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Assessment of Status of Irrigation Practice and Utilization in Western Hararghe Zone, Oromia, Ethiopia

Gamachu Ayala Beyisa Muleta Tadele Geremu
Oromia Agricultural Research Institute, Mechara Agricultural Research Center, P. O. Box. 19, Mechara, Ethiopia

Abstract
The study was conducted in three selected districts of Western Hararghe zone namely, Mieso, Tullo and Gemechis district with objectives to know the current irrigation practice and utilization of farmers in the area and to identify gaps and constraints of different irrigation practice. Sampling technique was purposive for identifying districts that have high irrigation potential from the zones. From each district, three peasant associations (PAs) were purposively selected each from three traditional agro ecological classifications highland, midland and lowland. A total of 180 households were interviewed and generated both qualitative and quantitative data on constraints, status and practices of irrigation water management. Secondary data were also collected from Zonal Irrigation Development Authority. The data was analyzed using descriptive statistics such as mean, frequency distribution and percentage, were used to analyze data after carefully coded and entered into SPSS V.20 statistical tools. According to the survey result, the mean land holding per household is about 0.78ha while the mean land allocated for irrigation per household is about 0.68ha. Three different types of irrigation were identified; among them Surface irrigation, Pressurized irrigation and water harvesting. While some farmers used combination of surface and pressurized irrigation. Surface irrigation type using furrow method of irrigation is the most common irrigation type in the study area which accounts about 66.5%. The major source of water is from river which accounts about 50%. The major crops cultivated using irrigation in the area were high value crops, about 43.2% cultivated both hot pepper and tomato followed by combination onion, cabbage, red root & tomato by 19.9% and 13% cultivate both onion and tomato as well the left others cultivate different horticultural crops. The study indicated that, water shortage for irrigation, lack improved seed (vegetable crop) varieties recommended for the area, lack of improved technology, diseases outbreak, pest, drought and low price were among major constraints of irrigation practices on the study area. And also there are no transport services because of no road access. In the study area water shortage and lack of improved technology and inputs were the main problem, therefore practicing water harvesting and supplying improved technologies such as seed, controlling diseases, infra structure (road) and providing extension service regularly for farmers should be practiced in future.
Keywords: status of irrigation, Gaps and constraints, Irrigation practice and utilization

1. INTRODUCTION

Ethiopia, a landlocked country located in the horn of Africa, has an area of 1,104,000km^2 and one of the poorest and least developed countries in the world. The current population is estimated at 90 million with an annual growth rate of about 3%. The economy is highly dependent on agriculture consisting of crop production and livestock rearing. Poverty is the central issue of the economic problem. Ethiopia had been self sufficient in staple food and was classified as a net exporter of food grains till the late 1950s. However, since the early 1970s, domestic food supply failed to meet the food requirements of the people. Even though sufficient quantities of food have been produced in most of the good years, the average food production during the last decade remained almost stagnant.

Agriculture is a mainstay of Ethiopian economy which dependent on the availability of seasonal rainfall. (World Bank, 2006; Makombe et al., 2011). The country is endowed with ample water resources with 12 river basins with an annual runoff volume of 122 billion m^3 of water and an estimated 2.6-2.65 billion m^3 of groundwater potential (Awulachew et al., 2007; Makombe et al., 2011; MoA, 2011a). Due to this Ethiopia is considered to be the water tower of Africa (Makombe et al., 2007). The country can only be a water tower in terms of receiving ample water and donating it to neighboring countries but not in terms of ample water resources that is readily available for use. The cultivated agricultural land of Ethiopia currently under cultivation is about 12 million ha (MoA, 2011a). The intensity of recurrent droughts affects the livelihoods of agricultural communities and the whole economy. Out of the total water resources, about 75% drains to neighbouring countries (MoWR 2001a). The issue of water is the issue of life. Societies that are able to use their water resources in an efficient and sustainable manner have succeeded in being food self-sufficient, reducing the incidence of water-borne diseases and minimising adverse effects of the resource. Unfortunately, this has not happened in Ethiopia. Sustainable management of land and water resources is essential for the alleviation of poverty, economic development and the enhancement of the well-being of the Ethiopian people (MOWR, 2002). Ethiopia is already suffering from food shortage because of its increasing population and chronic drought

occurrence in most parts of the eastern and northern part of the country. At the same time, Ethiopia is endowed with water resources, which could be easily tapped and used for irrigation.

Irrigation in Ethiopia is considered as a basic strategy to alleviate poverty and hence food security. It is useful to transform the rain-fed agricultural system which depends on rainfall into the combined rain-fed and irrigation agricultural system. Most of the traditional irrigated lands in Ethiopia are dominantly supplied by surface water sources, while ground water uses has just been started on a pilot basis in the East Amhara region (MoA, 2011). Makombe et al. (2011) noted that irrigation development is a key for sustainable and reliable agricultural development which leads to overall development in Ethiopia. Even if the potential and actual irrigated area is not precisely investigated (Belay and Bewket, 2013), estimates of irrigable land in Ethiopia vary between 1.5 and 4.3 million hectares (Mha), averaged about 3.5 Mha (MoWR, 2001; Werfring, 2004; Awulachew et al., 2005; Makombe et al., 2011). However, MoA (2011a) reported about 10 - 12% of the total irrigable potentials are currently under production using traditional and modern irrigation schemes. Moreover, differences in irrigation potentials and actually irrigated lands, for example 3.7 Million ha and 197,000 ha according to Awulachew et al. (2007) and 3.5 Million ha and 626,116 ha as reported by Hagos et al. (2009) respectively, are indicated differences in the same class. In Ethiopia, farm size per household is 0.5 ha and the irrigated land per households' ranges from 0.25 - 0.5 ha in the Ethiopian context (MoA, 2011). As a result, individual land holdings per households are too small to feed the household. With this limited landholdings, increasing food demands of the population depends on either one or a combination of increasing agricultural yield, increasing the area of arable land, and increasing cropping intensity by growing two or three crops per year using irrigation (MoA, 2011).

