | Un specified | HB1307 | | No | No | | Un specified | | | |
| MisraqAzenet Berbere | Un specified | | Un specified | HB1307 | Kuncho | Un identified | No | | Jalene, Gudene | | | |
| AlichoWuriro | | | Un specified | HB1307 | | No | No | | Un specified | | | |
| Yem | Un specified | | Un specified | HB1307 | No | No | No | | Un specified | | | |

Table 16. Proportion of extension participant in agricultural technologies scale out program 2016/2017 E.C

| Technology | 2006/7 of participants on full package | | | | 2008/9 % of participants on full package | | | |
|---|---|---|---|---|---|---|---|---|
| | No. extension participants | Women | Men | ha | No. extension participants | Women | Men | ha |
| Maize | 356,739 | 29,633 | 327,106 | 223,322.3 | 336,459 | 25,960 | 310,499 | 258,797 |
| Tef | 396,891 | 62,350 | 334,541 | 150,128.8 | 410,576 | 66,975 | 343,601 | 183,892 |
| Wheat | 453,620 | 70,125 | 382,495 | 185,316.7 | 456,300 | 75,359 | 380,941 | 188,098 |
| Barley | 205,630 | 36,540 | 169,090 | 66,784.5 | 234,946 | 39,628 | 195,318 | 88,794.17 |
| Sorghum | 8731 | 1,543 | 7,188 | 2,186 | 10,230 | 2,238 | 7,992 | 24,660.3 |
| Pulses | 1,207 | 412 | 795 | 21,693 | 1,288 | 489 | 799 | 2,111.65 |
| Forages | 2,484,053 | 431,836 | 2,052,217 | 72,645.9 | 2,065,225 | 516,306 | 1,548,919 | 75,869.2 |

## 8.3. Crop management

### 8.3.1. Pest

In many areas, farmers use herbicides, fungicides, and insecticides to control weeds, fungal disease, and insect pests, respectively. However, farmers said that the efficiency of the existing pesticides has reduced. Some of the pesticides available in the market are expired; the newly registered chemicals are not available and accessible to farmers. In some woredas, such as Cheha, farmers have less willingness to apply herbicides (2, 4-D) because they think that the chemicals have negative effect on their animals and bees. In other areas, for example, Yem, Enemorna Ener, Gumer, Mirab Azenet Berbere and Geta Woredas farmers believe that weeding is not necessary for some crops particularly for faba bean and field pea. The farmers use weeds as forage for livestock.

### 8.3.2. Soil fertility and moisture

**Fertilizer**: Most of the farmers use both organic and in organic fertilizers. Though, they are familiar with the method and rate of application of fertilizers; especially for maize, wheat barely, the amount applied for different crops is below the recommended amount. The main reasons, as perceived by the farmers, were due to the increased price of fertilizer and the low net return from the production. In Dauro and Konta, Melo koza, Basketo and most of south western zones (kafa,Bench maji, Shaka) farmers believe that the soil does not need the recommended amount of fertilizers. Farmers in Gedeb woreda stated that after applying urea fertilizer in some farms, the soil became firm for cultivation and subsequently new weeds emerge.

**Soil acidity**: Soil acidity was stated as a constraint in the highland areas affecting the productivity of crops. In Shey Bench, Arbegona, Bursa, Malga, and Bule, there was limited practice of liming due to shortage or unavailability of lime. Thus, due to low productivity of crops in Arbegona and Bursa farmers started shifting from crop to livestock production. Some farmers in Gedeb woreda tried to minimize the acidity by using compost and farmyard manure.

**Moisture**: There was no major moisture and drainage problem in Arbegona, Busa, Malga, Wondogenet, and Gedeb where irrigation is practiced. Some woredas such as Bursa have much water source that can be used for irrigation. However, in woredas, such as Cheha, water shortage was a major problem. In most areas, the irrigation system was traditional and farmers use their indigenous knowledge. The optimum frequency and amount of irrigation were not studied in many areas.

### 8.3.3. Improved agronomic practices

Most farmers have understood the importance of improved agronomic practices like using recommended planting and harvesting date, seed and fertilizer rate to increase the productivity of crops. Accordingly, therefore, in many areas, they are practicing the recommended fertilizer rate, plant spacing, and row planting of maize, wheat, and barely. Trainings have been given by Development Agents on agronomic practices including frequency of tillage (to plough three to four times per season). However, farmers in Arbegona, and

Bursa said that due to the existing soil acidity problem in the highland areas, there was no change on the productivity of crops. Thus, farmers requested the frequency of tillage to be studied in such areas. In Gorche and Malga, due to increased fertilizer price, resource poor famers used fertilizer below the recommended rate. In many areas, farmers are practicing row planting and they appreciated its advantages over broad casting in terms of increasing crop productivity. However, some farmers in Gorche, Wondogenet mentioned that row planting is labor intensive and because of this, some of them are using broadcast method of planting.

### 8.3.4. Cropping systems

Crop rotation is a common practice in most area though farmers lack awareness on its appropriate sequences of planting. In many areas, wheat, barley, faba bean, and potato are planted as mono cropping. Enset and maize are intercropped with kale, common bean particularly at the early stage of the main crops especially in Sidama zone- AGP-II intervention woredas.

### 8.3.5. Post-harvest

**Post-harvest management**: Most of the participants in different woredas; for example, Arbegona, Bursa, and Malga reported that they have no awareness on post-harvest handling. Farmers as one of the most prominent constraints mention lack of awareness on post-harvest handling of potato like warehouse and Diffused Light Store (DLS).

**Transportation:** In Arebegona, Debub Bench, Bursa, highland parts of Wondogenet, transportation was mentioned as major problem to sell crop products at better price particularly in the rainy season as most of the roads are dry weather roads. In addition, farmers reported that the existing enset processing tools are labor consuming and backward in Bursa, Enemorna-Eaner, Cheha, and Endegagn Woredas.

**Climate:** Unpredictable and erratic rainfall has been among the constraints affecting the production of crops in most of the woredas assessed particularly in the lowland agro ecologies. In addition, some diseases occur frequently because of climate changes.

### 8.3.6. Marketing

**Quality:** According to farmers, some of the technologies distributed to farmers are poor in quality. This includes impure seeds of barely, impure and broken seed of maize and poor germination of vegetable seed such as head cabbage and tomato. Provision of training related to quality and value adding of vegetables and food preparation. In Andracha Woreda drying of coffee using local material—due to shortage of improved material—affected the quality of coffee product.

**Accessibility:** In number of woredas, farmers reported that there is no problem of access to local market to sell their products despite the low price during harvesting time. Some farmers said that there is no immediate market to which farmers deliver their products particularly for avocado and orange fruits. Thus, lack of market linkage is one of the constraints in many woredas such as Arbegona, Debub Bench, Bursa, Gorche, Malga, Wondogenet, Debub Ari, Menit Goldia, and Chena. Most of the irrigated crops are perishable and can easily be rotten. Thus, farmers and Development Agents suggested that there should be intervention on market linkage before harvesting for such crops. Market linkage, particularly for coffee and vegetable production, is a major constraint in many areas such as Malga, Bena Tsemay, Debub Ari, Cheha Decha, and Yem special Woredas.

**Credit:** There is no enough credit access available for inputs except fertilizer credit service provided by the government in woredas such as Semen Bench, Gorche, Malga, Wondogenet, Gedeb, and Debub Bench. In Yeki where credit service is available such as through Omo micro finance institution, farmers have no access to credit due to lack of awareness on credit service by such institutions and fearing risks of credit return in cases of crop failure. On the other hand, there is no problem to access credit in woredas like Chena and Decha.

### 8.3.7. Knowledge management

**Training:** Farmers lack awareness on crop losses such as loss of weight, quality, nutritional value, viability and economic loss and there is no adequate training on proper post-harvest handling. When a new technology is introduced in an area, theoretical and practical training are most frequently given for few model

and men farmers. Thus, informants requested that training, for instance on quality and nutrition, have to be given for all farmers including women.

**Knowledge gaps:** Even though the government provides training to fill the skill gap, there was no strong structure to improve extension service. Some of the knowledge gaps in crop production in different areas include sanitary control measure on enset, bacterial blight and coffee wilt and CBD, pesticide usage to prevent and control different pests, use of recommended input rate and production of quality seed that still need attention of the extension service to increase the level of understanding of the farmers.

**Information:** There was no information gap on technologies in Gorche, and Andaracha. Whereas, in woredas, such as Menit Goldia, Bita, and Yeki there was constraint of awareness on agronomic practices—appropriate seed rate, fertilizer rate, weeding time and time of harvesting, harvesting and processing. The main information sources were Development Agents, friends and neighbors. Information about new technologies was transferred to farmers through Development Agents and from neighbors and friends. However, information on market, improved seed, credit access, pesticide type and their application were not clearly transferred to farmers in Wondogenet Woreda. Farmers in Debub Ari produce low quality products due to lack of awareness, lack of market competition and accessibility.

**Extension**: The government organized at regional, zonal, provides the extension service and woreda/district level is weak.Tables 17, 18 and 19 show the number of development agents at kebeles, FTC, and level of FTC in the region. Agricultural experts provide technical support how to use improved practices and advice how to manage pests in all cropping season. Nevertheless, due to lack of adapted varieties to in some areas, the yield obtained decreased from time to time. Farmers grow their crops using improved practices and improved varieties with the support of agricultural experts; however, the productivity remains low. This was elaborated by informants that the cause might be due to use of incompatible variety to the area or due to soil problem. So the technologies should be first demonstrated in the area before scale up at large level.

Table 17. Summary of development agents at Kebele (PAs) in the region.

| No of kebeles | No of FTC | Crop dev.t agents | | | Natural res. dev.t agents | | | Crop and Livestock DAs | Assistant cooperative agents | | | Animal production DA | AI technician | Animal health technician | Total | Total DAs at Keble level | DAs of Crop, Livestock and NRM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | male | female | total | male | female | total | | Male | Female | Total | | | | | | |
| 3775 | 37 67 | 36 30 | 112 2 | 47 52 | 343 5 | 929 | 436 4 | 9116 | 58 8 | 103 0 | 16 18 | 4016 | 359 | 2819 | 71 94 | 179 28 | 13132 |

Table 18 Summary of regional farmers training centers' rank

| No of kebeles | Minimum standard fulfilled FTCs | | | | FTCs not fulfilled minimum standard | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-basic | Basic | Intermediate | Advance | FTCs with no sub station | FTCs with sub stations but not constructed | FTCs not constructed | Total |
| 3768 | 691 | 1369 | 1202 | 35 | 199 | 78 | 194 | 3768 |

**Table 19.** AGP woredas' FTC level status as 2017/18

| Woreda | No of kebele | No of FTc | No of Functional Ftc | Level of FTC | | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Prebasic | Basic | Intermediate | Advance | Total | |
| Enemorener | 64 | 64 | 64 | 48 | 9 | 6 | 1 | 64 | All FTCs are functional but level of building status and functionalities are vary from FTC to FTC, in one FTC some buildings are functional and others are non functional. In AGP 1 **[67]** |
| Cheha | 39 | 39 | 39 | 0 | 32 | 6 | 1 | 39 | |
| Endegagne | 17 | 17 | 17 | 0 | 14 | 2 | 1 | 17 | |
| Gumer | 18 | 18 | 18 | 9 | 4 | 4 | 1 | 18 | |
| Geta | 16 | 16 | 16 | 11 | 0 | 4 | 1 | 16 | |
| **Total** | **154** | **154** | **154** | **68** | **59** | **22** | **5** | **154** | |
| Chena | 43 | 42 | 42 | 26 | 12 | **3** | 1 | 42 | |
| Decha | 58 | 58 | **58** | 18 | 29 | 10 | 1 | **58** | |
| Gimbo | 31 | 31 | 31 | 29 | 0 | 1 | 1 | 31 | |
| Gewata | 30 | 30 | 30 | 5 | 24 | 0 | 1 | 30 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bitta | 24 | 24 | 24 | 21 | 0 | 2 | 1 | 24 | Equiped FTCs are 612 and rehabilitated (maintaining) FTCs are 327. |
| **Total** | **186** | **185** | **185** | **99** | **65** | **16** | 5 | **185** | |
| Mesirak Azernet B | 17 | 17 | 17 | 12 | 3 | **1** | 1 | 17 | |
| Alichowerero | 24 | 24 | 24 | 1 | 17 | 5 | 1 | 24 | |
| Mirab Azernet B | 19 | 17 | 17 | 0 | 13 | 3 | 1 | 17 | |
| **Total** | **60** | **58** | **58** | **13** | **33** | **9** | **3** | **58** | |
| Sheyebench | 21 | 21 | 21 | 4 | 10 | **6** | 1 | 21 | |
| Debub bench | 25 | 25 | 25 | 15 | 7 | 2 | 1 | 25 | |
| Semen bench | 31 | 31 | 31 | 25 | 0 | 5 | 1 | 31 | |
| Menetgoldiya | 29 | 29 | 29 | 24 | 4 | 0 | 1 | 29 | |
| **Total** | **106** | **106** | **106** | **68** | **21** | **13** | **4** | **106** | |
| Esara | 29 | 29 | 29 | 13 | 12 | **3** | 1 | 29 | |
| Tocha | 36 | 36 | 36 | 20 | 15 | 0 | 1 | 36 | |
| **Total** | **65** | **65** | **65** | **33** | **27** | 3 | 2 | **65** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wondogenet | 14 | 13 | 13 | 3 | 5 | 4 | 1 | 13 |
| Gorichie | 21 | 20 | 20 | 9 | 5 | 5 | 1 | 20 |
| Meliga | 23 | 23 | 23 | 14 | 5 | 3 | 1 | 23 |
| Aribegona | 38 | 38 | 38 | 33 | 0 | 4 | 1 | 38 |
| Burissa | 28 | 27 | 27 | 26 | 0 | 0 | 1 | 27 |
| **Total** | **124** | **121** | **121** | **85** | **15** | **16** | **5** | **121** |
| Yeki | 22 | 22 | 22 | 2 | 13 | 6 | 1 | 22 |
| Andericha | 16 | 16 | 16 | 5 | 10 | 0 | 1 | 16 |
| **Total** | **38** | **38** | **38** | **7** | **23** | **6** | **2** | **38** |
| Gedeb | 16 | 16 | 16 | 2 | 9 | 4 | 1 | 16 |
| Bulie | 30 | 30 | 30 | 20 | 7 | 2 | 1 | 30 |
| **Total** | **46** | **46** | **46** | **22** | **16** | **6** | **2** | **46** |
| Debub ARi | 49 | 48 | 48 | 8 | 29 | 10 | 1 | 48 |
| Semen Ari | 33 | 33 | 33 | 12 | 15 | 5 | 1 | 33 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Benasemaye | 30 | 12 | 12 | 10 | 0 | 1 | 1 | 12 |
| **Total** | **112** | **93** | **93** | **30** | **44** | **16** | **3** | **93** |
| Melekoza | 37 | 37 | 37 | 28 | 2 | 6 | 1 | 37 |
| **Total** | **37** | **37** | **37** | **28** | **8** | **0** | **1** | **37** |
| Basiketo | 30 | 30 | 30 | 10 | 12 | 7 | 1 | 30 |
| Konita | 43 | 43 | 43 | 4 | 35 | 3 | 1 | 43 |
| Yem | 31 | 31 | 31 | 4 | 22 | 4 | 1 | 31 |
| **Total** | **104** | **104** | **104** | **18** | **69** | **14** | **3** | **104** |
| **Grand total** | **1032** | **1007** | **1007** | **471** | **380** | **121** | **35** | **1007** |

N.B. Advanced level is planned for the year 2010, but the status of making advancedis vary from woreda toworeda
N.B. For the year 2017/18 Intermediate level is planned 96 .

