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RESEARCH ARTICLE

Popularization of Finger Millet Production, Value Addition, and Marketing in Wayu Tuka Wereda, East Wollega Zone

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Abstract

Finger millet is one of the most important food cereals and the crop is among the food security crops, widely used for food, local beverage preparation, and animal feed. In Ethiopia, the crop is mainly grown in the northern, northwestern, and western parts of the country, especially during the main rainy season. The nutritional value of the grain is high and it is used as an important staple food and generally consumed as Porridge. However, traditional farming practices such as sowing without fertilizers, lack of improved seed, low productivity of soil, inappropriate land preparation, lack of awareness on production value addition and marketing problems, and postharvest losses result in low production and productivity in the study area. Therefore this study aimed to popularize addition and improved Finger millet Variety production, value addition, and marketing in the study of the area. Thirty target farmers were selected purposively depending on their interest, acreage of lands they hold, and the numbers of target farmers were identified by using Yamane's sample size determination formula. Data was collected by using interviews and analyzed by percentage, frequency, and table ranking. The derived result indicated that the finger millet production was ranged from 17.44-19.2 qt/ha with an average of 18.20 (Qt/ha). On the other hand, after the training session, the targeted farmers increased their knowledge to 86.67, 90, 80, 90, 86.67, 96.67, 83.33, and 86.67% on improved Finger millet seed variety (Boneya), row spacing, fertilizer rate, seed rate, sowing/planting, weed control, and harvesting/threshing, respectively. As result, the value additions were increased by Place, time, and form to make a favorable market and better price, harvesting on time, storing perfectible condition when there is a favorable storage area, and change into the local brewery, mixed with teff for preparation of Enjera. Finally, the project contributed 2534.68 birrs profit and knowledge on land preparation, sowing method, weeding, fertilizer application rate and amount, harvesting time, and marketing awareness to the farmers. Generally, the research result indicated that improved Finger millet seed variety production is high, best suited to ecology, and greater than local practices were achieved in the demonstration site. Furthermore, the farmers should adapt to the use of new technology to increase their production and productivity of Finger millet, they must join forces and work together in forms of cooperatives.

Keywords: Finger Millet, Production, Marketing, Constraint, Ethiopia

Introduction

Background of the Action Research

Finger millet (*Eleusine coracana*) Poaceae ranks third in importance among millets in the world after pearl millet (*Pennisetum glaucum*) and foxtail millet (Setaria italic) (Gebreyohannes A. 2021). Millets are in the family of cereals grown globally with differential importance across continents and within regions of the world. They form a diverse group of small grains cultivated in diverse environments, mostly in the dry, semiarid to sub-humid drought-prone agro ecosystems with average annual rainfall at 800- 1000 mm. The nutritional value of the grain is high and it is used as an important staple food and generally consumed as Porridge. This observation has scientific merit in that finger millet contains a relatively higher concentration of calcium and dietary fiber than other cereals (Adugna A. *et al.*, 2011). Finger millet is one of the important food crops in Ethiopia. It plays a significant role both as food grain and animal feed in areas where production of other cereals is reduced by marginal environments. As a result of increased drought and soil fertility degradation, a growing number of farmers are resorting to finger millet, and thus the area allocated for this crop has significantly increased over the last ten years (Bezaweletaw K. *et al.*, 2007). Finger millet (Degussa) is an indigenous food crop to Ethiopia and occupies an average 5% (228,000 ha) of the total area covered by cereal production and accounts for 4% of total cereal yield annually. It is an important crop in different parts of the Oromia region such as Wollega, Illubabor, Eastern Hararghe, and Arsi, and from the Amhara region. The grain is used for making traditional fermented liquors, Tella and Areki. The flour of finger millet alone or with a mixture of teff (*Eragrostis tef*), Maize (Zea mays) and Barley (Hordeum