Hence, there is no consistent and reliable inventory and well-studied and documented with regards to water and irrigations related potentials in the Ethiopian context. This shows that there is little study details in the area. This knowledge is important in such a way that the people and government who are living today become aware of what the people and governments in the past had done in the sector.

Research in water resource development could enable the development of low-cost structures and irrigation systems for handling water. Where research information is lacking, there is a danger of over-design, which results in high cost or under-design, which results in failure. Specific research has not yet been conducted to address problems related with flow structures (canals, ditches, flumes etc.); water storage facilities (farm ponds, irrigation reservoirs) and sediment traps. Agricultural water management research should, therefore, be accompanied with the water resource development and research activities to have a significant impact on the future development of irrigated agriculture (Paulos etal, 2002). Irrigation, water harvesting and agricultural research were considered to play a significant role in ensuring long-term food security.

The research should also focus on the investigation of national, zonal, regional and other problems in particular to the needs of the people related to water resources development in line with the agricultural water management. This could provide practical and sustainable solutions to the existing problems. Moreover, applied research should be given priority than the theoretical one. Therefore, integrated research approach is the key for bringing effective, efficient and complete research technologies to the end users (Paulos etal, 2002).

The country can only be a water tower in terms of receiving ample water and donating it to neighboring countries but not in terms of ample water resources that is readily available for use.

Irrigation development may benefit the poor by raising labour productivity, promoting the production of high-value crops, and the generation of farm and non-farm employment

In the semi-arid areas of Ethiopia, drought and climate change are the factors influencing agricultural production. In these areas where the amount and distribution of rainfall is not sufficient to sustain crop growth and development, an alternative approach is to make use of the rivers and underground water for irrigation. So, irrigation has long played a key role in feeding expanding population and will undoubtedly play a still greater role in the future.

Therefore, knowledge about current status and performance of different irrigation practice is essential, since it serves as a base for formulation of irrigation projects. Moreover, it gives a bench mark for monitoring progresses within the irrigation system. Thus, there is a need to evaluate the current small-scale irrigation in general and family drip irrigation in particular in the western Hararghe. Such an assessment could assist in identifying constraints for future strategies that address water scarcity and consequently food security issues at household and national levels. Therefore, in western Hararghe where drought and climate change were problems assessing the status of irrigation practice to identify constraints, challenges and opportunities in water productivity for the future is a key issue.

1.2.Objectives of the study

- To assess the current irrigation practice and utilization of farmers in the area and to identify gaps and constraints of using different irrigation practice
- To assess the status of irrigation practice to identify constraints, challenges and opportunities in the

study area

2. MATERIAL AND METHODS

2.1. Description of the Study area

The study was conducted at Western Hararghe Zone of Oromia which is located on about 325 km East of the capital city of Ethiopia, Addis-Ababa, and 225 km from Adama town, along the main road to Harar and Dire-dawa on longitude and latitude of 40°03'413" to 41°09'00" E and 7°52'15" to 9°28'43"N. The zone is bordered on the south by the Shebelle river which separates it from Bale, on the southwest by Arsi, on the northwest by the Afar region, on the north by the Somali region and on the east by East Hararghe.

Western Hararghe has about fourteen (14) districts with total population of 2,164,115 (Zonal irrigation development authority, 2014). Most of western Hararghe districts were lies in the semi-arid to most highland agro climate. Their annual average rainfall ranges between 500-1300 mm and rainfall distribution in the area is bimodal with short rainy of spring season from February to April and main rainy of summer season from July to September. April, July and August are months of high rainfall and May, June, March, September and October are months of low rainfall. Rainfall in the area is characterized by intense and showery, low in amount and do not start on time. The temperature is usually very hot in winter. Its average temperature is 25^{o}c and 30^{o}c in summer and winter respectively. It is also characterized by mixed farming system. Diverse crop species from cereals like sorghum, maize and fruit crops like coffee, chat, mango and avocado widely cultivated. During spring season staple crops (maize and sorghum) and haricot bean are the major crops sown followed by summer season, planting teff, barley, finger/pearl millet and chick pea and short season matured maize. Sandy loam clay is the dominant soil type in this zone.

Three districts having irrigation potentials were purposively selected based on agro ecologies that represents western Hararghe as lowland, midland and highland for this particular study in 2016 as below.

Miesso district: is located at the distance of 304 km from Addis Ababa to East direction and 25km from Zone Chiro town. The astronomical location of 9°13'59.99"N latitude and 40°45'0"E, longitude with altitude of 1332 m a.s.l. The relative location boarder of the district on east Doba, on west Afar region, on south Chiro and on north Somale region. Total population of the district is about 129,630 with male 63,519 and female of 66,111. The area of the district is about 257,344ha and with the temperature of minimum of 25^{o}c & maximum 37^{o}c respectively. The annual rainfall of the district ranges from 500-700mm with main rainy season of June to August. The dominant soil types of the districts are sandy loam (75%) and loam (25%). The agro ecology of the district about 99% covered by lowland and pastoral/mixed farming is the major farming system of the area. Major crops produced by irrigation in the district are maize, sorghum and chat. River is the main source of irrigation water in the district.