N.B. AGP rehabilitated(maintained), equipped, fenced and fulfill demonstration tool for the last 6 years. Some FTCs lack of full blocks of rooms, optimum demonstration site, irrigation water source and optimum number of DAs to reached to the level of intermediate

Source: BoANR SNNR

### 8.3.8. Prioritization of the crop related agricultural problems

The following are lists of the major crop production constraints identified in the surveyed areas. Most of the constraints are common to several woredas. Reports from most of the research centers did not include ranking of the constraints. Therefore, the sequence in the list does not mean necessarily ranking orders.

1. Disease and insect pests on different crops
2. Lack of improved and disease tolerant varieties
3. Shortage of improved seeds for different crops' varieties
4. Soil acidity problem
5. High price of inputs
6. Decline of soil fertility
7. Lack of genuine seed source for vegetables
8. Post-harvest handling problem particularly for fruits, root and tuber crops
9. Lack of awareness on different improved agronomic practices
10. Lack of /no sustainable seedling source for fruits, pulses
11. Lack of moisture stress resistant variety
12. Limited access to pesticides and training on pesticide usage
13. Absence of early maturing improved crop varieties
14. Vertebrate pests
15. Erratic rainfall
16. Lack of improved food processing technology on fruit, root and tuber crops
17. Lack of awareness on economic and nutritional value of root and tuber crops,
18. Lack of appropriate tillage frequency for different groecology
19. Lack of awareness for technology for coffee drying in some woredas of South Omo
20. Challenge in weed infestation and in some areas farmers are reluctant to weed on time
21. Lack of market linkage
22. Shortage of credit access and adequate amount of money from credit institution
23. Shortage of transportation for products

### 8.3.9. Recommendations and outlines of research and development proposals

Generally, it is possible to conclude that research and development interventions are required in crop variety improvement, adaptation and demonstration, quality seed production and supply on time, developing package on improved cropping system, developing integrated pest management, post-harvest management and processing as well as socio-economic interventions. Specific interventions are suggested for specific problem against major crop types as indicated in Table 20 Some of the problems identified need the intervention of agricultural extension system and other stockholders.

*Table 20 Crop production and related constraints and possible interventions*

| Crop | Constraint | Intervention |
|---|---|---|
| Barely | • Rust and smut | • Developing rust tolerant variety, demonstration fungicides , using IPM techniques |
| | • Shootfly and cut worm | • Introducing and demonstrating control options |
| | • Lodging | • Evaluation of varieties against logging/ management option |
| | • Poor agronomic practices (crop rotation, intercropping rate, fertilizer application, etc.) | • Training on improved practices |
| Wheat | • Wheat rust and smut<br>• Lack of disease resistant high yielder and adapted variety | • Variety evaluation, Screening varieties against disease<br>• Training of farmers on symptom identification, demonstration of fungicides |
| | • Weevil, shoot fly | • Training of farmers on chemical usage,<br>• Evaluation insecticides |
| | • Farmers' low interest to weeding | • Demonstration of control options (IPM) |
| Rice | • Rice beetle | • Evaluate different control options |
| Sorghum | • Sorghum Anthracnose; Head smut<br>• | • Evaluation of varieties against disease<br>• Evaluation of seed treatment fungicides,<br>• Training on disease transmission and pesticide usage |
| | • Grain midges, aphid, bird, weevil (Bena Tsemay), stalk borer (grass hopper (locust) | • Evaluation and demonstration of pre-harvest, storage and vertebrate pest control options |
| | • Lack of resistant varieties to drought and disease;<br>• Poor agronomic practices (crop rotation; inter cropping, no fertilizer application, etc.)<br>• Lack of disease, weed and insect pest controlling methods. | • Demonstration and evaluation of drought resistance varieties, Training on improved agronomic practices |
| Finger millet | • Locust, birds and rodents | • Demonstration of IPM |

| | | |
|---|---|---|
| Maize | • Stalk borer and cut worm, grain midges, rice black beetle, termite, weevil, mole rat | • Evaluation and demonstration of IPM practices |
| | • MLND, Smut, ear rot , blight and rust | • Variety evaluation against diseases, Training and demonstration on IPM, Evaluation of seed treatment chemicals on smut, blight and rust |
| | • Lack of alterative high land improved varieties<br>• Lack of pure and certified improved maize seed,<br>• Low price of maize at harvesting time and lack of market linkage lack of pesticide or access for pesticide, limitation of purchasing power of farmers | • Introduction and demonstration of improved varieties<br>• Create market linkage with cooperatives<br>• Create credit access opportunities' |
| Sesame | • Sesame leaf blight<br>• Bacterial wilting during flowering,<br>• Lack of disease weed and insect pest controlling method. | • Introducing tolerant variety<br>• Study alternative disease management methods |
| | • Aphid, termite, Webworm, storage pest | • Study control measures |
| | • Lack of improved and low shattering capacity varieties<br>• Poor agronomic practices (crop rotation, no fertilizer application etc.), Poor post-harvest handling,<br>• Low cost and no updated market information | • Developing and introducing less shattering nature variety<br>• Awareness creation on improved practice of Sesame |
| Ground nut | • porcupine, Mole rat, ground nut bruchid, white grub Aphid and mealy bug | • Developing control measures<br>• Demonstration of the existing improved cultural practice |
| Faba bean | • Fusarium wilt, Disease (flower dropped ), chocolate spot and rust on fababean | • Variety trial<br>• Evaluation different control option |
| | • Aphid , Ball worm at maturity, pod borer, weevil | • Demonstration chemicals<br>• Screening of chemicals against insect |
| | • lack of improved seed (disease resistance<br>• and compatible to the locality)<br>• Lack of improved and lodging resistant verities | • Demonstration of registered variety<br>• Introduction of variety |
| | • Poor agronomic practices (sowing method, tillage, etc.)<br>• Lack of disease, weed and insect pest controlling method | |
| | • lack of training on IPM<br>• Lack of training on post-harvest handling | • |

| | | |
|---|---|---|
| Field pea | • Powdery mildew | • Screening of chemicals against powdery mildew |
| | • Aphid and ball worms | • Chemical screening |
| | • Lack of improved verities<br>• Lack of disease weed and insect pest controlling method. | • Multiplication of certified seed according to farmers interest |
| | • Poor agronomic practices (no weeding, sowing method, crop rotation, etc.)<br>• Poor harvesting and post-harvest handling practice | • Demonstration of recommended practice |
| Common bean | • Common bacterial blight, ALS | • Screening against diseases |
| | • Bean stem maggot, leaf holler, pod borer, Aphid, weevil, Leaf cutters, pod worms | • Evaluation of chemical at field condition and treatment of seed |
| | • Lack of improved verities<br>• Poor agronomic practices (crop rotation fertilizer application, etc.)<br>• Lack of disease weed and insect pest controlling method. | • Demonstration IPM<br>• Demonstration and training of farmers |
| Mung bean | • Aphid, worms, Pod Borer, | • Evaluation of insecticides<br>• Study and determination of yield loss |
| | • Poor agronomic practices (crop rotation, fertilizer application, etc.); Poor post-harvest handling;<br>• There is no nutritional analysis for local food products preparation | • Demonstration of improved practice<br>• Evaluation of proportions of taro with different crops |
| Enset | • Bacterial wilt and fusarium wilt | • Demonstration and scale up of sanitary control measure\<br>• Introducing tolerant enset<br>• Variety evaluation against EBW |
| | • Mealy bag , leaf hoppers | • Demonstration of integrated pest management<br>• Evaluation of different cultural management option ,<br>• screening insecticide |
| | • Lack of processing materials | • Introduction and demonstration of processing technology |
| | • Mole rat, | • Demonstration IPM |
| Potato | • Late blight and bacterial wilt | • Variety evaluation and screening for bacterial wilt and late blight<br>• Demonstration of IPM practice |

| | | |
|---|---|---|
| | • Red ant, Spotted leaf beetles, weevil, mole rat, cut worm | • Screening of chemicals<br>• Demonstration IPM |
| | • Pesticide and pesticide sprayer not available<br>• Lack of disease resistant variety | • |
| | • Lack of market linkage,<br>• Low price of potato at harvesting<br>• Lack of knowledge the relation of timely harvesting and insect attack, tuber rot | • |
| Sweet potato | • White worm, cut worm and Sweet potato weevil. | • Evaluation and demonstration of insecticides |
| | • mole rat, porcupine, | • Demonstration cultural practice |
| | • Blight, virus, Lack of improved and disease resistance varieties | • Screening sweet potato against disease<br>• Training on IPM |
| | • Poor agronomic practices (rotation, fertilizer application etc.)<br>• Poor post-harvest handling techniques | • Demonstration of post-harvest handling and training of farmers |
| Taro | • Poor agronomic practices (crop rotation, fertilizer application, etc.)<br>• Improper proportion of blended product with Tef and Wheat, nutrition analysis for local foods (*Phosease*)<br>• Lack of market linkage | • Training and demonstration of different food preparation<br>Study the proportion of taro with<br>• different crops for utilization |
| Mango | • White scale, fruit fly | • Screening of varieties and demonstration of IPM |
| | • Anthracnose, powdery mildew , un identified disease, un identified fruit dropping disease | • Survey of mango growing area<br>• Evaluation fungicides<br>• Evaluation tolerant variety |
| Avocado | • Anthracnose and phaytophthora rotting | • Evaluation of chemical and varieties<br>• Use of improved practice |
| | • Avocado ( leaf and fruit borer) | • Evaluation cultivars |
| | • Lack of improved varieties<br>• Poor agronomic practices (disease management, spacing, etc.) | • Introducing and demonstration of Improved agronomic practice |
| | • Poor post-harvest handling | • Demonstration post-harvest handling technology |

| | | |
|---|---|---|
| Apple | • Fruit dropping at maturity | • Survey to identify the disease |
| Coffee | • Fusarium wilt, Coffee berry disease<br>• coffee leaf rust, Fruit rotting | • Demonstration the existing IPM practice<br>• Introducing disease tolerant cultivar |
| | • Leaf skeletonizer, | • Survey on the status of the pest |
| | • Lower market price for coffee and market linkage | • |
| | • Lack of Improved seedling. | • Introduction of newly released coffee seedlings |
| Ginger | • Bacterial wilt and other fungal disease | • Demonstration of IPM<br>• Study planting date<br>• Study control measures |
| | • Rotting when it stay long period of time in the soil (over mature)<br>• Poor agronomic practices<br>• Poor post-harvest handling | • Demonstration IPM<br>• Demonstration post-harvest handling technique |
| Hot pepper | • Fruit rot , blight | • Demonstration of IPM |
| | • Cut worms, | • Demonstrations of IPM |
| | • Poor agronomic practices (disease management, spacing, etc.) | • Demonstrations of IPM |
| | • Poor post-harvest handling consumption and local market | • Training on post-harvest usage |
| Garlic | • Rust, and leaf blight | • Evaluation and screening of varieties<br>• Evaluation chemicals |
| | • Lack of improved variety and use of traditional planting method | • Adaptation and demonstration of variety<br>• Training on improved practice |
| Kale | • Re Red ant , cut worm aphid | • Evaluation and demonstration of control options<br>• Evaluation of insecticides against cabbage aphid |
| Local onion | • Leaf blight, Downey mildew | • Develop control measures |
| Head cabbage | • Red ant | • Develop control measures |
| | • Bacterial soft rot | • Develop control measures |
| Beet root | • Red ant | • Develop control measures |

| | | |
|---|---|---|
| | • Bacterial soft rot | • Develop control measures |
| Carrot | • Around maturity white spores on the leaf | • Develop control measures |
| Onion | • Root worm, red ant ,Crickets, cut worm | • Develop control measures |
| | • Leaf blight, powdery mildew | • Introducing chemicals |
| | • Tomato fruit worm, late blight , early blight , Tomato fruit worm and birds, Red spider mites and Bird | • Study on different control measures<br>• Planting date study<br>• Demonstration of newly registered fungicides |
| Vegetables | • Lack of market linkage at harvest<br>• Lack of known certified vegetable seed source<br>• Lack of introducing newly registered fungicide | • |
| | • Soil acidity | • Options of reducing soil acidity should be familiarized |
| | • Lack of improved storage method or post-harvest handling | • Introducing improved storage method and techniques |
| | • Late provision of fungicide and lack of training on control measures. | • Training on IPM |

# 9. Livestock Production Constraints

## 9.1. Livestock production system

Livestock is an integral component of agricultural production system of the region. Different production systems are available and the scenarios are similar in AGP and non-AGP districts of the region. Generally, the production system could be categorized as described in (Table 21).