vulgare) is commonly used for making injera and bread. Traditionally, porridge prepared from finger millet flour is believed to cure diarrhoea and malaria and the straw is used for animal feed and thatching roof (Bezaweletaw *et al.*, 2007). The greatest value of finger millet is it can be stored for about ten years without damage by weevils, but with little bird damage, which makes it a perfect food grain commodity for famine prone areas (Erenso *et al.*, 2009; Asfaw *et al.*, 2011). The yields of finger millet are low in Ethiopia due to different production problems including: shortage of improved varieties, little research emphasis given to the crop, non-adoption of improved technologies, poor attitude to the crop, disease like blast which is the most serious disease, lodging and moisture stress in dry areas, threshing and milling problem are some of most serious production constraints in finger millet production in Ethiopia (Tsehaye & Kebebew 2002). Finger millet is grown in Wayu Tuka woreda mainly for consumption and for marketing purpose. Because of farmer attitude is not fulfill believed the millet as source on income. However, the yield potential of the commodity is below the potential yields that is 8.5 quintals/ ha. Therefore this action research proposal is necessary to improve farmer's knowledge and application regarding to millet growing, and to solve production problems of finger millet variety in Gute Badiya kebele, Wayu Tuka woreda.The yields of finger millet are low in Ethiopia due to different production problems including: poor agronomic managements and Lack of improved varieties (Woyema A. 2013).Despite large area coverage and known crop in the study area millet production, value addition and marketing are still low due to several known and unknown reasons. In the 2017/2018 crop calendar, about 425 ha was covered by millet in the Gute Badiya kebele (WAO 2018). From this area about 14662 quintal of yield was obtained. Thus, the productivity of millet in the area seems to be low i.e. 8.5 quintal/ha. But, with recommended applications for millet, it is intended to produce about 16 quintals/ha. The major problems lead to low productivity were Lack of awareness on spacing, Seed rate, fertilizer rate, Lack of awareness on product value addition and its marketing and shortage of improved seed variety, agronomic practice varieties. Other related problems are lack of farmers' awareness and lack of using Agricultural technologies, most of the farmers use local seed or old millet variety with poor growing practice and poor land productivity, Shortage of good storage and awareness of storing for long time. Therefore this action research proposal was done to solve those problems in the study area with the objective of popularization of finger millet production, value addition and marketing.

Literature Review

Theoretical Review

Agro ecological adaptation of finger millet is a short-day plant with a growing optimum twelve hours of daylight for most varieties. Its main growing area ranges from 20° N to 20° S, meaning mainly the semiarid to arid tropics. Nevertheless, it is generally considered as a drought tolerant crop. The majority of worldwide finger millet farmers grow it rain fed, although yields often can be significantly improved when irrigation is applied. The optimal average growth temperature ranges at about 27 °C, while the minimal temperatures shouldn't be lower than 18°C. Relatively to other millet species. Finger millet has a higher tolerance to cool temperatures. It is grown from about 500 m above sea level up to about 2400 m above sea level. By that, it can be cultivated on higher elevations than most tropical crops. Finger millet can grow on various soils, including highly weathered tropical lateritic soils. Furthermore, it can tolerate soil salinity up to a certain extent. (Erenso *et al.*, 2009; Asfaw *et al.*, 2011). Its ability to bear water logging is limited, therefore good drainage of the soils and moderate water holding capacity are optimal National Research Council (1996).Finger millet can tolerate moderately acidic soils (pH 5) but also moderately alkaline soils (pH 8.2).

Production trends

Worldwide, the area sown to millet has remained relatively stable at around 38 million hectares for the past two decades. Both production and yield increased by a little over 10 percent through the 1980s, but have remained unchanged since then. Current global production is about 28 million tons, and average yields are 0.75 t/ha. At a regional level, however, there are sharp differences in trends, especially between the two main producers, Asia and Africa.

Production constraints: Millet production in the developing world, particularly in Africa, suffers from a number of constraints - poor soil fertility, low and erratic rainfall, high temperatures, widespread Striga infestation, downy mildew disease and loss of grain to birds. Population pressures have led to a shortening of fallow periods, which in turn has accelerated the decline in soil fertility. These processes have also prompted the expansion of millet into more marginal lands. The impact is evident in the declining yields of millet in the major producing countries in Africa (Niger, Mali, and Nigeria) over the past 15 years. Similar trends are also evident in the harsher millet production environments in Asia. Threshing and cleaning as after the first harvesting National Research Council (1996).

Empirical Review

Finger millet is an annualherbaceousplant widely grown as a cereal crop in the arid and semiarid areas in Africa and Asia. And self-pollinating species probably evolved from its wild relative Africana. National Research Council (1996).

Cropping systems: Finger millet monocots grown under rain fed conditions are most common in drier areas of Eastern Africa. In addition, intercropping with legumes, such as cowpea or pigeon pea, are also quite common in East Africa. Tropical Central Africa supports scattered regions of finger millet intercropping mostly with legumes, but also with cassava, plantain and vegetables National Research Council (1996).