Tullo district: is found at the distance of 375km from Addis Ababa to the East direction, 275km from Adama and 45km from Zonal city Chiro. The astronomical location of 9^{o}10' N latitude and 41^{o}00'E longitude with altitude of 1600-270 m a.s.l

The boarder of the district on east is Dedder and Goro Gutu, on north Doba district, on west Chiro district and on south Mesela district. Total population of the district is about 148,180. Temperature in degree Celsius ranges from 19 - 22$^{o}_{c}$ and the rainfall is about 850 - 1250 mm**.** The main rainy season of the district is from April - September (maziya - meskerem). The soil types of the district are vertisol (58%) and loam (42%). The agro ecology of the district in percent is about 25% highlands, 75% midland and no lowland. The farming system of the district is mixed farming system and the major crops cultivated in the area were maize, sorghum, potato, tomato, onion, chat, coffee, cabbage, carrot, sugar cane, banana, red root etc. About 8532 ha is covered by irrigated land and the water source for irrigation is river, pond and ground water.

Gemechis district: is located on a distance of 333km from Addis Ababa and 17km from zonal town of Chiro with altitude of 1300-3017m a.s.l. The geographical location of the district lies between 8^{o}10'N latitude and 40^{o} 45'E longitude. The relative location of the district is, on east Mesela district, on south Oda Bultum, on west and north Chiro district. The minimum and maximum temperature of the district in degree Celsius is 20-30^{o}c respectively with rainfall of 850 - 1000 mm. Main rainy season of the district is from March to May and June to September. The agro ecology of the district by percent of 15% highland, 45% midland and 40% lowland. The farming system of the district is characterized by mixed farming system. The water source for irrigation is river or stream, pond, shallow well and ground water is the most available and surface irrigation is common in the area. Major crops produced by irrigation are onion, tomatoes, potatoes, cabbage, mango, sugar, carrot, avocado, sweet potato, hot pepper, coffee, chat and maize. The dominant soil type of the district is sandy-loam.