- Extensive (free grazing, animals trekked over distant areas searching for feed and water);
- Semi-intensive (free grazing, tethered feeding and strategic supplementation of wheat bran, Noug cake, and other home and industrial by products); and
- Intensive (cut and carry feeding, health care, use inputs, technological options, better housing, feeding strategic supplementary feeding)

Extensive production system is dominantly found in Benatsemay, Semen and Debub Ari (south omo), Menit Goldia and Debub Bench (western), Basketo, Malokoza (southwest) and Gojeb (west) and Arbegona (southeast). From reports done in lowlands of AGP districts, there is no woreda reported to be semi-intensive or intensive. Some pocket areas of midlands and highlands were either semi-intensive. For example, Enemur Ener, Cheha, Gumer, Malakoza, Yem, Wondogent; while no woreda can suffice definition of intensive production system.

*Table 21.* Major livestock production systems in AGP-II districts (n=20 woredas)

| Production system | Lowland | Midland | Highland |
|---|---|---|---|
| Extensive | Benetsemay, Gogeb, Basketo, Malokoza, Menit Goldia, South Bench, Semen and Debub Ari | Konta, Malakoza, Enamur Ener, Yem | Tocha, Esera, Konta |
| Semi-intensive | NA | Malga, Misra and Mierab Azernet, S and D/ Ari, Cheha, Wondogent | Cheha, Wongogent |
| Intensive | NA | NS | NS |

*NS=not significant*

## 9.2. Livestock, poultry and honeybee colony holdings

Livestock population, breed type, and productivity vary depending on production system and agro-ecological zones among others (Table 22). Cattle holding per household ranged from 0 to 4 (highland), 0-5 on average (midland) and 0-15 (lowlands). Similarly, sheep and goats holding per household ranged from 0 to 5 (highland), 2-8 sheep (midland), and 5-20 head (lowlands). Majority (over 95%) of domestic animals are of local breeds except poultry, which has been reported 20-50% crossbred breeds. Major crossbred cattle breeds distributed in the region are Holstein Frisian (HF) and Jersey whereas RIR, White leghorn and SASO poultry breeds. The source of improved poultry breeds is Mizan, Gubre and Bonga poultry farms for western and northern zones and Konta special districts; Hawassa poultry farm for Arbegona and Wondogent woreda and Debrezeit Agricultural research center for Dawuro zone, Malokoza, and Basketo Woreda. Although not significant, the percentage of crossbred animals increased from lowland to highlands while the reverse trend was observed for indigenous breeds. The percentage of crossbred animals was insignificant across ecological zones, particularly in lowlands. Majority of improved breeds were distributed by governmental institutions while few by non-governmental organizations (NGO's).

Table 22. Percentage livestock/bee colony holdings per agro-ecological zones of AGP districts

| Livestock | Breed/technology | % livestock/bee colonies per ecology | | |
|---|---|---|---|---|
| | | Lowland | Midland | Highland |
| Cattle | Indigenous | 99.98 | 99.76 | 99.74 |
| | Cross bred | 0.02 | 0.242 | 0.26 |
| Sheep | Indigenous | 100 | 100 | 100 |
| | Crossbred | NS | NS | NS |
| Goats | Indigenous | 100 | 100 | 100 |
| | Crossbred | NS | NS | NS |
| Poultry | Indigenous | 80 | 77.1 | 63.6 |
| | Exotic | 20 | 22.9 | 36.4 |
| Bee colonies | Traditional (n) | 90.66 | 90 | 85 |
| | Transitional (n) | 5 | 4 | 5 |
| | Modern (n) | 4.34 | 6 | 10 |

## 9.3. Livestock productivity

Livestock production and productivity varied greatly across ecological zones and production systems mainly due to variations in resource availability/accessibility and technological interventions including input supplies and institutional support: logistics, training, and equipment. Generally, most AGP districts have the least accesses to livestock technological options due to their remoteness and rugged topography. As a result, improved livestock technologies were not appropriately disseminated to the woredas, particularly to lowland agro-ecological zones. For example, crossbred cattle are few in lowlands due to low access, management problems, and diseases in addition to other barriers (Table 23). The average milk yield of mature crossbred cows is 7.5 liter/day/cow for middle and highland areas of the woredas while it is 2 liter /day/cow for indigenous. The milk yield of indigenous cows in lowlands is lower than two litters (1.5 liters per day per cow), which is too low compared to national average. Similarly, meat yield varied across ecological zones, lowlands being lesser compared to midlands and highlands. The average meat yield from mature oxen/cows at lowlands ranged from 90 to 120 kg/head while it was slightly higher at midlands (100-135 kg/head) and highlands (100-135 kg/head). The higher yield in midlands and highlands is mainly due to strategic feed supplementation and fattening practices.

Sheep and goats are mainly considered as a sideline activity to other agricultural activities, mainly crop. As a result, efforts made towards improvements of sheep and goat is limited across ecological zones and production systems. The average meat yield ranged from 10 to 12 kg/head in lowlands to highlands for sheep and goat. Improved sheep and goat breeds are generally low in the majority of the studied woredas. Additionally, community based breed improvement program did not include AGP districts although there is a great demand from local community to improve indigenous breeds through selection; for example, in Tocha and Malakoza Woredas.

There variation in egg production and productivity is usually high, egg yield ranging from 60 eggs/hen/annum in lowlands from local chicken to 150 eggs/layer/annum from improved chicken. Studies indicated that 50% of the

available chicken breed is improved. Honey yield ranged 2-4 kg/hive/annum in lowlands, 4-8 kg/hive/annum in midlands and 10-20 kg/hive/annum in highlands from traditional, transitional, and modern beehives, respectively. It could mainly be due to vegetation variation that determined honey yield rather than ecological zones. The potential and demand of honey bee production is actually high in Bench Maji, Keffa, Sheka, Dawuro Zones, Konta special Woreda), Benatsemay, and Malakoza Woredas . As a result, honeybee production has been prioritized as an important commodity in the mentioned zones and special districts.

Table 23. Productivity (egg/ milk/meat yield/animal or amount of honey per hive) in studied AGP woredas

| Product | | Productivity | | | Remark |
|---|---|---|---|---|---|
| | | Lowland | Midland | Highland | |
| Milk (liter /cow/day) | Crossbred | NS | 7.5 | 7.5 | Crossbred animal number varies within agro-ecology |
| | Local | 1.5 | 2 | 2 | |
| Meat yield (kg/head)-mature animal (beef) | | 90-120 | 100-135 | 100-135 | Better due to supplementary feeding in mid and highlands |
| Mutton (kg/head)-sheep or goat | | 10 | 10 | 12 | |
| Egg yield (number of eggs/hen/year) | | 50* | 60, 120 | 60, 150 | Local, crossbred, * crossbred chicken not reported |
| Honey (kg/hive/year) | | T2-6, Tr 4-6, M 10-12 | T (2-6) Tr (4-6) M (15-20) | T (2-6) Tr (4-6) M (15-20) | |

*Ns=non-significant; T, traditional; Tr, transitional: M. modern*

## 9.4. Feed sources and productivity

Major livestock feed sources are indicated in (Table 24) Livestock grazing on natural pasture—communal or private—is still a major feed source for ruminants across agro-ecological zones during the wet season. Tillers, fillers

and green fodder are also sources of livestock feed in all agro-ecologies during wet season. Banana leaves and Pseudostems in lowlands and enset (*Ensete verticosum*) whole parts in midlands and highlands are important feed sources of ruminant animals all year round. During the wet season, grazing on private lands and tethered feeding management is more profound in highland areas while free grazing is a typical livestock management system in lowlands. To a limited extent, animals graze near roadsides and valley bottoms in both seasons. Limited practices of improved forage production have been reported from midlands and highland areas of the studied woredas. However, due to land shortage the adoption rate is very limited except for some forage crops, desho (most woredas), Napier (some woredas), and tree lucerne (Gumer Woreda), which is usually moderate. The practice of using industrial by products is usually low. The only exception is residues of local beverage/ *'areke'* and *'cheka' 'atela'*/ used by local communities in some districts of the region. During the dry season, crop residues, enset parts, indigenous browse, and natural pasture are major feed sources of ruminant animals. Enset parts are dominantly used as basal diet as well as supplementary feeding in midlands and highlands. Sorghum stover is the major crop residue in lowlands while maize stover and wheat straw is dominantly available in midlands. The difference in feed sources across agro-ecology is due to the variation in vegetation (indigenous browses) and crop residue types. In this regard, indigenous browse trees play a significant role in livestock nutrition across ecological zones. For example, *Acacia* in lowlands, *Cordia Africana*, *Erthirna spp* and 'Arkiniti' (Jinka) in midlands are important browse species among others. Generally forage productivity reports are limited, but yield and adaptation information of major grass species such as 'desho' (*Pennisetum glacifolium*), oat (*avena* spp) and Napier (*Pennisetum purpureum*) are available in research centers for few location specific trials (Example Gumer, Geta, freeze) (Figure 5 and 6).

*Table 24.* Livestock feed sources disaggregated by season in AGP districts of the region

| Feed sources | Lowland | Midland | Highland |
|---|---|---|---|
| **Wet season** | Grazing land /natural pasture | Grazing land | Grazing land (limited) |
| | Tillers and fillers (weeds) | Tiller and fillers | Tillers and fillers (weeds) |
| | Green fodder (sorghum and other green feeds) | Green fodder (maize) | Green fodder (maize) |
| | Banana leaves and *Pseusostems* | Enset parts | Enset (not major) |
| | - | 'desho' and Napier (limited) | 'desho', tree Lucerne (Gumer) |
| | 'atela' | *'atela'* | 'atela' |
| **Dry season** | Indigenous browse trees (*Acacia* spp, buzuwa, etc.) | Indigenous browse trees (*'wanza, girawa, korch*) | Browse tree ('Arkiniti (Jinka local name)', Enjori |
| | Grass hay | Grass hay, crop residues | Crop residues |
| | Maize, Sorghum residue | Maize, Millet and tef straw | Wheat, barley, pea and bean straw |
| | 'Checka atela' | 'atela' | 'atela' |
| | | Bran and grain (maize) | Bran and wheat (poultry) |

(a) Napier grass (*Pennisetum purpureum*) (b) 'Desho' grass (*Pennisetum pedicellatum*)

(c) Oat (*Avena sativa)* at Jinka (d) Local (Mursi breed) cattle at JARC on station

Figure 6: Major improved grass species at on-station and on-farm conditions and Mursi breed cattle

(a) Alfalfa (*Medicago sativa*) specie at Jinka (b) Tree Lucerne (highland legume tree) at Gumer

Figure 7. Major legume species tested at research station and on-farm

## 9.5. Livestock management

### 9.5.1. Feeding

Free grazing on natural pasture and feeding indigenous fodder tree is practiced in lowland woredas. In Benatsemay, the community move with their animals searching for livestock feed and water. In mid and highlands, animals are usually fed tethered with a limited movement for free grazing while livestock is mainly fed tethered or cut and carry system in highlands due to land shortage and high human population density (Table24) . Across agro-ecological zones priority is given to feed milking cows, draught animals and calves. In some mid and highland areas farmers practice cattle fattening using energy and protein rich feed sources (haricot bean, maize, sweet potato, enset corm, faba bean, etc.) which is similar with other zones in central and northern parts of the region. Draught animals and working donkeys are given with barley grain as a

supplementary feed intermittently. Kitchen leftovers, wheat and maize grain, and wheat bran are considered as supplemental feeds for poultry.

### 9.5.2. Housing

Livestock house type and housing differed in different agro-ecological zones (Table 26). Fences and shelters are usually used for livestock housing in the majority of the lowland such as Benatsemay Woreda. Small houses are constructed for poultry. In mid and highland areas cattle, sheep and goats, are kept within human residences using separate fences. The special case is sheep and goats are kept tethered around huts (Debub and Semen Arí) (Figure 7). River, pond, and 'chirosh' (water harvested from sand) are major water sources of livestock in lowlands while river, pond and pipe water are the major sources of water for livestock in mid and highland districts.

### 9.5.3. Breeding

Breeding is not controlled in the majority of the cases; particularly breeding is uncontrolled in lowlands due mainly to movement of animals for feed and water. This might be difficult to control transmission of diseases in lowlands. Nevertheless, there are efforts made to control breeding at mid and highland areas of the studied woredas, which might also help us to control diseases. Crossbred by using bull and AI service in some woredas of the region is started to improve the genetic potential and productivity of indigenous cattle for better milk and butter production (Table 25).

Table. 25. Livestock improvement participant farmers

| Technology | 2916 | | | | 2017 | | | |
|---|---|---|---|---|---|---|---|---|
| | No of farmers participated in Livestock improvement | | | | No of farmers participated in Livestock improvement | | | |
| | Total | women | men | | Total | women | men | |
| Synchronization and Artificial insemination | 115,442 | 38096 | 77,346 | 281,906 | 292,680 | 64,248 | 228,432 | 311,209 |
| poultry | 403,714 | 122,846 | 280,868 | 5,580,369 | 422,997 | 183,615 | 239,382 | 6,935,364 |
| Bee keeping | 170,339 | 7,847 | 162,492 | 166,135 | 361,061 | 94,266 | 266,795 | 52,750 |

Table 26. Livestock management system in AGP districts of the region

| Management | Agro-ecology | | | More descriptions |
|---|---|---|---|---|
| Feeding | Lowland | Midland | Highland | |
| | Grazing | Partially tethered grazing | Tethered and cut and carry feeding, feeding (limited) | Majority (90%) of households feed their animals without feed trough |
| | | Cut and carry grazing | Cut and carry (crop leftovers and tillers) | |
| | Free | Boiled feeding (haricot bean, maize, ) | Boiled feeding | |
| | Green fodder | Green fodder, supplementary feeding) | Green fodder | |
| House type and housing | Fences, within/outside human residence (poultry) | Within human residence (poultry) | Within human residence (poultry) | |
| | Without housing separated from human residence for cattle | Housing within human residence for cattle | Housing within human residence for cattle | |
| Watering | River, pond, '*chirosh*' | River, pond, pipe | River, pond, pipe | |
| Breeding | Uncontrolled | Partially controlled | Partially controlled | |
| | Partial castration | Full castration | Full castration | |

(a) under shelter

(b) around house

Figure 8. Housing (under shelter, a and around house, b) for sheep and goats at Debub and Semen Ari Weredas, South Omo Zone

### 9.5.4 Animal health management

Livestock diseases and parasites are among the reported impediments for livestock production and productivity (Table 27)cross agro-ecological zones. In lowlands, major livestock diseases reported in cattle are trypanosomiasis, pastuellosis, and LSD while major parasites include tick, lice and leech. Mastitis, pastuellosis, anthrax, black leg, and foot and mouth disease are major diseases in mid and highland areas of the districts. In sheep and goats, the major diseases reported are ORF, Fascilosis, and pasturellosis while major ecto-parasites are lice and ticks. The main endo-parasite is fluke, which causes fasciolosis. Poultry diseases include new castle disease (NCD), coccidiosis, salmonella, and fowl pox with slight prevalence intensity variations across ecological zones. Ascaris, mite and lice are major parasites in poultry production. Wax moth and ant is reported to affect honeybee production in the majority of the studied districts. Toxic plants are also reported as threat of livestock production from western zones.