Weed control: Weeds are the major biotic stresses for finger millet cultivation. Its seeds are very small, which leads to a relatively slow development in early growing stages. This makes finger millet a weak competitor for light, water and nutrients

compared with weed. In East and Southern Africa, the closely related species *Eleusineindica* (common name Indian goose grass) is a severe weed competitor of finger millet. Especially in early growing stages of the crop and the weed and when broadcast seeding instead of row seeding is applied (as often the case in East Africa), the two species are very difficult to distinguish National Research Council (1996).

Harvest: Crop does not mature uniformly and hence the harvest is to be taken up in two stages. When the ear head on the main shoot and 50% of the ear heads on the crop turn brown, the crop is ready for the first harvest. At the first harvest, all ear heads that have turned brown should be cut. After this drying, threshing and cleaning the grains by winnowing. The second harvest is around seven days after the first. All ear heads, including the green ones, should be cut. The grains should then be cured to obtain maturity by heaping the harvested ear heads in shade for one day without drying, so that the humidity and temperature increase and the grains get cured. After this drying, threshing and cleaning as after the first harvesting National Research Council (1996)

Storage: Once harvested, the seeds keep extremely well and are seldom attacked by insects or molds. Finger millet can be kept for up to 10 years when it is threshed. Some sources report storage duration up to 50 years under good storage conditions. The long storage capacity makes finger millet an important crop in risk-avoidance strategies as a famine crop for poor farming communities.

Nutritional value of finger millet: Finger millet is having excellent nutritional value. As it contains 6% to 8% protein, 1% to 1.7% fat, starch 65% to 75%, minerals 2% to 2.25% and dietary fiber 18% to 20%. Its proximate composition is superior to wheat, millet, sorghum and rice with regard to dietary fiber, calcium and few micronutrients. The seed coat of this millet is rich source of phenolic compounds, minerals and dietary fiber. Value Added Products from Finger Millet.

It can be used in a variety of ways and is a great substitute for other grains such as rice and other starchy grains. Some of the examples of value added products and possibilities of utilizing this minor millet as one of the basic ingredients are discussed below. These products are either in practice or have been demonstrated for enhancing consumption of this particular millet. Papad from finger millet flour 15-20% (w/w) along with other essential ingredients such as black or green gram, rice and spices is also prepared in which it is used as base material. In this flourish first cooked in water till it is gelatinized and dough is prepared. From this dough thin sheet are prepared by rolling it and cutting into desired shapes and sizes followed by drying of these papa pieces to desired moisture content of 7- 8% (db). However it gives a little dark color to the papadasthe per carp is not separated out from the starch, which again upon frying or roasting turns to lighter with good consumer acceptability.

Wheat and finger millet in the ratio of 7:3 (wheat: finger millet) is suitable for making chapatti (roti). In this proposed blend, though the gluten content is reduced the making of flattering chapatti is not affected. Moreover, the color of the chapatti turns to slightly dark. Fortification of finger millet in chapattis not only improves the taste but also controls glucose levels in diabetic patients very efficiently. Slower digestion rate and bulkiness of the fibers makes us feel fuller on, fewer calories and therefore may help to prevent from eating excess calories. In addition Finger millet fiber content is helpful to the individuals having the problem of constipation.

Research Methodology

Description of the study Area

Gute Badiya kebele is located in Wayu Tuka Wereda, East wellega zone of Oromia Regional State. The agro ecological zone of the kebele is woina dega. The altitude ranges from 1600 to 1900 M.A. S.l. Annual average rainfall of approximately 1000mm and average annual temperature of 21°C. Majority of the soil type is sandy silt. The kebele has total land coverage of 3143.51 ha. From the total land coverage, about 1714ha is covered by different annual crops. The major crops grown in the area are teff, millet, sorghum, pulse crops, oil crops, etc. Millet is widely grown crop in the area. The total farmer households of the kebele are 524 (452 male and 72 female). The total populations of the kebele are 2844 (1501 males and 1343 females).

Key recommendation

According to Bako Agricultural Research center the followings are key recommendations for sorghum production. Tab. 1.

Sampling size and sampling technique

The total population of farmers in Gute Badiya Kebele was 524 (452 male and 72 female) and out of these 232 are growers. From those producers 70 respondents (60 male and 10) women were selected as representative by using Yamane's sample size determination formula by using purposive sampling techniques considering their willingness, and area of land they could allocate for the research purpose. Due to budget and time shortage the actual sample size were reduced to 30 by considering the farmer's willingness, and area of land they could allocate for the research purpose.

$$n = \frac{N}{1 + Ne^2}$$

n= 232/ (1+232*0.1²) =70

Whereas n=sample size, N= growers, e= margin of error

Data source and Method of data collection

Data source: Both qualitative and quantitative data were collected from respondents, woreda expert, DAs and neighborhoods'.