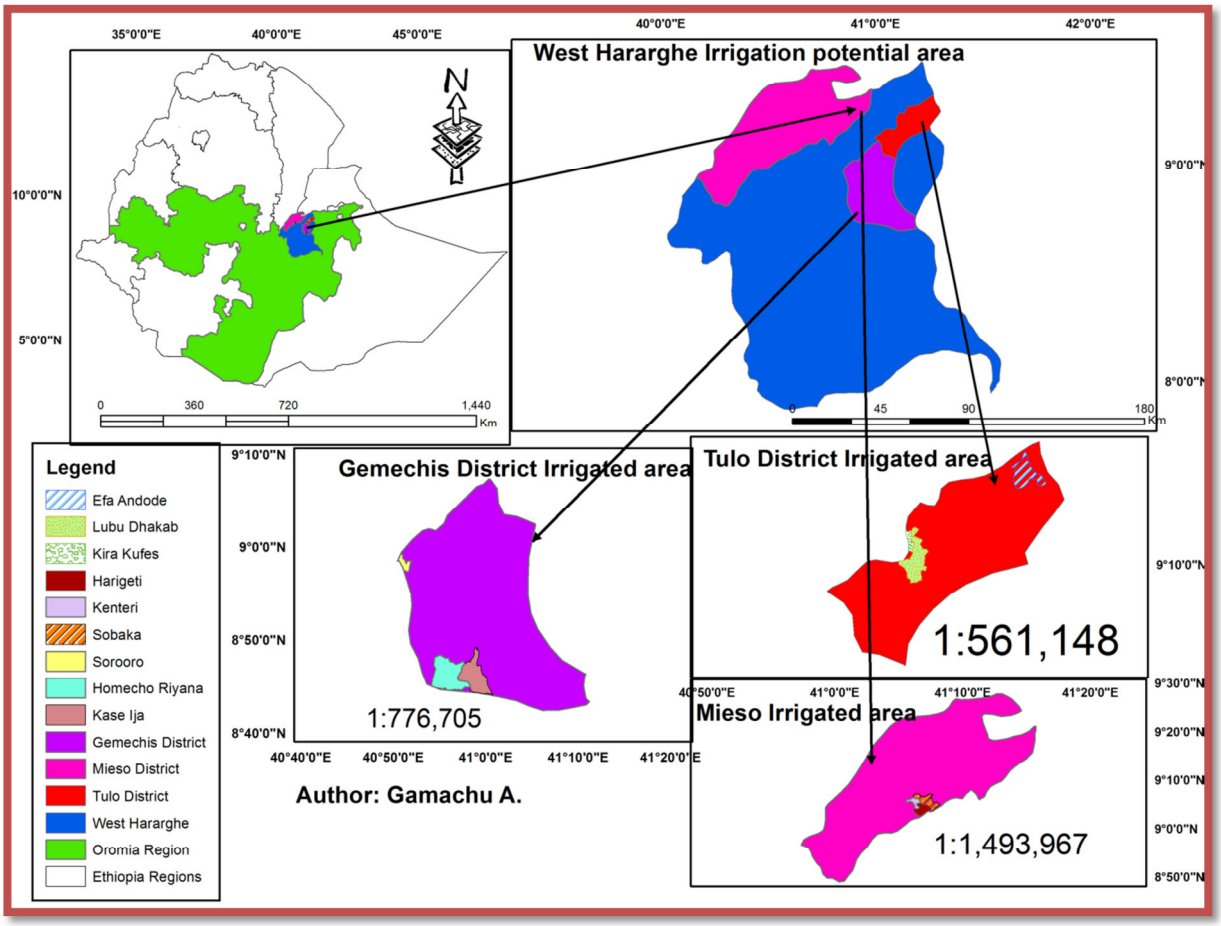

Figure 1. Western Hararghe district of irrigation potential area

2.2. Demography of Western Hararghe

Based on the 2007 Census conducted by the CSA, this zone has a total population of 1,871,706, an increase of 47.16% over the 1994 census, of whom 958,861 are men and 912,845 women; with an area of 15,065.86 km^2, West Hararghe has a population density of 124.23. While 160,895 or 9.36% are urban inhabitants, a further 10,567 or 0.56% are pastoralists. A total of 395,127 households were counted in this zone, which results in an average of 4.74 persons to a household, and 380,019 housing units. The three largest ethnic groups reported were the Oromo (90.12%), the Amhara (7.24%) and the Somali (1.26%); all other ethnic groups made up 1.38% of the population. Oromiffa was spoken as a first language by 89.47%, Amharic was spoken by 8.82% and Somali by 1.2%; the remaining 0.51% spoke all other primary languages reported. The majority of the inhabitants were Muslim, with 88.05% of the population having reported they practiced that belief, while 11.11% of the population professed Ethiopian Orthodox Christianity (CSA, 2007). The 1994 national census reported a total population for this zone of 1,271,894 in 265,147 households, of whom 653,529 were men and 618,365 women; 95,864 or 7.54% of its population were urban dwellers at the time. (This total also includes an estimate for the inhabitants of one rural and one urban kebeles and parts of two urban ones, which were not counted; they were estimated to have 2,978 inhabitants, of whom 1,524 were men and 1,454 were women. According to a May 24, 2004 World Bank memorandum, 9% of the inhabitants of West Hararghe have access to electricity, this zone has a road density of 23.6 kilometers per 1000 square kilometers (compared to the national average of 30 kilometers), the average rural household has 0.5 hectare of land (compared to the national average of 1.01 hectare of land and an average of 1.14 for the Oromia region) (Klaus Deininger et al, 2006) and the equivalent of 0.6 heads of livestock. 16.4% of the population is in non-farm related jobs, compared to the national average of 25% and a regional average of 24%. Concerning education, 55% of all eligible children are enrolled in primary school, and 8% in secondary schools. Concerning health, 92% of the zone is exposed to malaria, and none to Tsetse fly. The memorandum gave this zone a drought risk rating of 372 (World Bank, 2006). The Oromia regional government announced 25 May 2006 that 429 drinkable water projects had been completed in the zone, which combined with other ongoing projects would bring drinkable water to 72,300 inhabitants and raise the percentage of access from 37% to 47%.

2.3. Method of Data collection

To achieve the objectives of research mentioned above data were collected through primary and secondary sources. Primary data was collected from the sample of rural households using a structured questionnaire, GPS reading and field observation. Also secondary data was collected from published and unpublished materials, reports, proceedings and statistical abstracts about the study area, agricultural production and irrigation practice activities. The information was also collected from zonal and district level offices of irrigation authority.

2.4. Sample Technique and Size

The study was carried out for selected sites at the different agro-ecological zones of the Western Hararghe intended to represent the irrigation potential areas to assess the irrigation practice and utilization with respective constraints, problems and opportunities. Purposive Sampling technique was used for identifying three districts that have better irrigation practices and utilization in Western Hararghe zone. These three districts were taken from different agro ecologies classification (Lowland, mid land and high land) depend on availability of irrigation practices and information collected from Zonal Irrigation Authority (ZIA) as secondary information. From each district, three peasant associations (PAs) were purposively selected from each three agro ecological classifications highland, midland lowland. Accordingly nine PAs namely Kase Ija, Sororo and Homecho Rihana from Gemechis district; Sabaka, Kinteri and Argiti from Mieso district and Efa Andode, Lubu Dhekeb and Kira Kufis from Tullo district were used to conduct the survey.

About a total of 180 households were interviewed using semi structured and open ended questionnaire. From each peasant association (PAs) twenty farmers were randomly selected and interviewed to achieve the desired objectives. A multidisciplinary team was formed to collect data.

2.5. Data collection

Data of types of irrigation, source of water for irrigation, utilization, gaps, constraints exist in irrigation, major crop that farmers used, the seasonal climate pattern of the area, Area covered by irrigation practices were collected.

2.6. Method of Data Analysis and Presentation

The both quantitative and qualitative data collected by the structured questionnaires were analyzed using excel and the frequencies and descriptive procedures of the statistical Package for Social Science (SPSS) software, version 20.