Farmers use significant number of traditional livestock and poultry disease and parasite treating practices. For example, black leg is treated by burning skin. Similarly, farmers treat Punmonia by manual removal of vesicles, drenching tobacco juice and 'kurunfud'. Cutting out of infected areas to treat laminitis—disease mainly affects sheep. Different mastitis treatment practices were reported. For example, in Shei Bench, mastitis is treated using crushed mixture of medicinal plant seeds and salts (eg 'Magrito', Semen Bench) while farmers use boiled leaves locally named as 'dumdumach', gormach' (eg. Menit Goldia). Black leg is treated using mixture of chilies (Semen Bench).

To treat NCD farmers mix ash, lemon, and traditional alcohol residue and drench a single drop. Others use mixture of '*tena adam*', garlic seed and red pepper and feed poultry to treat NCD. Likewise, farmers use boiled corn to treat NCD while they use mixtures of chalk, lemon and eucalyptus tree leaf to treat Fowl Cholorea in Benatsemay, South Omo. Farmers practice using crushing of tobacco and '*Kippo*' leaves to treat NCD. Burning poultry feather and smoking to them is practices traditionally to treat NCD in Semen Bench, Western parts of the region.

Different traditional practices area available to treat external and internal parasites (Table 27). For example, crushing and mixing '*washa*' leave and tobacco juice and nasal smelling/drenching to remove leech has been reported from Malokoza, Basketo (south) and Gumer and Endegay (North) parts of the region. To treat external parasites, farmers practice topical application of use roots of 'bosha' (crushing and mixing with water). In Debub Ari, some farmers drench crushed bark of plants, '*Wulish*' to remove leech. To control poultry mite, farmers practice use smoking '*zegiba*' leave and put straws of '*banbisa*' on their wall in Malakoza, Gamo Gofa zone.

Treating livestock diseases and parasites in modern methods (animal health clinics) is too limited and institutionally has not been well organized. At animal health clinics, diseases are treated using different types of drugs and parasites, such as using acaricides and antihelminths. Animal diseased by toxic plants are treated using crushed '*amitbalo*', indigenous plant leave.

Table 27. Livestock health management in AGP districts of the region

| Major diseases and parasites | Agro-ecology | | |
|---|---|---|---|
| Major diseases and management practices | Lowland | Midland | Highland |
| Cattle | Mastitis, Trypanosomiasis Pastuellosis, LSD, Anthrax | Mastitis, Pastuellosis, LSD, FMD, Anthrax, Black leg | Mastitis, Pastuellosis, FMD, Anthrax, Black leg |
| Traditional treatment | Ethino-veterinary medicines, for example burning of skin to treat black leg; manual removal of vesicles; tobacco juice and 'kurufud' to treat Pnumonia; boiling leaves of plants locally named as 'dumadumach', gormach'; mix medicinal plant seeds and salts to treat Mastitis | Ethino-veterinary medicines<br><br>boiling leaves of plants locally named as '*dumadumach*', *gormach'* to treat Mastitis | veterinary medicines, for example burning of skin to treat black leg; manual removal of vesicles; boiling leaves of plants locally named as '*dumadumach', gormach*' to treat Mastitis |
| Improved | Trps drugs, broadspectrums | Trps drugs | Broad spectrums |
| Sheep and goats | ORF, ovine pasturolosis | ORF, sheep pox | ORF, sheep pox |
| Traditional | NO | NO | NO |
| Improved | Modern vet treat | Modern treat (vet) | Modern treat (vet) |
| Poultry | NCD, coccidiosis | NCD, Salmonella, fowl pox | Coccidiosis |
| Traditional treatment | Tetracycline with butter; feeding 'tikur azmud' flour, 'mitimita'; ash, lemon and 'areke' mixed with water | Tetracycline with butter; feeding 'tikur azmud' flour | 'mitimita'; ash |

| Improved treatment | Modern treatment | Modern treatment | Modern treatment |
|---|---|---|---|
| Parasites | External and internal parasites (tick, lice, leech, *etc.*) | External and internal parasites (fasciolaa, *lungworm*) | External and internal parasites |
| Traditional | Peeling out of the parasite in addition of using salt and fuel (gas oil); drenching of 'washa' juice (Malakoza) to treat leech; topical application of 'bosha' to treat external parasites | Peeling out of the parasite in addition of using salt and fuel (gas oil); drenching of 'washa' juice (Malakoza) to treat leech; topical application of 'bosha' to treat external parasites | Peeling out of the parasite in addition of using salt and fuel (gas oil); drenching of 'washa' juice (Malakoza) to treat leech; topical application of 'bosha' to treat external parasites |
| Modern | Accaricides for external and antihelmenths for *internal* | Accaricides for external and *antihelmenths for* internal | Accaricides for external and *antihelmenths for* internal |

### 9.5.5. Livestock products processing

Generally, modern livestock products' processing is not reported from the studied woredas except traditional milk processing methods. . Cheese and whey is mainly produced in a traditional way in mid and highlands while traditional butter processing is commonly reported from all woredas across agro-ecological zones. Although not significant, milk churner has been demonstrated in peripheral areas of small cities. The study suggests product's processing plant and methods need to be demonstrated in all woredas irrespective of agro-ecological zones (Table 28).

Table 28. Livestock products processing in AGP districts of the region

| Product | Agro-ecology | | |
|---|---|---|---|
| | Lowland | Midland | Highland |
| Butter | Traditional | Traditional<br>Modern (limited) | Traditional<br>Modern (limited) |
| Cheese | NS, very limited | Traditional | Traditional |
| Yogurt | Traditional (pot) | Traditional (fridge) | Traditional |
| whey | NS | Traditional | Traditional |

*NS-non significant or available*

### 9.5.6. Livestock and poultry constraints

#### 9.5. 6.1. Dairy

There are reported technical and institutional problems, which threatens production and productivity of dairy animals in the studied woredas of the region. Access to technological inputs (improved breed), diseases, low feed, poor management and the associated reduced productivity are the major technical barriers of dairy production across agro-ecological zones of the region. However, the intensity of the problems varied from agro-ecology to agro-ecology and from woreda to woreda. Access to improved cattle breed (availability and affordability) is ranked as a primary problem across locations. Disease related loss (death of dairy cattle or reduction in milk yield, stagnant calf growth) is ranked as a second important problem of dairy cattle production, particularly at peak milking stage. On the other hand, disease leads to sharp decline in milk production among others feed availability both in quality and quantity. Poor institutional support, poor supply of inputs such as seeds/planting materials , etc. are also challenges reported from all districts as a third important problem of dairy production. Due to the aforementioned constraints and the associated poor management, productivity of dairy animals has usually been reported as low (Table 29).

#### 9.5. 6.2. Poultry

Across agro-ecological zones, the major, and primary limiting factor of poultry production is poor management include housing, feeding and health managements. Lack of proper housing and chicken death due to predators has been reported as a 2$^{nd}$ and 3$^{rd}$ factors or problems of the AGP woredas across agro-ecological zones (Table 29). Disease further contributes for the death of chicken in all woredas. Poor institutional arrangement and poor follow up of distributed day-old chicken further threatened the improvement of the sub-sector. Furthermore, lack of feedback data due to poor recording system is another barrier in the improvement process of chicken production and productivity.

### 9.5.7. Feeds and feeding

Livestock feed shortage has been reported among the major constraints that affects livestock production in the region. In previous study, farming system characterization, it was one of the top prioritized problems of the region (SARI

Research Strategy Document, 2003). Other than uneven special distribution, feed shortage is a serious problem in both quality and quantity. Access to improved forage seeds, problems associated with land allocation for forage cultivation, management, and resistance to plant forage crops, poor adaptability of some forages and knowledge gaps are identified as major constraints of forage production across agro-ecological zones of the region. Community mobility is reported as a problem for forage production in lowlands but is not a problem in mid and highland areas. Shrinkage of grazing lands, overstocking, bush and unwanted invasive weeds (eg *Parthenium*, *Ambuka*, etc.) and poor management are also reported as problems related feed from natural pasture. Providing farmers with improved seed, over-sowing degraded lands, paddocked grazing management and improved forage production and exercising feed conservation practices could be suggested to alleviate the problems.

### 9.5. 8. Animal health

Animal health problem is the second most important constraint in tropical animal production. It is one of the constraints usually reported as an important problem of livestock in southern region. One of the major barriers reported in this regard is weak institutional support (health inputs delivery and technical support) across all the studied districts. Health clinics and posts are less accessible by the majority of farmers in the study areas and the sector has less attention in general and is not well organized with human power and facility. Because of the above gaps and poor information system, the problem is repeatedly reported from all AGP woredas. The exception is that pastoral communities at lowlands such as in Benatsemay are usually mobile and is not convenient for health clinics product packaging, follow up and training.

### 9.5.9. Technology

Technological interventions related to livestock are generally limited in the majority of the AGP-II woredas. Particularly, technological provisions related to dairy animals such as dairy processing plants, packaging equipment, etc. lacks in all the studied woredas. Few improved churners were introduced and demonstrated to northern (Gumer, Cheha, Endegagn, Mirab Azernet, etc.) and south eastern zones (Wondogenet and Tula woredas of Sidama zone and Gojeb woredas, Gedeo zone) the region but the distribution these technology is limited. Similarly, milk containers, AI equipment (fluid nitrogen container) and

milk transporting equipment are lacking in all studied woredas. Feed processing, mixing, reserving, and analyzing technologies are not available at all AGP-II woredas and agro-ecological zones. Eggs transporting boxes, incubators or other improved technological options were not reported from any of the studied woredas, particularly at farmer's level and were not accessible. In addition, private institutions/companies were not involving in provision of such technological options.

*Table 29.* Livestock and poultry problems as ranked by respondents of AGP-II woredas

| Problem | | Rank across agro-ecologies | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lowland | Rank | Midland | Rank | Highland | Rank |
| Dairy | Access to breed | Limited access to improved breed (cattle, poultry) | 1st | Limited access (availability and affordability) | 1st | Limited access (availability and affordability) | 1st |
| | Disease | Poor institutional support | 2nd | Poor institutional support | 2nd | Poor institutional support | 2nd |
| | Institutional support* | Poor coordination and input delivery system | 3rd | Diseases | 3rd | Diseases | 3rd |
| | Management | Poor | 4th | Poor | 4th | Poor | 4th |
| | Low productivity | Poor | 5th | Poor | 5th | Poor | 5th |
| | Adaptability | Poor | 6th | | - | | - |
| Poultry | | Poor management | 1st | Poor | 1st | Poor | 1st |
| | | Predator | 3rd | | 2nd | | 2nd |
| | | Disease | 2nd | | 3rd | | 3rd |
| Forages | Access to improved forage | Poor improved forage seed access | 1st | Access to improved forage | 1st | Access to improved forage | 1st |

| Problem | | Rank across agro-ecologies | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lowland | Rank | Midland | Rank | Highland | Rank |
| | seeds | | | (availability) | | (availability) | |
| | | Poor management and resistance to plant forage | 2nd | Knowledge gap (by-product use, ration balance) | 2nd | Knowledge gap (by-product use and ration balance) | 2nd |
| | | Knowledge gap | 3rd | | | | |
| | | Adaptability | 4th | | | | |
| | | Mobility | 5th | | | | |
| Feed | Shrinkage of grazing land | Declining | 1st | Limited (ever-decreasing) feed supply | 1st | Limited (ever-decreasing) feed supply | 1st |
| | Poor productivity | Bush and unwanted weeds encroachment | 2nd | Degradation | 2nd | Degradation | 2nd |
| | | Poor supplementation | 3rd | Knowledge gap | 3rd | Knowledge gap | 3rd |
| | Poor information on feed quality | Knowledge gap | 4th | | 4th | | 4th |
| Animal health | Less institutional support | Institutional arrangement (health delivery, inputs supply, etc.) | 1st | Institutional arrangement (delivery, inputs supply, etc.) | 1st | Institutional arrangement (delivery system, inputs, etc.) | 1st |
| | Access | Limited | 2nd | Limited | 2nd | Limited | 2nd |

| Problem | | Rank across agro-ecologies | | | | | |
|---|---|---|---|---|---|---|---|
| | | Lowland | Rank | Midland | Rank | Highland | Rank |
| | | access | | | | | |
| | Knowledge gap (packaging, training, etc.) | Poor information** | 3rd | Poor information | 3rd | Poor information | 3rd |
| | Mobility problem | Mobility (pastoral community) | 3rd | - | - | - | - |
| Technological constraints | Technology (processing) materials /equipment delivery and maintenance | Poor technology delivery | Yes | | Yes | | Yes |
| | | Lack of feed processing plants | 1st | Lack of feed plants | 1st | Lack of feed plants | 1st |
| | | Lack of milk processing plant and equipment | 2nd | Lack of processing plant and equipment | 2nd | Lack of processing plant and equipment | 2nd |
| | | Lack of transporting equipment (egg box, Fluid nitrogen containers, milk containers, food grade, Fridge, etc.) | 3rd | Lack of transporting equipment (egg box, Fluid nitrogen | 3rd | Lack of transporting equipment (egg box, Fluid nitrogen | 3rd |

** Capacitating farmers (training and insufficient follow up), supply and or deliver AI services, facility, logistics, inputs (semen, fluid nitrogen, vehicle, etc.) and information system*

*** Updated and seasonal information delivery (information system)*

### 9.5.10. Marketing problems

Among other problems limiting production and production of livestock and poultry is marketing system constraints are important, as a result they are not only important at AGP-II woredas but also at regional level (Table 30). Except northern zone woredas (Gumer, Cheha, M/Azernet) and south central zone woredas (Wondogenet and Tula) which accounts for about 14.3% of the AGP woredas, whereas other districts have significant livestock marketing problems. Producers are not making direct benefit from the sale of live animals and products due to poor market information, long marketing channels, and the associated overall poor marketing system. For example, involvement of significant number of brokers in the marketing system is one of the major challenges of livestock marketing in all the studied woredas. Seasonal price dynamics and uncertainty are also pointed out as important problem impeding benefits made from the system. Product quality of meat, milk, and egg is usually ranked low due to gaps in technological inputs to improve quality of livestock products. The problems are more or less similar across agro-ecological zones. However, lack of infrastructures (road, water, etc.) is the constraints more severe in lowland woredas. Constraints related to agro-processing ranked as 6$^{th}$ due mainly to less surplus production in the AGP-II districts. While having these all barriers, the districts are potential for livestock (all districts), poultry (Wondogenet, Tula, Gumer, Cheha, etc.), and honeybee production (western zone districts, Dawuro zone, Konta).

Table 30. Livestock and poultry marketing problems as ranked in AGP districts of the region

| Problems | Rank across agro-ecologies | | | | | | Remark |
|---|---|---|---|---|---|---|---|
| | Lowland | | Midland | | Highland | | |
| Market access to sell products and marketing system | *** | 1st | ** | 3rd | Yes | 3rd | |
| Agro-processing | | 5th | | 6th | | 6th | |
| Institutional | Market linkages | 2nd | | 2nd | | 2nd | |
| Information | | 2nd | | 2nd | | 2nd | Malokoza highlands are far from market |
| Quality | | 3rd | | 3rd | | 3rd | |
| Pricing | | 5th | | 5th | | 5th | |
| Transportation | | 3rd | | 4th | | 4th | |
| Seasonal demand | Price fluctuation | 4th | | 1st | | 1st | |
| Credit<br>• Access<br>• Knowledge gap | | 7th | | 9th | | 9th | |

*In Dawuro zone and midland of Malokoza, market access is a serious problem while not the case of in midland of Malokoza and other central and northern zones of the region*

### 9.5.11. Potentials and Opportunities

- Almost all AGP woredas have potentially untapped resources (less soil degradation, i.e., relatively better feed resources endowment, etc.) (Tocha and Esera of Dawuro zone); agro-forestry based (Sidama and Gedio) and forestry based (western zones), rangelands (south zones);
- Western zones have promising natural resource base which is very suitable for honeybee production;
- Diversified livestock breeds/populations, number and productivity gaps, gives rooms for accelerated productivity improvement;
- Diversified and locally available fodder tree and shrub species;
- Availability of technology and presence of technological gaps;
- Road construction, training centres and increasing academic institutions near to these districts;
- Diverse agro-ecologies; and
- Availability of educated family members

9.5.12. Interventions

- Compressive documentation of major indigenous livestock, poultry and feed resources;
- Undertaking improved forage and livestock breed adaptation and demonstration trials and studies ($2^{nd}$);
- Screening of promising livestock or forage technologies and doing verification with active involvement of beneficiaries ($1^{st}$);
- Introduction and evaluation of sexed semen technologies (mid and highlands) ($1^{st}$, $2^{nd}$ );
- Development of improved livestock breed and forage seeds revolving system by establishing community based seed production, formulation of community binding rules;
- Value chain analysis of selected commodities dairy and sheep, Dawuro and Konta;
- Evaluation of various health improvement packages;
- Demonstration of product processing technologies (churner, cream separator) and feed processing (mower, baler, chopper, grinder, mixer, etc.);
- Introduction and participatory evaluation of feed conservation technologies, silage and hay making in Malakoza, Basketo, Tocha, Esera, and Benatsemay and improved technologies (Urea treatment, UMB, EM, etc.);
- Demonstration and evaluation of layer and broiler chicken breeds;
- Improving ani mal health delivery system, AI and equipping with facility, logistics and information network;
- Establishing bull stations with strong management formulating bylaws and community binding rules;
- Evaluation, documentation and use of traditional livestock disease and parasite treatment practices;
- Introduction, evaluation and scaling up use of improved honey bee technologies and linking with national and international markets (Dawuro and Konta);
- Designing community based breed improvement schemes, sheep (sheep at Tocha and Malakoza) and goats (Benatsemay); and
- Training and awareness creation on major commodities

# 10. Production Constraint Assessment on Natural Resources Management

Natural resource based problems have been influencing agricultural productivity in particular, and livelihood of people in general. Furthermore, the quality of environmental and ecological services has been dwindling from time to time. Various research and development intervention efforts have been made here and there to overcome the ever-increasing land resource related problems. However, better collaboration and coordination is needed to solve emerging and existing natural resource management (NRM) based constraints under a variety of soil, water, forest, climate and management conditions. Furthermore, an urgent need exists for filling the most important knowledge gaps: agricultural management effects on soil–plant–atmosphere properties and processes; plant response to water, nutrient and temperature stresses; and effects of natural hazards such as drought, hail, frost, insects, and diseases. With these considerations in mind, quick survey has been carried out in thirty-five AGP-II target woredas of Southern Nations Nationalities and Peoples Regional State (SNNPR) to identify natural resources management related constraints, understand the real farm situation, and suggest possible innovations for NRM problems. The identified natural resource (soil, water, forest) management constraints and practices are reported under four categories: soil fertility management, soil and water conservation, small-scale irrigation management, and forestry and agro-forestry management.

## 10.1. Sidama and Gedio Zones

Sidama and Gedeo are representative zones of the Southern Nations Nationalities and Peoples' Regional State (SNNPRS) of Ethiopia with a prevalence of agroforestry system. Sidama and Gedeo are the most densely populated area in Ethiopia. They are located between 5°45′–6°45′ N and 38°5′–39°41′ E, and 5°50′–6°12′ N and 38°03′–38°18′ E, respectively. The rainfall distribution is bimodal with a long (June–September) and short (March–May) rainy season. Both Sidama and Gedeo straddle two agro-ecological zones, the moist mid-altitude (woinadega) and the moist highland (dega). The mid-

altitude zone ranges in elevation from 1500 to 2300 m and receives 1200–1600 mm rainfall annually; the average annual temperature ranges from 16 to 22 °C. The highland lies between 2300 and 3200 m a.s.l.; annual rainfall is 1600 to 2000 mm and the average annual temperature ranges from 15 to 19 °C (Kippie, 2002; Abebe, 2005). A range of soil types are found, but the dominant soil type of Sidama and Gedio are Nitisols. Potentials and constraints in natural resource management of the surveyed area are mentioned as follows.

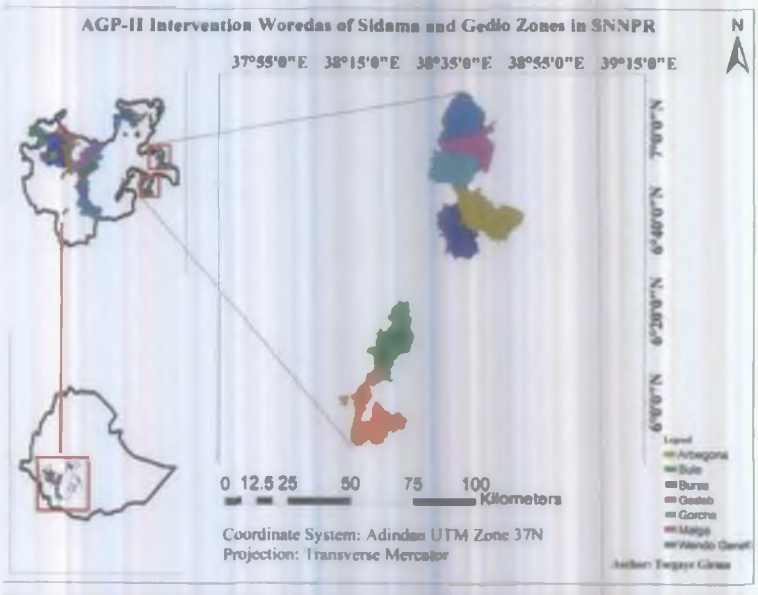


Figure 9. Map of AGP-II intervention woredas of Sidama and Gedio Zones in SNNPR

### 10.1.1. Soil fertility

According to farmers and experts in Sidama and Gedeo, soil fertility decline due to continuous cropping without nutrient replenishment is one of the major factors contributing to decreasing of agricultural productivity. This problem is aggravated by severe soil erosion and deforestation. Organic matter depletion has become a common phenomenon due to competing uses of crop residues and manure as livestock feed and fuel, respectively. Soil acidity is also the other major threats to agricultural production in the highlands of the areas affecting more highland cereals such as wheat and barley. Farmers have reported low level of fertilizer use, late provision of fertilizers, and lack of bio-fertilizers provision and other technologies. Due to rapid population growth,

fallow periods practiced in the areas are replaced by continuous and intensive cropping. Unprecedented rise in the cost of fertilizers is the major limiting factor for application of recommended dose of fertilizer. Furthermore, they claimed that the response of the soil to fertilizers has been decreasing from time to time. In some areas like Gorche, delay in maturity of compost and knowledge gap on how to prepare and use compost is also reported. In order to reduce the afro-mentioned problems, though inadequate, farmers have been managing their soils for years. The management includes three times plowing, terracing on sloppy lands, application of organic nutrient sources such as farm yard manure, and application of chemical fertilizers. Some of soil management practices vary among soil types. For instance, black soils are tilled three to four times before sowing, but twice for the red soils.

### 10.1.2. Soil and water conservation

Soil erosion is a significant environmental problem in Sidama and Gedio zones. To combat the problem a number of soil conservation campaigns have been conducted. Soil bund and fanyaju are the dominant physical conservation measures used to address the problem. According to the experts in some of surveyed areas cut off drains, waterways, micro basins (particularly in coffee fields) and bench terrace have been started in some farmlands while check dams and half-moon are also common to be used in degraded lands. However, inappropriate design and lack of maintenance of physical conservation measures that is aggravated by free grazing habit are observable problem in the surveyed areas. Experts revealed that low or inadequate practice of biological conservation measures. However, some farmers plant biological stabilizers such as desho, elephant, and Guatemala grasses on physical structures. In areas like Bursa and Bule, farmers plant woody species such as *Erythrina* and *Milletia* on physical structures for stabilization.

### 10.1.3. Small-scale irrigation

Sidama and Gedio zones have significant surface and ground water potential. There are many rivers with sufficient flow volume for supporting irrigation agriculture. For instance, Logita is a perennial river found in Arbegona woreda, which has significant yield even in dry season. The other water resources for irrigation development exist include springs, hand dug wells, ponds and roof water (in some areas). However, there is only limited number of water harvesting structures constructed both in the highland and mid altitude areas.

Most of the water sources are dominantly used for surface irrigation and irrigating using water can to produce vegetables such as head cabbage, carrot, beetroot, potato, onion, garlic, and kale. However, the topography is undulating and rivers are situated in the middle of valleys making traditional irrigation difficult and tiresome. According to experts there is no modern irrigation schemes in Arbegona woreda whereas in Melga woreda, there is one big river called Udessa but not facilitated to be used for large members of farmers, only those farmers who are near by the river are using it. Therefore, it needs to be developed and facilitated in order to upgrade the command area. In general, the major constraints in irrigation development include lack of skill to use rivers for irrigation water, lack of motor pumps to draw water up slope from rivers and fetch water from well, lack of modern irrigation schemes and irrigation technologies such as drip irrigation and irrigation scheduling, and lack of study on the irrigation water quality.

### 10.1. 4. Forestry and Agroforestry

Traditional agroforestry system is a common and age-old land management system in Sidama and Gedio. It is a principal means of living for most people in the areas. Sidama and Gedio are well known zones of Ethiopia with a prevalence of enset-oriented and khat-based home gardens which is characterized by the production of enset, coffee and multi-purpose trees accompanied by root and tuber crops, vegetables, annual cereal crops and livestock keeping. Farmers in the area incorporate and manage woody species in agricultural landscape deliberately. *Millettia ferruginea, Ficus spp, Croton macrostachyus, Cordia africana, Erythrinia spp.* and *Podocarpus gracillor* are common planted/retained tree species used for agroforestry systems. Some farmers apply organic sources like farm yard manure for better survival of planted seedlings. However, in most cases, the effort to protect and manage the planted seedlings so as to increase the survival rate is not satisfactory. Experts and farmers in the surveyed areas perceive that *Eucalyptus* is not appropriate tree species for managing agroforestry practices though it has been expanding in agricultural landscape. For instance, planting *Eucalyptus* at the border of neighboring farmlands has become a source of conflicts between adjacent farmers in Gorche woreda perceiving that the tree could affects the nearby crops. Key informants claimed that expansion of khat (*Chata edulis*) has resulted in homogenization of the structure and composition of home garden agroforestry.

As reported by key informants, the natural forests in the surveyed areas consists of various multipurpose indigenous woody species such as *'mikicho', 'guwacho', Haygenia, Ficus spp., Erythryna spp., Schefflera abyssinica, 'bikicho' Croton macrostayches, 'boncho', 'dashincho', Vernonia spp., Prunus africana, Juniperous procera, 'garanbicho', 'tewerako' 'maticho', Syzygium guineense,* and *Olea spp.* The plantation forests of highland consists dominantly exotic woody species such as *Cupressus lustanica, Grevilea robusta* and *Eucalyptus spp,* and some indigenous woody species such as *Arudinaria alpina*. However, the forest resources have been dwindling from time to time at an alarming rate because of a number of factors. Agricultural expansion seems to be the number one reason for deforestation in the area. The other major factors stated by farmers and experts are overexploitation without replanting for various purposes such as fuel wood, charcoal, construction material and timber. The effort made to encourage farmers to plant indigenous tree seedlings is not as such effective because farmers would like to grow fast growing woody species that would bring high return in short period of time. Furthermore, due to poor management, the survival of planted seedlings was reported to be as a major problem. Recently, disease and pest on exotic (e.g. *Eucalyptus*) and indigenous woody species (e.g. Bamboo) has become remarkable problem. For instance, farmers in Bursa reported that some indigenous trees species like '*Hatawicho'* have been lost due to tree diseases.