3. RESULT AND DISCUSSION

3.1. General Overview of Demography of Respondents

From the sampled households, 82.8% were male households and 17.2% were female households. Females were family headed when their husband have been died or migrates from their original residences. The study has identified five educational levels in the study district: illiterate, can read and write, elementary schooling (grade 1-6), secondary schooling (grade 7-12), Certificate and diploma (grade 10+3 or 12+2). From the survey result, about 40.6% of the household heads had no formal education, 44.4% of the respondents were attended primary school (grade1-6), 11.1% attended secondary schooling and 3.9% have Certificate up to Diploma. The study shows about 92.2% of the respondents were married and 6.1 % were single and only 1.7% widowed or divorce. So that the farmers of the area are actively participate in irrigation production without social problem. The farming system of the area is characterized by small scale subsistence mixed farming of about 42.8%, 53.8% is produced crop only and 1.1% rearing livestock only. The major crops produced in the area were Sorghum, Maize, Chat, Coffee etc.

Table 1. Socioeconomic Characteristics of sample Respondent

		Frequency	Percent
Sex	Male	149	82.8
	Female	31	17.2
	Total	180	100.0
Marital status	Single	11	6.1
	Married	166	92.2
	Widowed	3	1.7
	Total	180	100.0
Educational status	Illiterate	73	40.6
	1-6 grade	80	44.4
	7-12 grade	20	11.1
	Certificate	5	2.8
	Diploma	2	1.1
	Total	180	100.0
Farming System	crop production only	97	53.8
	live stock rearing only	2	1.1
	mixed farming	77	42.8
	Total	180	100.0

Source: Survey result of 2016

3.2. Land holding size

Land is one of the most important factors that determine the level of agriculture. According to the survey result, the minimum land holding per house hold is 0.06ha and the maximum land holding is 6ha per household with the mean of about 0.78ha. While the total land allocated for irrigation with minimum land holding per house hold of 0.06ha and the maximum land holding is 3ha per household with the mean of about 0.68ha. The maximum land holding per house hold is about 6 ha observed in Mieso district because the area almost pastoral area while the minimum is observed in Gemechis and Tullo district since population density is high in these area. The land allocated for irrigation is small this is due to shortage water for irrigation half of maximum land holding is allocated for irrigation (Table 2). This study is similar with (MoA, 2011) that shows in Ethiopia, farm size per household is 0.5 ha and the irrigated land per households' ranges from 0.25 - 0.5 ha. As a result, individual land holdings per households are too small to feed the household. With this limited landholdings, increasing food demands of the population depends on either one or a combination of increasing agricultural yield, increasing the area of arable land, and increasing cropping intensity by growing two or three crops per year using irrigation (MoA, 2011)

Table 2. Total land holding of household

	Minimum	Maximum	Mean
Age of the HH	18.00	73.00	36.43
Total land holding size of HH in ha	0.06	6.00	0.78
Total irrigated land of HH in ha	0.06	3.00	0.68

Source: Survey result of 2016

3.3. Major crops produced by the respondents

The major crops cultivated in the area are coffee, khat, maize and sorghum, and irrigation with land allocated for these crops are 0.87ha, 0.27ha, 0.56ha, and 0.68ha respectively (Table 3). This indicates that it is almost the same to CSA of land allocating for cultivation in the zone.

Table 3. Type of crop produced by the respondents

Variables	Frequency	Percent
cereal crop	18	10.1
Horticultural crop	49	27.5
Cash crop (coffee & chat)	6	3.4
cereal and horticultural crop	62	34.8
Horticulture and cash crop (coffee & chat)	11	6.2
Cereal ,horticulture and cash crop	16	9.0
cereal and cash crop	12	6.7
cereal, pulse and horticulture	3	1.7
Total	178	100.0

Source: Survey result, 2016

3.4. Area covered by irrigation

The total area of western Hararghe zone is about 1,723,165ha which composed of 375,615 ha of farm land, 102,000 ha of irrigable land, 197,271 ha of mountainous area, 277,620 ha of arable land and 84,550 ha protected land. The main rainy season is belg season from March to May and summer season from June to August. Currently area under irrigation in the zone is estimated as about 90,217ha (5%) and the main irrigation season is mostly in winter from October to January and spring season from January to May as well as farmers irrigates their land as supplementary irrigation due to shortage of rainfall (secondary data from Zonal Irrigation Authority). Districts which have large irrigation potential according to their rank as Gemechis with about 7754.8ha, Oda Bultum with about 11260ha, Miesso with about 2993ha and Tullo is on fourth by 8532ha.

Table 4. Area covered by irrigation

No	District name	Area covered by irrigation/ ha	Rank
1	Oda Bultum	11260	first
2	Tullo	8532	second
3	Gemechis	7754.8	third
4	Miesso	2993	fourth

Source: (ZIA, 2015)

3.5. Major crops cultivated by irrigation

The major crops cultivated using irrigation in the area are high value crops such as tomato, onion, pepper, cabbage, carrot, red root, garlic onion and potatoes are among the crops. The study shows, from total sampled respondents about 43.2% cultivated both hot pepper and tomato followed by combination onion, cabbage, red root & tomato by 19.9% (Table 5). About 78.5% house hold said the seed bed was prepared in September to November and the seed sown on the bed, then transplanted after one month.

Table 5. Major crops cultivated by irrigation

Major crops	Frequency	Percent
Tomato	17	11.6
onion	6	4.1
pepper/hot pepper	2	1.4
tomato & onion	19	13.0
Tomato and cabbage	5	3.4
hot pepper and tomato	63	43.2
Cabbage and onion	5	3.4
Onion, cabbage, red root & tomato	29	19.9

Source: Survey result of 2016

3.6. Irrigation season of the area

From total sampled house holds about 26.7% practiced irrigation from March to May, while most farmers practice irrigation from September to November by 14.2% (Table 6). The various season is due to irrigation is practiced in different agro ecologies. As shown from table many farmers practice irrigation from March to May.