## 10.2. Dawro Zone and Konta Special Woreda

Dawuro zone and Konta special woreda (figure 10) are located at $6^0$59"– $7^0$34" N and $36^0$68"–$37^0$52" E, and 6° 55′ 0″ N, 36° 35′ 0″ E respectively, and at altitudinal range between 550–2820 meter above sea level in Southern Nations, Nationalities and Peoples Region (SNNPR). The major landscape type of Dawro and Konta is undulating and rugged, and found in between Omo River from North to South and Gojeb River from Northwest to North. Like the other parts of SNNPR, the major economic activity of the people is mixed agriculture (rearing of animals and growing of crops). The main food crops grown in the area are enset, maize, taro, sweet potato, sorghum, millet, tef, pulses and yam. Enset is the staple food in Dawuro and Konta special woreda, particularly in mid and high altitude areas, while maize is the most important crop in the lowlands. The area is a naturally gifted land with diverse

topography, diverse climate, and varied ecology. It is home to a wide range of fauna and flora diversity in wildlife and botanical resources. The area in the Dega receives rainfall almost throughout the year and heavy rain comes between June and September. The mean annual rainfall is 1705.4mm at Gasa Chere Station while 1424.9mm at Tercha station. The maximum and minimum mean annual temperature is (22.30C and 12.4 0C) and (29.30C and 16.80C) in Gasa Chere and Tercha stations respectively (Mathewos *et al.*, 2013a).

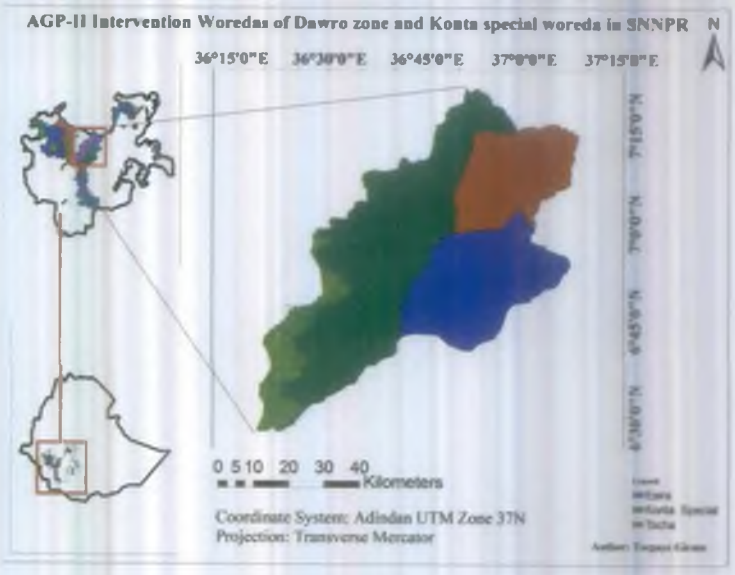


Figure 10. Map of AGP-II intervention woreda of Dawro zone and Konta special woreda in SNNPR

### 10.2. 1. Soil fertility

In most of surveyed Dawro zone and Konta special woreda areas, farmers classify the soil in to red and black. Farmers till their soil three to four times, apply crop residue and farm yard manure even though limited to around the homestead for growing vegetable, and inorganic fertilizers (DAP and Urea) to combat the ever increasing soil fertility problem. According to key informants, however, most farmers apply artificial fertilizers below the recommended amount despite the rate of recommended fertilizer application varied among farmers depending on economic status, farm size, farmers' awareness, and fertility status of the soil. Declining of soil fertility mainly caused by soil erosion, soil acidity, lack of area specific fertilizers recommendation, high price of fertilizers, lack of awareness on compost preparation and use, and lack of bio-fertilizers are some of soil related problems in the area.

### 10.2.2. Soil and Water conservation

Soil erosion is a serious problem affecting agricultural productivity in the areas surveyed. Sheet and rill erosion, which are caused by high rainfall coupled with cultivation of sloppy lands are main types of soil erosion in the area. Farmers manage this problem using both physical and biological conservation measures particularly through a massive community based participatory watershed development programs. Among various physical soil conservation measures such as traditional soil bund, stone bund, and diversion ditch and fanyajuu are common in the area. Recently, some farmers have also started to construct bench terrace to address the soil erosion problem. Planting stabilizers such as desho grass, pigeon pea, *Sesbania* and *Grevilea* on the structures are some of biological measures practiced in the area. However, the use of biological soil conservation measures is very limited in both types and area coverage calling for introduction of different plants to stabilize the physical structures. Lack of adequate and effective soil and water conservation measures (both in-situ and ex-situ) coupled with poor management of the existing conservation measures have led the problem of soil erosion to continue.

### 10.2.3. Small-scale irrigation

According to the information from key informants, there are various perennial and intermittent rivers in Dawro zone and Konta special woreda presume to have sufficient potential for irrigation development. The other water resources available and being used for traditional irrigation in the areas are ground water,

and water harvested from roof. However, irrigation is not practiced widely in the area due to lack of modern irrigation schemes, lack of irrigation technologies such water pump to draw water up slope, sprinkler and drip irrigation. The major crops grown by irrigation include cabbage, onion, tomato, and carrot. In order to reduce the problem of inaccessibility, the contribution of water harvesting could be remarkable. However, in the surveyed area, it is not common to see water-harvesting technologies such as pond and reservoir.

### 10.2.4. Forestry and Agroforestry

Farmers in Dawro and Konta have been practicing traditional agro-forestry system for many years. This system dominantly consists of both indigenous woody species such as *Erythrina spp*, *Ficus spp.*, *Acacia spp*, *Vernonia spp, Cordia africana, bamboo,* and *Millettia ferruginea,* and exotic species such as *Cupressus lusitanica, Eucalyptus spp., Sesbania sesban* and *Grevillea robusta.* The system also consists of fruit tree species such as Avocado, Mango, Papaya, Lemmon, Orange, and Banana. Some farmers manage these trees by applying farmyard manure and plant residues. The major problems related to agro-forestry are lack of supply of improved varieties of fruit trees. The forest in Dawro and Konta has an important role for the livelihood of people living in the areas. It is an important source of food, medicine, energy, fodder, and farm implement and construction materials. However, due to agricultural expansion and overexploitation of the natural forest, accelerated deforestation is a major environmental threats and result in several socioeconomic and environmental challenges. The effort to conserve the existing natural forest and increase woody species in agricultural landscape was reported to be low. Low enforcement of forest proclamation and law has influenced the effort negatively.

## 10.3. South Omo Zone

Quick survey has been carried out in three AGP-II woredas of Debub Omo zone to identify natural resources management related production potentials and constraints. Debub Omo zone is the largest zone (area) of the region situated between $4.43^0$ – $6.46^0$ N and $35.79^0$ - $36.06^0$ E (Fig. 11), and an altitude ranging from 376 – 3500 masl with mean annual min and max temperature and rainfall of 10.1 - >$27.5^0$C and 400 – 1600 mm, respectively.

Three woredas, namely Debub Ari, Semen Ari, and Benatsemay, were covered in the survey ( figure 11). The land uses of the zone are cultivated land, grazing land, forestland, cultivable land, none cultivable land and others with the proportion of 11.22, 29.25, 12.55, 15.69, 10.85 and 20.42 per cent, respectively.

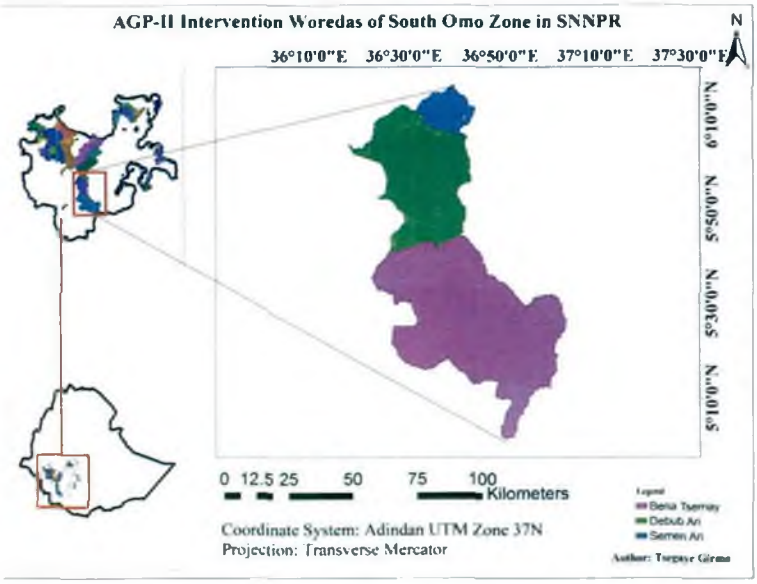


Figure 11 Map of AGP-II intervention woreda of South Omo zone in SNNPR

### 10.3.1. Soil fertility

The AGP-II woredas of the South Omo zone have varied types of soils, which have different soil fertility status and need different management. According to local farmers' classification, black soils, red soils, gray, and white soils based on color, and sandy and stony mixed soils are common in the woredas. Farmers also have categorized the soil into three fertility classes: highly fertile (black and alluvial soils), moderately fertile and low; for example red soils. All surveyed respondents cited that, soil fertility decline is one of the major crop production constraints in all woredas and declining from year to year due to erosion, deforestation, low or lack of input use, and soil acidity; for example, example Semen Ari. In the case of Semen Ari, soil acidity is a serious problem of production and productivity, but the knowledge on the magnitude and the status of acidity, and on acid soil amelioration is lacking. Conventional tillage practices, varying from 2 to 6 times, based on crop types are widely adopted. Land preparation practices for crop planting have also contributed to soil erosion. Lack of promising technologies, such as fertilizer type and rates;

organic manures rate, nutrient content and application time; lime requirement and application time; and effective and efficient bio-fertilizer types for legume crops were also reported in the survey results. Furthermore, survey reports showed that high price of inorganic fertilizers but low output (low fertilizer recovery) in poor soils was one of the reasons for low inorganic fertilizer use.

According to the survey report of the three woredas, farmers traditionally manage their soils fertility and improve crop production and productivity by applying organic manures and inorganic fertilizers, crop rotation, intercropping and fallowing, though fallowing is limited to only large farm size in lowland areas. The common inorganic fertilizers types that have been used in the three woredas are urea and NPS (NPS not distributed adequately). Manure is specifically used in Benatsemay woreda. However, reports have shown that a number of farmers in some kebeles still do not use inorganic fertilizers as well as manures.

### 10.3.2. Soil and water conservation

A survey result indicated that farmers in the surveyed areas exclusively agreed in that soil erosion is a serious problem in the high and midlands of the woredas, and pose serious problem in crop production and productivity. Erosion caused by heavy and erratic rainfall, natural topography, and anthropogenic activities such as deforestation, overgrazing, land use change, and tillage, is a major cause for land degradation in the areas. To-date, conversion of forest and grassland into cropland has become very common and led to increased vulnerability to soil erosion. In drier parts of lowlands of Benatsemay woreda, wind erosion is also reported as potential cause of land degradation. Damage on animals and humans by flood during heavy rainstorm is reported. Severe downstream siltation and deposition is identified as soil erosion problem in Semen Ari.

According to survey results, farmers in the highlands and midlands of the three woredas practiced the use of physical soil conservation measures to combat soil erosion. Most widely used physical conservation measures by farmers of all woredas are soil bund, stone bund, and terraces (bench and hill). Fanya-ju and half-moon conservation measures are used in Bentsemay and Semen Ari woredas whereas the use of waterways as soil erosion control measure is reported in Semen Ari. Report from Benatsemay woreda showed that practice

of grass strips and tree planting on established physical structures were smoothly started. However, biological conservation measures in the three woredas were minimal. Even if few stabilizers planted in rainy season, will dry or grazed on dry season and not sustainable. Most of the conservation structures were constructed on communal lands, mountainous areas, range lands, selected watersheds, but mostly not practiced on private farmlands. The survey report also indicated that the use of physical conservation measures are not carried out by the farmers own initiative but initiated by GOs and NGOs. As a result, constructed soil and water conservation measure structures failed to serve the intended purpose, according to the survey report. In addition, inappropriate design, wrong structure selection and construction, damage by heavy runoff, human activities and animal (grazing), lack of follow-up and maintenance. Instead of maintaining the damaged structures, farmer destruct and change into farm/grazing land, according to the respondents. Knowledge gap on benefits and management of conservation measures together with poor perception might be the reason for destruction.

### 10.3.3. Small-scale irrigation

The occurrence of frequent droughts due to low and erratic rainfall poses high uncertainty and agricultural production risks leading to wide spread poverty and food insecurity. Therefore, maximum efforts should be made to enhance the already started traditional irrigated agriculture in the zone. To enhance the irrigated agriculture, the knowledge on the potential source, access and constraints is paramount important.

In South Omo Zone perennial rivers including Omo, Woito, Kako, and Neri, small rivers, streams, springs water harvesting are sources of irrigation water. Survey result indicated that landscape/topography, lack of irrigation facilities, the amount of water availability, labor based irrigation system, and seasonality of rivers/water sources are major problems. In general, small- scale irrigation is not widely practiced in highland and midland areas of the Debub Ari woreda and in Semen Ari due to aforementioned reasons, which hindered most farmers from using irrigation. Because of landscape, almost none of water resources are accessible for simple surface irrigation system by smallholder farmers. However, in the lowlands of Debub Ari Woreda youth and others use modern small-scale irrigation developed by government on Kako River. Poor canal development and siltation of canals are also reported as constraints. Some farmers use pressurized pumps but it is not affordable by most farmers. In

Benatsemay woreda, farmers around Woyito river basin are using irrigation water for crop production. In the woreda, pond water harvesting is practiced but due to scarcity of other water sources the harvested water is used for livestock and home uses. In Benatsemay woreda, local people used runoff diversion (spate irrigation) to the cropland in rainy season (huge irrigation potential type but not widely practiced). Conflicts, between irrigation water users and others who demand for animals use, on water use was reported, particularly when water volume is decreasing. The commonly irrigated crops by farmers are onion, cabbage, hot pepper, banana, and tomato. There is no fixed irrigation scheduling and the amount of irrigation water application did not consider crop water requirement.

### 10.3.4. Forestry and Agro-forestry

In South Omo zone the size of natural forest and woodland are large, second in the region. Most of the rural people have been dependent on Government-owned forests and community woodlots, which are under severe pressure and vanishing rapidly due to lack of poor participatory protection. Thus, deforestation has been severely affecting the ecosystem and economy. In the last two to three decades, government promoted tree plantation in degraded and marginal agricultural lands and several million trees were planted but no information was available on the number of established and grown seedlings.

The survey report of the three woredas of the zone indicated that deforestation is more expanding due to population pressure, expansion of agricultural lands/ land use change, overgrazing, fuel wood demand, charcoal making, and settlements of people and forest fire. Cutting trees from forest or woodland without any controlling mechanism and replanting enhanced loss of important indigenous trees. Endangered tree species (*Croton macronstachyus* (B*ata*), *Ficus vasta* (*Woma*) and *Vernonia amegdlina* (*Gara*)) are reported from Semen Ari woreda. Forest resource management is very poor and forest pest and disease protection is absent. Bamboo disease (zemamit and death of young bamboo) from this woreda is reported. Reports from Benatsemay woreda indicated that the problem of planting Eucalyptus trees in farm and in the boarder of farm on crop production is raised as serious issue. Lack of sufficient indigenous/exotic fodder trees and shrubs contributed livestock pressure on forest. Management problems of MPTS such as tending of seedlings, pruning, lopping, pollarding, and coppicing are also reported from all surveyed woredas.

Nursery establishment in all woredas is very week because of available water shortage, so it's difficult to raise the seedlings.

Reports indicated that farmers practiced planting trees in farmlands and in the boarder of their farm. Mostly eucalyptus, bamboo, *Grevillea*, *Cordia*, and *Junipers* plantation has been carried out. *Mangifera indica, Persea americana ,Alibiza gummifera, Millettia ferruginea, Ficus sur, Cordia africana, Vitex doniana, Podocarpus falcatus, Croton macrostachytus, Woma (*Aregna*)* are planted as agroforestry system. These species are integrated with crops to diversify the production. However, due to their excessive shade effect *Persea americana* and *Mangifera indica* are not advisable to integrate with under growing crops. Different species of natural bamboo are grown widely in the highlands of Semen Ari; but not managed and utilized well.

## 10.4. Southwest Zones

A quick survey was done to identify the major problems those hamper crop production and productivity. A summarized report compiled from eleven woredas in three south west Zone of Bench Maji (Meanet Goldiya, Debub Bench, Semen Bench and Shey Bench), Kafa (Bita, Chena, Decha, Gewata and Gimbo) and Sheka (Andracha and Yeki). The area geographical located 6.22 to 7.76 N and 35.09 to 36.51 E (Fig. 12). The total area of the the eleven woredas covers about 1,225,363.2 ha. Topographical the area dominated by undulating terrian and slopy landscape. The temperature of 15.1 to 27.5, 10.1 to 27.5 and 15.1 to 25; rainfall of 400 to 2000, 1001 to 2200 and 1800 to 2200, and elevation of 500 to 2500, 501 to 3500 and 1001 to 300 at Bench Manji, Kefa and Sheka respectively. Agroecological the areas are clasified moist qolla, woyina-dega, Dega and high dega.

Southwestern part of the SNNPR, is endowed by natural resources particularly comprise most of the remaining natural forests of the country, which have economically and ecologically important different plant species. The forests of the area are recognized and designated by UNESCO in June 2010 as a biosphere reserve - pursuing to be balance development and conservation for the good life of the communities in the area. Mixed cropping (coffee based) is the dominant farming system in the areas of Bench-Maji, Kaffa, and Sheka zones. Kafa, an Ethiopian highland region which contains 50 per cent of the

country's remaining Afromontane evergreen forest ecosystems and origin of the rare *Coffee arabica*, was added to the network, as was Yayu, in the country's southwest. The forest in Sheka, which is also part of the southwest highlands forests of Ethiopia, is important for the conservation of Afromontane forest vegetation types. Coffee holds more than half of their lands, and on the remaining cultivated land they grow cereals mostly maize and tef while Enset and different vegetables are grown around the homestead. In the semi-arid lowland woredas of the three zones, sorghum is the dominant crop in terms of area cultured. Maize sorghum and Tef are generally the major crops with some roots and tuber crops.

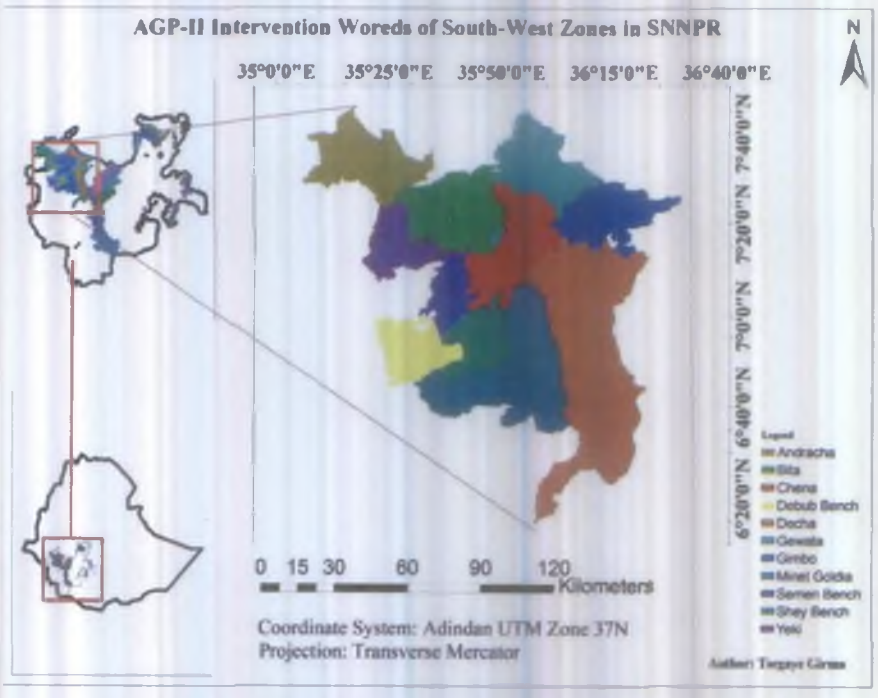


Figure 12. Map of AGP-II intervention woredas of Bench-Maji, Kefa and Sheka

### 10.4.1. Soil fertility

Due to different reasons, farmers have reported soil fertility degradation as a serious problem in southwestern part of the region. The major factor for declining soil fertility is imbalance and sub-optimal fertilizer application and hence low response for crop productivity in the area. Most farmers perceive that the cost of inorganic fertilizers is very high and unaffordable. The other reason aggravates loss of soil fertility is lack of site-specific fertilizer

recommendation. Farmers in Debub Bench, Andracha, and Chena have pointed out soil acidity as the major problem, which hinders nutrient availability and agricultural productivity. Lack of integrated soil fertility management (ISFM) practice, low distribution and absence of new blended fertilizers (e.g. Gewata and Yeki woreda), and inadequate knowledge and use of bio-fertilizer have been accelerating the complications of soil fertility problem in the area. Limitation of experience to intercropping, mulching, crop rotation as a means enhancing soil fertility was reported as a major problem. Respondents in all surveyed woredas have mentioned continuous cropping, plowing of steep land, use of crop residues as feed of animals, soil erosion, lack of biological soil conservation practices and deforestation as a major factors for soil fertility degradation.

Farmers in the area have been practiced different soil fertility management options to overcome the above listed problems. During group discussion farmers explained that they are used urea and NPS fertilizers, is used instead of DAP. For the past ten years there has been an increase of fertilizer demand and supply. However, the provision did not satisfy the demand adequately and the distribution was conducted timely. According to farmers in the surveyed area, the use of organic sources (farmyard manure and household waste) as a fertilizers are a common practice to enhance soil fertility. However, due to labor intensiveness they use organic sources only for home garden crops. Although farmers have interest to prepare and use compost and other improved organic fertilizers, lack of awareness and knowledge gap have hindered proper utilization. For acidic soil management, lime has been supplied by the woreda office of Agriculture and Natural resource. However, because of awareness gap farmers do not use the lime properly. For instance, farmers consider lime as it substitute artificial fertilizer.

### 10.4.2. Soil and water conservation

During group discussion, the respondent specified soil erosion as one of the major problems in the area. Since, the area received high rainfall, sheet and rill erosion are common types of erosion and in some areas gullies also observed. High deforestation in surveyed area has also accelerated soil erosion problems. The other reasons that facilitated soil erosion are continuous cropping, burning of crop residue, less attention for biological soil conservation practices, and lack of model watershed and different soil conservation structures for

demonstration.. Expansion of agricultural lands on sloppy land without physical and biological conservation practices is also reported as cause of soil erosion and landslide. Less integration of soil and water conservation practices with agro forestry practices is also another problem. In order to reduce the aforementioned problems farmers practice different biological and physical soil and water conservation measures. Planting of multipurpose plant species like vetiver grass, desho grass, banana, enset, mango, avocado, orange, taro, and sugarcane on the physical structures are some measures practiced by the farming community. Farmers like in *Chena* woreda, construct physical soil and water conservation practice like soil bund, fanyajuu, stone bund, check dam, cutoff drains, and waterways. However, the area coverage is small and lacks integrations with biological practices.

### 10.4.3. Irrigation

According to discussions with farmers and experts, there are different challenges and opportunities of irrigation development. In south west of SNNPR, there are different irrigation water sources such as rivers, streams, and ground water. However, inaccessibility of water resources due to topography hinders diversion of river to farmland. In the area, water-harvesting practice is not common like Debub Bench woreda, farmers are unable to produce crops using irrigation during dry season especially in the farms which are far from rivers and springs. Moreover, inconsistent availability of water sources, lack of modern irrigation technologies, less awareness of farmers to irrigation are also the problems mentioned by the respondents.

Fluctuation of rain season, late start and early finish of the rainfall, has negative impact on the farming system in the area. Therefore, farmers believe that irrigation has become as an important solution to overcome the problem. There is a good start to use stream and ground water for irrigation to grow vegetables and raise coffee seedling at dry season but not common for other crops.

### 10.4.4. Forestry and agroforestry

Farmers explained that the forests of the area have been reducing alarmingly due to agricultural land expansion, high demand of furniture, fuel wood, construction materials, farm tool, and illegal logging of indigenous tree species. Lack of introduction and promotion of multi-purpose trees, insufficient

supply of indigenous tree seeds, lack of quality seeds, and awareness gap on nursery management are major problems related to forest development in the area. Furthermore, lack of improved management of NTFP, lack of study on economically and ecologically important indigenous tree species are other important problems mentioned by farmers.

Lack of proper association of tree vs crop are also reported as management problem of multipurpose trees in the area. Other major forest related problems are lack of appropriate nursery site, free grazing practice that have induced negative impact on survival of planted seedlings and rehabilitation of degraded lands. Climate change, forest disease and pest occurrence are affecting the existence of both indigenous and exotic tree species e.g. *Milletia*, *Eucalyptus* and bamboo.

South west of SNNPR endowed with natural forest contributing to livelihood of people in the area. *Cordia africana* (Wanza), *Vernonia spp, Ficus spp*, *Ertryina spp*, *Millettia*, are *Albizia gumiefera* are some of retained tree species in agricultural land. Farmers in the area are experienced planting of multipurpose tree species (MPTs) in their farmland to obtain multifunction of the trees. The major multipurpose tree species include *Cordia africana* (*Wanza*), *Eucalyptus*, *Vernonia spp*, *Ficus spp*, *Grevillea, Sesbania* and *Luceanea*, *Ertryina spp*, *Millettia*, *Albizia gumiefera*, and *Cupressus lusitanica*.

Pruning and pollarding are some of management practices farmers apply to reduce above ground competition. Other best practices that have an advantageous on forest conservation are utilization of NTFPs like honey, coffee, medicinal plants and spices without major exploitation of tree products through participatory forest management practice.

## 10.5. Melokoza Woreda and Basketo Special woreda

Field survey has been carried out at Melekoza woreda in Gomogofa zone and Basketo special woreda to identify natural resources management related constraints. Melekoza woreda is situated in 6.28 - 6.72 N latitude and 36.38 - 37.00 E and an altitude ranging from 501 – 2500 masl with mean min and max

temperature and rainfall of 15.1 - 27.5$^0$C and 750 – 1500 mm, respectively. Basketo special woreda is situated in 6.13-6.39 N and 36.39 - 36.70 E (Fig 13), and an altitude ranging from 501 – 2000 masl with mean min and max temperature and rainfall of 17.6 - 27.5$^0$C and 1401 – 1600 mm, respectively.