Table 6. Irrigation Season and frequency of the area

Season	Frequency	Percent
Sept- Nov	25	14.2
Dec- Feb	22	12.5
Mar- May	47	26.7
Jun-Aug	30	16.8
sep- Feb	21	11.9
Sep- May	18	10.2
Dec- May	13	7.4

Source: Survey result of 2016

3.7. Topography of the Area

From the field observation the topographic features of the area is characterized by about 69.4% is flat land, 17.2% is rolling topography and 12.8% is undulating type. As shown on the Table 7, majority of the landscape of the area is appropriate for irrigation and has positive effect on irrigation practices and utilization.

Table 7. Topographic features of land on which irrigation practiced

	Frequency	Percent
Flat land	125	68.4
Rolling topography	31	17.2
Undulating	23	12.8
Total	180	100.0

Source: Survey result of 2016

3.8. Irrigation practices and Water management of the study Area

3.8.1. Source of water for irrigation

The development of irrigation and agricultural water management holds significant potential to improve production and productivity. Although Ethiopia has abundant rainfall and water resources, its agricultural system does not yet fully benefit from the technologies of water management and irrigation (Awulachew, 2010). As shown on the Table 8 below baseline survey conducted on irrigation status and potential in western Hararghe (Mieso, Tullo, Gemechis) shows different source of water were used for irrigation. From the result of sampled respondents, the source of water used for irrigation from river accounts 50%, spring (35.6%), Water harvesting (3.3%), Ground water (2.2%) and others (9%) respectively. The study shows, river is major source of water for irrigation with about 50% followed by spring by 35.6% and 14.4% others such as ground water, water harvesting and their combinations were used (Table 8). In addition, in terms of water source proximity to irrigated farm about 69.8% says the source is far from irrigated farm and 30.2% is closer to irrigated farm. Availability of water from these sources is decreasing from time to time due to decreasing rainfall amount, overpopulation and deforestation (64.6%). About 86.6% of the respondents said availability of water from these sources is decreasing and others responded increasing (7.7%) & maintained (5.7%) (Unpublished survey of MARC, 2010).

Table 8. Source of water for irrigation

Source of Irrigation Water	Frequency	Percent
Ground Water	4	2.2
Water Harvesting	6	3.3
Spring	64	35.6
River	90	50.0
Ground water and spring	6	3.3
Ground water , Spring + river	4	2.4
spring + river	6	3.3
Total	180	100.0

Source: Survey result of 2016

3.8.2. Type of irrigation practice and Methods used in study area

Small scale irrigation is widely practiced in the Ethiopia. Small scale irrigations include household water harvesting, hand-dug and shallow wells, flooding (spate), individual household-based river diversions and other traditional methods. The information related to small scale irrigation is not readily available and data about many water harvesting are extremely difficult to capture due to poor information management and availability of data (Teklu *et al.*, 2010).

Based on survey result carried out in the study area, farmers used about three types of irrigations (Surface irrigation, Pressurized irrigation and water harvesting). While some farmers used combination of surface and pressurized irrigation. Pressurized irrigation is use of motor pump from water source either from hand dug wells or harvested water or another source. The study revealed that surface irrigation only covers about 75%, 44% and 79.7% while combination of surface and pressurized irrigation covers about 21.7, 51.7 and 20.3% in Mieso, Tullo and Gemechis district respectively. Farmers used pressurized irrigation from water harvested were about 3.3 and 1.7% in Mieso and Tullo districts respectively. Mieso and Gemechis districts widely used surface irrigation only with about 75% and 79.7% respectively.

When we see as western Hararghe as a whole, farmers used surface irrigation only is about 66.2% followed by combination of surface and pressurized irrigation by about 31.2% and 2.6% others such as pressurized irrigation, combination pressurized irrigation and water harvesting at the same time. From this study, surface irrigation is dominant irrigation type in western Hararghe, on areas where irrigation potential practiced. From surface irrigation furrow irrigation accounts about 55.6% followed by combination of furrow and underground irrigation by 19.1%, combination of furrow and flood irrigation by 11.8% and 13.5% others used.

Table 9. Irrigation types practiced in the study area

Districts	Irrigation type practiced	Frequency	Percent
Mieso	surface irrigation	45	75.0
	Surface+ Pressurized irrigation	13	21.7
	pressurized & WH	2	3.3
Gemechis	surface irrigation	47	79.7
	Surface + Pressurized	13	20.3
Tullo	surface irrigation	28	44.8
	Surface + Pressurized	30	51.7
	pressurized & WH	1	3.4
Total		180	100

Source: Survey result of 2016

3.8.3. Constraints of water harvesting

In addition to irrigation small number of farmers practiced water harvesting for irrigation, domestic use and for other purposes. From sampled respondents, about 20.6% household used water harvesting for different purpose in the study area. Water harvesting in the area is constrained by shortage of equipment such as pond cover shortage (Geo membrane), siltation problem, seepage problem, rainfall shortage, lack of awareness and needs high labor (unpublished survey of MARC, 2010).

Table 10. Irrigation methods used by the respondents

Irrigation method used	Frequency	Percent
Furrow irrigation	99	55.6
Basin irrigation	5	2.8
Furrow and flood irrigation	21	11.8
Furrow+ underground	34	19.1
Furrow, border and underground irrigation	6	3.4
Furrow + flood + pumping irrigation	7	3.9
Total	178	100.0

Source: own survey 2016

3.8.4. Distance of water source from irrigated farm

The distance from water source to irrigated land have an effect on water utilization. For example if the distance between water source and irrigated land are far away from each other the amount of water is affected by seepage, sediments and evaporations. As it's shown on Table 11 water distance greater than 2 km is about 53.9% while distance less than 2km is about 46.1%. If the distance between water source and irrigated close to one another the loss due to seepage and evaporation due scheme is minimized.

Table 11. Distance between water source and irrigated land.

Variables	Frequency	Valid Percent
less than 1km	39	21.9
1km-2km	43	24.2
2.1km-5km	64	36.0
above 5km-10	28	15.7
above 10km-20	4	2.2
Total	178	100.0

Source: Survey result of 2016

3.8.5. Problem faced farmers during irrigation

Irrigation frequency (when apply) is important parameters during irrigation water utilization and management. As survey result shows about 30.2% household responded they use irrigation in scheduled manner while about 69.8% irrigate their lands at time they get water. Irrigating lands in unscheduled manner affects crop production and productivity. For example sensitive crops (shallow root crops) require irrigation frequently and when didn't get water on time their yield can be reduced below the potential. And also losses of water and soil erosion are common problems during irrigation. From total sampled households about 49.2% household faces losses of water and 61.1% were challenged by soil erosion. This loss of water may due to evaporation or seepage while problem soil erosion occurred due to topography of the irrigated land (Table 12).

Table 12. Problems faced during irrigation

Problems	indicator	Yes	no
Loss of water during irrigation	Frequency	87	90
	%	49.2	50.8
Soil erosion	Frequency	110	70
	%	61.1	38.9
Frequency Irrigation		In scheduled	At time of get
	frequency	54	125
	%	30.2	69.8

Source: Survey result of 2016

3.8.6. Challenges and constraints of irrigation in the study area

Some challenge faced the farmer when they practice irrigation. Among them greater challenges were; un availability/shortage of water, lack of improved seed, disease outbreak, low performance of scheme due to sedimentation and seepage, technical problem and labor shortages are among the major problems faced households. As a study shows, based on severity of problems shortage of water for irrigation accounts about 52.5% followed by lack of improved technologies by 24.1% (such as technical problem, inputs preventing seepage and evaporation, etc.), lack of improved seed/inputs by 9.1% and combination of water shortage/unavailability and disease problem are among the identified major challenges faced farmers (Table 13). Water management association was established to schedule irrigation for farmers.

Conflicts between farmers within the same irrigation blocks occur mainly due to issues related to sharing of irrigation water and water theft. So, water management association should be effective in scheduling irrigation for farmers. As suggested by Amede (2014) the water shortage can be one the major causes of conflict between farmers. These above challenges were similar with study of (MoWIE, 2013) and (MoA, 2011), such as technical constraints and knowledge gaps as (1) inadequate awareness of irrigation water management as in irrigation scheduling techniques, water saving irrigation technologies, water measurement techniques, operation and maintenance of irrigation facilities, (2) inadequate knowledge on improved and diversified irrigation agronomic practices, (3) shortage of basic technical knowledge on irrigation pumps, drip irrigation system, sprinkler irrigations, surface and spate irrigation methods (4) scheme based approach rather than area/catchments based approach for the development of small scale irrigation schemes, (5) inadequate baseline data and information on the development of water resources, (6) lack of experience in design, construction and supervision of quality irrigation projects, (7) low productivity of existing irrigation schemes, (8) inadequate community involvement and consultation in scheme planning, construction and implementation of irrigation development, (9) poor economic background of users for irrigation infrastructure development, to access irrigation technologies and agricultural inputs, where the price increment is not affordable to farmers.

Table 13. Challenges and constraints of irrigation

challenges	Frequency	Percent
water shortage	94	52.5
Lack of seed/input available	16	9.1
diseases out break	4	2.2
water shortage and disease out break	14	7.8
Lack of improved technology	43	24.1
Labour & transport shortage	8	4.5

Source: Survey result of 2016

3.8.7. Extension Service given for farmers on irrigation

The study shows that, from total sampled respondents about 85.3% obtained extension service from different organization while about 14.7% household didn't get extension service on irrigation from any organization. The different organization gives extension service for farmers on irrigation were bureau of agriculture and rural development through DA, irrigation authority and NGOs play important role in the area. From total sampled respondents about 75.1% of household got extension service on combination irrigation water management, application of water, irrigation scheduling and utilization of improved seeds while about 6.1, 1.2, 1.2 and 3% trained on irrigation water management, application of water, irrigation scheduling and utilization of improved seeds respectively (Table 14). Even if extension service is given for farmers, those above mentioned problems are still a problem in the area

Table 14. Extension service given for farmers

Extension service type	Frequency	Percent
water management	10	6.1
Application/supply of water	2	1.2
Irrigation scheduling	2	1.2
Utilization of improve. seeds& other input	5	3.0
Combination of all	124	75.1
Nothing	22	13.3