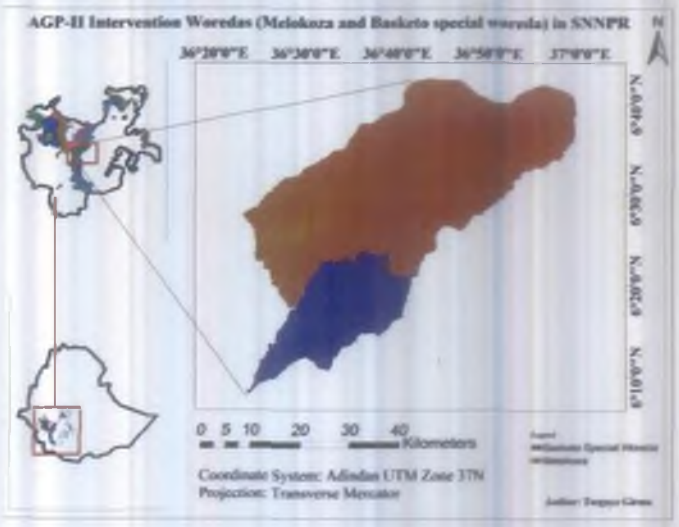


Figure 13. Map of Melokoza and Baseketo special woreda in SNNPR

### 10.5.1. Soil fertility

The survey results of Basket special woreda indicated that farmers of the woreda believe that as if their soils are innately fertile to support crop production of the area, which is very far from the reality on the ground. The other soil fertility related problems such as Vertisols management (drainage), soil acidity, knowledge gap on the preparation and use of organic fertilizer sources, and absence of recommendations on the type and rate of inorganic fertilizers are identified as major problems in both Melekoza woreda and Basketo special woreda. Low inorganic and low or no organic fertilizers use aggravated the declining of soil fertility. Farmers use urea and NPS fertilizers. In spite of soil acidity problems, there was no report on the amelioration of acid soils in the highlands and midlands of these woredas.

### 10.5.2. Soil and water conservation

Survey report of both Melekoza Woreda and Basketo special Woreda showed that soil erosion is serious problem of production and productivity of the area. High rainfall, continuous tillage, cultivation of steep slopes without appropriate conservation measure and overgrazing are reported as major causes of soil

erosion in both woredas. Limited or absence of physical and biological conservation measures in high and midlands of both woredas and lack of moisture conservation measure in lowlands are among major problems in the woredas. Farms plow along the slope; for example, in Melekoza tuber crops planted vertically to plant crops, which aggravate the soil erosion.

### 10.5.3. Small-scale irrigation

Melokoza woreda and Basketo special woreda are endowed with much rivers/surface water those are potentially good for small-scale irrigation, although potentials of most rivers are yet not verified. Usno River in both Melekoza woreda and Basketo special woreda and Sanka and Husu in Basketo are the main sources of irrigation. However, undulating and rugged topography of the area made the rivers hardly accessible for surface irrigation. In areas where some small-scale irrigation schemes developed, serious problems are reported on design of canals, their performance, and coverage. About 2500 ha is irrigated traditionally in Melekoza, according to the information obtained from agriculture and natural resource office. Reports of the survey indicated that in most irrigated areas of the woredas, irrigation water management is poor, distribution is uneven, and utilization is wasteful (over application) which creates water scarcity in lower parts of rivers and creates interest conflict among water users. Water harvesting practices, even though the potential is high, are not adopted in both woredas.

### 10.5.4. Forestry and Agro-forestry

Reports of survey on forestry and agro forestry indicated that the size of forest area is shrinking from time to time in Melekoza and Basketo. Deforestation for expansion of agriculture lands, fuel wood, charcoal, and respondents report timber and house construction as major cause for diminishing forest areas. Agro-forestry practices are not widely adopted by farmers, particularly in Melekoza woreda and tree planting to replace the cut trees is poor, some farmers have the habit of planting multipurpose trees and shrubs around their home and farmland. Absence of nursery sites is also reported as major problem.

The dominant forest and agroforestry trees and shrubs in Melekoza woreda are *Cordia africana, Hagynian abyssinica, Cajanus cajan, Sesbania and Luceania,* whereas in Basketo special woreda are *Cordia africana, Ficus spp., Acacia*

*spp., Ficus spp., Eucleara cemosa, Eucalyptus spp., Moringa stenopetella, Croton marcostachyus, Prunus africana, Avocado, Podocarpus falcatus(zigba), Juniperus procera,* and *Grevillea robusta.* As usually known, negative effects of planting Eucalyptus with crop or in the border of crop also is reported from both woredas.

## 10.6. Gurage and Siltie Zones, and Yem Special Woreda

**Gurage Zone:** Gurage Zone is one of SNNPRS Zones with 13 Woredas that cover about 5932 square kilometers. Among 13 woredas five are AGP II beneficiary woredas these are Gumer, Geta, Cheha, Enemor Enere and Endegagn. The elevation of this zone ranges from 1000 to 3600 meters above sea level. Gurage zone comprises three agro- ecological zone including dega (35%) woyna dega (62%) and kolla (3%). The mean annual rainfall ranges from 600-1600 mm and annual average temperature ranges from 13°C to 30°C. Concerning the land use, 52% of the total area is a cultivated land, and 13 .4%, 9.9% and 7.3% of the total area are grazing land, natural and plantation forest and unproductive land, respectively. Others cover the remaining 17.6%. Major crops grown in this zone include cereals (tef, wheat, maize, and barley), horticultural crops (enset, Irish potato, and cabbage), and pulses (faba bean, field pea). Other stimulant crops such as coffee and khat are also cultivated.

**Siltie zone:** Siltie zone has eight woredas out of which Alicho Wurriro, Mierab Azarinet Berbere, and Misirak Azarinet Berebere are AGP II beneficiary woredas. Agro-ecologically the zone falls on dega and woina dega with 20.5% and 79.5% coverage, respectively. The mean annual rainfall ranges from 650-1818 mm and annual average temperature ranges from 12°C to 25.5°C. The altitude reaches to 3273 meters above sea level.

**Yem Special Woreda:** Yem Special Woreda is one of the woredas supported by AGP II from SNNPR. . The Woreda has 35 kebeles (4 urban and 31 rural kebeles). It is categorized as 18.38 % high land, 57.6 % mid land and 23.1 % lowland. . The altitude ranges from 991 and2934 masl. The mean annual rainfall is 1100 mm and annual average temperature ranges from 12°C to 30°C. Major cereal crops grown includes (wheat, tef, maize, sorghum), pulse crops (faba bean, field pea, haricot bean), horticulture crops (potato, tomato, carrot, cabbage, beat root, onion, garlic), fruits (avocado, mango, apple, banana) and major oil crop are nug and flax seed (*telba*). Geographical the district ranges $7^0$35' to $8^0$15' E and $37^0$25' to $38^0$20' N (Fig. 14).

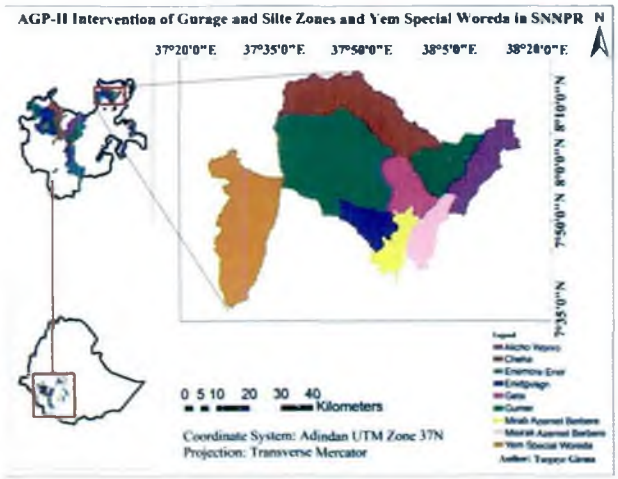


Figure 14. AGP-II intervention of Gurage and Silte zones and Yem special woreda in SNNPR

### 10.6.1. Soil fertility management

Farmers, experts, and development agents reported various constraints related to soil fertility management. Acid soil problem and its management practice were frequently raised almost in all woredas. The problems include lack of information on the magnitude and coverage of acidic soil, and lack of different management options including lime application rate. Other common production problem reported by the respondents of all woredas was lack of different soil fertility management. Particularly, inorganic fertilizer recommendation (types and rate) for each major crop was strictly reported from all farming communities of all woredas. Usually farmers use blanket or below the blanket recommendation and they apply similar amount and types of fertilizers for almost all crops regardless of the requirement. Farmers also mentioned high price of commercial fertilizer frequently since the current price is not affordable by poor farmers. In some woredas like Enamorina Ener, inorganic fertilizers of all types were not provided timely. . Lack of other management options like bio slurry technology also reported in some woredas like Mierab Azernet (Siltie Zone). Lack of access to bio fertilizer also rose as a production constraint for legume crops.

### 10.6.2. Soil and water conservation

Soil and water conservation related production constraints are major problems for farmers in Gurage and Siltie zones and Yem special woreda. Soil erosion mainly caused by high rainfall coupled with sloppy topography was reported

from all respondents of all surveyed woredas. Consequently, big gullies are formed in some areas as expressed in Geta woreda (Gurage Zone). Sometimes high rainfall formed runoff and soil erosion became more severe as reported by Alicho Woriro (Siltie Zone). Although soil erosion is stated as major natural resource constraints, farmers do not construct soil conservation measures as expected and also the constructed bunds are not stabilized by grass or/and multipurpose tree species. Proven technologies like multipurpose tree and grass species for stabilizing structures were not available or rarely available. In addition, lack of appropriate soil and water conservation technologies for each agro ecologies and soil types also reported as problems in most woredas.

### 10.6.3. Small-scale irrigation

According to the respondents participated in this quick survey, there were some small-scale irrigation practices almost in all woredas. However, the bottlenecks related to small-scale irrigation practices were more diverse and challenging to the farming community. Moreover, the constraints differ from place to place even with in the woreda. . In some areas there are a permanent water sources problem like indicated in Mierab Azerinet and Alicho Wuriro whereas in most areas lack of technologies those improve water use efficiency were mentioned by farmers. Other measure problem raised by farmers, almost in all woredas, was technical knowledge gap in water harvesting for horticultural crop production around homesteads. Most respondents reported lack of improved irrigation technologies while others stated adoption problem for new irrigation technologies. Experts in Misirak Azarinet rose that irrigation feasibility study was quite important in the area. In some area water springs become dried and due attention is required to rehabilitate the springs in order to diversify the water sources for small-scale irrigation.

### 10.6.4. Forestry and agroforestry

Forestry and agro forestry were the major focus area included in the survey to understand the potentials and the main management constraints faced farmers in each woreda. Since the use of all types of trees species is divers, the problems affect agricultural productivities, climate, water resources etc. Deforestation is one of the major environmental problem occurred in all surveyed areas. Some of the endangered indigenous trees species reported in the areas are *Koso* and *ye habesha tid.* Moreover, provision and plantings of indigenous tree seedlings is very low and the survival rate is also inadequate.

Similarly, the practice of planting exotic tree species is not satisfactory. To enrich the agro forestry system, provision of multipurpose tree has a paramount important. However, almost in all areas, lack of appropriate multipurpose tree seedlings for agro forestry was reported. In addition, low introduction and adaptation of fruit trees (e.g. apple and mango) to improve home gardens was also reported in different woredas. Poor seedling management, lack of disease resistant seed, low the farming community reported adaptable seed dissemination etc. Farmers and experts also emphasized improved bamboo production practices and market linkage problems. As usual, Eucalyptus management should also needs attention by all stockholders, since the problem was frequently reported almost in each woreda.

# 11 Summary

In different agro-ecology of thirty-five AGP-II target woreda of SNNPR, various natural resource management based problems were identified through *active participation of relevant stakeholders that need different management* options. The identified constraints are categorized the lack of improved technologies and practices that insure sustainable management of natural resources; awareness gap in managing the natural resources (water, soil, and forest) for agriculture; climate variability and change; and economical (financial, credit access, saving) problems to invest in agricultural technologies and inputs. Summary of the identified problems and possible interventions are presented in (Table 31)

Table 31. Natural Resources' Productivity Constraints of Intervention Woredas of SNNPR

| Categories | Major constraints | Possible interventions |
|---|---|---|
| Soil fertility | soil fertility decline, soil acidity, lack of soil characterization and classification studies, lack of ISFM practice, knowledge gap on preparation and use of organic fertilizers, late provision and high price of fertilizer, lack of fertilizer recommendations for major crops, low/no provision of bio-fertilizer, lack of new technologies eg. Bio slurry, low response, unbalanced/suboptimal application of fertilizers; vertisol management problem | Reclamation of soil acidity through introduction of lime technology, use of organic sources, selection of acid tolerant crops, determination of type, rate and application method of chemical fertilizers for major crops, introducing ISFM, provision of bio-fertilizers for major legumes crops, characterizing and classifying of soils, training and demo on preparation and use of organic fertilizers; timely provision of inorganic fertilizer, introducing low cost alternative fertilizer, vertisol management (timely tillage, appropriately draining, nutrient management) |
| Soil and water conservation | high soil erosion, gullies formation; skill gap on soil and water conservation practices, soil bund stabilizing technology gap (grass, multipurpose trees and shrubs, knowledge gap), lack of suitable conservation structures fitting to each agro ecology and soil types, inappropriate designs of structures, maintenance gap on physical structures, high runoff, ploughing of sloppy land | Options of soil and water conservation measures suitable for each agro ecology, soil type and topography; gully controlling and rehabilitation technologies; promotion of biological conservation measures (grass, multipurpose tree and shrubs); training and demo on improved conservation measures; land use police; promotion of conservation agriculture |
| Small scale irrigation | Lack of irrigation schemes and water harvesting techniques, poor design of established schemes, shortage and inaccessibility of water sources, lack of improved irrigation technologies, lack of water pump, inaccessibility of ground water, inappropriate utilization of irrigation water, low adoption of irrigation technologies, skill gap on improved irrigation technologies, market linkage gap | Establishing modern irrigation schemes; promoting water harvesting technologies; introducing appropriate technologies (devices) to use inaccessible water source; determining irrigation scheduling, crop water requirement and improving water use efficiency; increasing awareness on improved irrigation technologies; creating market linkage for irrigated crops |
| Forestry and agroforestry | Low provision of indigenous and exotic trees, and fruit tree seedlings; deforestation (agricultural land expansion and investment), inadequate seed source and low dissemination; tree pest and disease problems; lack of improved agroforestry practices; skill gap on bamboo processing and marketing; extinction of indigenous tree species; lack of nurseries and poor seedling management; low survival of seedlings; expansion of eucalyptus tree in agricultural lands; low attention on practice of NTFPs | Introducing and promoting multipurpose tree, fruit tree and indigenous tree species for each agro ecologies, improved agroforestry practices, promoting improved forest management practices, technologies/improved practices for forest pest and disease control, increase community awareness in mixed plantation, technologies for bamboo production and processing, compromise the issue of investment with sustainable utilization of forest resources |

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