Source: own survey of 2016

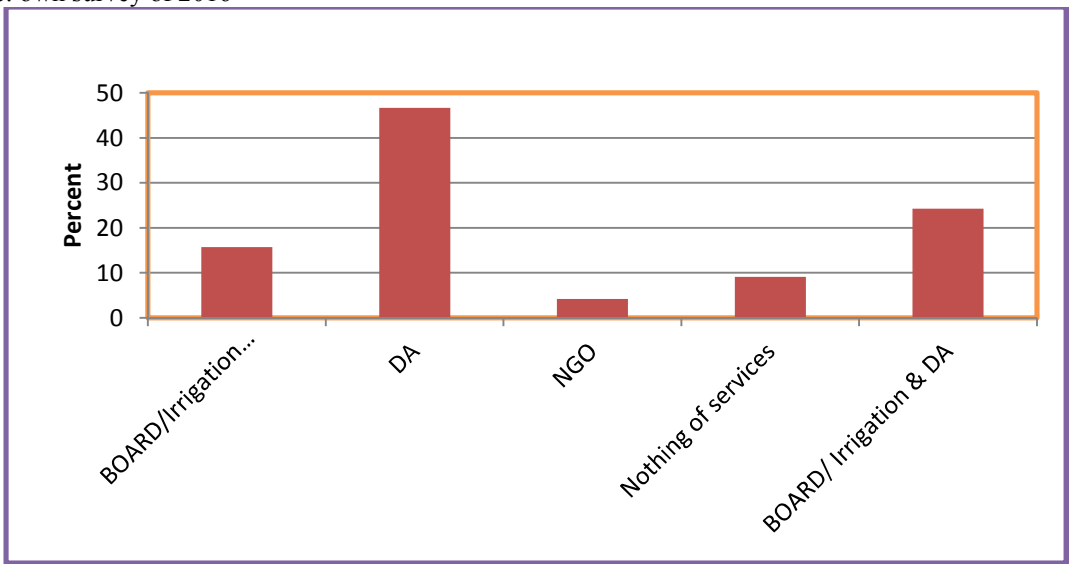

Figure 2. Extension service given for farmers by different stakeholders

3.7.8. Opportunities of irrigation

The basic opportunities considerations regarding irrigation practices in the area are; emphasis and priorities are given to irrigation in the area due to drought problems, indigenous knowledge and introduction of promising household water harvesting and micro- irrigation technologies, Government's commitment and encouragement in irrigation development are among opportunities exist in the study area.

4. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

This research work was done in western Hararghe in three districts namely Gemechis, Mieso and Tullo where climate change and drought were common problems, to assess and know the status of irrigation practice, to identify constraints, challenges and opportunities of irrigation on agriculture for the future use. Irrigation is considered as a basic strategy to alleviate poverty and enhance food security. According to the survey result, the mean land holding per household is about 0.78ha while the mean land allocated for irrigation per household is about 0.68ha in the study area. Three different types of irrigation were identified; among them surface irrigation, pressurized irrigation and water harvesting. While some farmers used combination of surface and pressurized irrigation. Surface irrigation type using furrow method of irrigation is the most common irrigation type in the study area which accounts about 66.5%. River is major source of water for irrigation with about 50% followed by springs by 35.6% and 14.4% others such as Groundwater, water harvesting and their combinations were used. In addition, in terms of water source proximity to irrigated farm about 53.9% of household says the source is far (greater than 2 km) from irrigated farm and 46.1% is closer to irrigated farm with less than 2 km. If the distance between water source and irrigated close to one another the loss due to seepage and evaporation due scheme is minimized.

However, due to many constraints, the efficiency of irrigation is not satisfying users of irrigation. Thus, as observed from the result there are many challenges faced farmers while practicing irrigation. The major constraints that highly affect irrigation practices in the study area are shortage of water for irrigation due to erratic rainfall. Soil erosion from the irrigated field, source of water diverted from the river by weir construction is far from the irrigated land even more than 20km causes loss of water due to sedimentation and evaporation and flow to the field through the canals, most farmers irrigate their land twice per month.

The most widely cultivated crops by irrigation in the study area are Khat and horticultural crops such as Onion, garlic, potato, carrots, tomato, cabbage, hot pepper and red root. All the crops produced in the study areas are produced with many challenges. The problems redundantly raised with the production under irrigation are

unavailability of improved horticultural crop varieties, disease outbreak especially with tomato. Therefore the irrigation practices in the study areas are full of challenges and constraints from water source up to production, and then finally market accessibility and road problem.

4.2. Recommendation

Even if extension service was given for many farmers by different stakeholders isn't sufficient especially on efficient utilization of water, agronomic practices (all management and fertilizer application methods), disease management, post harvest process and supply of input.

Therefore, awareness creation on above mentioned problems should be introduced in the study area to improve the irrigation water use efficiency. Promotion of soil and water conservation integrated with irrigation water application is needed to control the loss of water from the irrigated field and also lining the canal, canal maintenance, removal of sediments and unwanted weeds from the canal is very important to control the water loss from the canal. Also, developments of ground water and water harvesting practices for irrigation water source become more effective since river dried when rain fall decreased. As well as promotion of soil and water conservation on upper stream of irrigation is important to enhance recharge water and improve water availability. Because of farmers wait rainfall even for irrigation as supplementary irrigation. In the absence of rainfall, the volume of water reduced and also dried in cropping season. This leads to food insecure in lowlands of the study areas. Therefore ground water development and water harvesting is the best option for effective production through irrigation. Provision of training and awareness on irrigation practices and utilization, irrigation water management, crop production, disease protection, all agronomic practices should be introduced in the study areas. In addition to this, provision of credit services in kind such as improved varieties based on farmers' needs, chemicals and inputs is a must to be more effective. Finally, market and road accessibility promote farmers and they might become more effective

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