Secondary data sources were include from Internet, documents, Woreda agricultural office. Tab. 2.

Method of Data Collection: The data were collected by using: - interview and observation on practice of farmers.

Method of Data Analysis

Data were analyzed using by descriptive statistics such as percentage, table, and frequency distribution.

Research Deign

Materials and inputs used

Materials: During the project activity from the beginning up to the end of the project period the materials used was meter tape for measuring the plots, strings for layout, peg, and cultivation equipment for field preparation.

Inputs: According to this, the input we used was improved Finger millet (Boneya variety), fertilizer like NPS and UREA are given for the respondents by the supporting of Wayu Tuka Woreda agricultural office.

Implementation of the project

Orientation: The project implementation was started from the middle half of March 2020 Since to September 2020 as the project seated time. During March, the first communication was held with all clients those are the district officer, DA of the district target farmer, and other concerned stockholders. The project Designee and work plan was manifested to whom the concerning of stockholders and to the main clients that of target farmers. This work relationship and work plan was oriented by a researcher individually at home and at field. And then, convincing was done what they have to do after they understand this research work plan and field Orientation.

Table 1. Variety of Finger Millet (Boneya varaities)

Ref	Adaption area	Key recommendations
1	Altitude	1600 masl to 1900 masl
2	Rainfall	800mm to 1000 mm
3	Fertilizer rate	
4	DAP or NPS	100 kg
5	UREA	50 kg
6	Planting date	June 05 to 08/2020
7	Seed rate per/ha	15 kg
8	Frequency of ploughing	3 times to 4 times
9	between rows	30 cm to 40 cm
10	Depth of sowing	3 cm to 4 cm
11	Weed control	2 times to 3 times

Table 2. Research Deign.

Objective	Specific data required	Source of data	Method of data collection	Method of data analysis
Production objective To increase the productivity of finger millet Variety from 8.5q/ha to 16q/ha among 33 target farmers in year 2020	Knowledge on variety Spacing Seed rate Fertilizer rate Land preparation Sowing time Sowing method Harvesting	Millet producers men 30	Interview Group discussion observation	Descriptive Statistics Table Percentage Frequency
Value Addition Objective To establish improved storage and reduce postharvest losses of finger millet in the study area for30 producers on year 2020	Value addition along PHM Drying Threshing Grinding Packing Storing	Millet producers men 30	Interview Group discussion Observation	Descriptive Statistics Table Percentage Frequency
Marketing Objective To organize 30 farmers in farmers in cooperative to facilitate the market linkage system in the study area in year 2020	Marketing information Market outlet Market price Market actors	Finger millet producers men 30	Interview Group discussion Observation	Description Statistics Table Percentage Frequency
Learning Objective To evaluate the effectiveness of 82 farmers' mass extension method (Community field days, Brochure, Farmers Round visit, group training) for the farmers and mass extension method in year 2020.	Information about best practice Farmers' experience New technology Feedback of the project	Finger millet producers men 30	Interview Group discussion observation	Description Statistics Table Percentage Frequency

Conducting Training: Training is about extending and developing individual's capabilities (attitude) for better performance in their job. According to need assessment survey of last year farmers need more training on all agronomic practices, especially on use of improved seed and its management activities. So, because of these different training method was conducted. The training techniques are individual and demonstration was conduct in the project implementation. The training was given for 30 target farmers. The conducted training has:-

- Importance and objectives of project.
- Land preparation
- Way of sowing or planting (time, spacing amount of fertilizer used, seed rate)
- Management system: -
    - weed control
    - urea application
    - harvesting time
    - storage system
    - The way of reducing postharvest loss.

The training was focus on knowledge, skills, experience and attitudes on the technology and to create sustainability of the technology, finally to solve the problem that they already faced. In addition, the training was mainly to increase the capability of the farmers on the introduced technologies. Before the training has given, the target farmers knowledge and skill was measure.

Use of Improved Seed

The farmers were used improved Finger Millet variety which are supported by Wayu Tuka agricultural office for action research implementation and distributed to farmers April 2020.

Land preparation: Fig.1. Land preparation is required during the dry season while the soil has sufficient moisture and it is to avoid weeds. Land preparation involves plough, harrowing and leveling the field to make it suitable for crop establishment. Human resource, draft animal (such as oxen) can be used as power sources in land preparation. The land was plough three to four times before sowing and finally the seed was sow.

Sowing: The demonstration plots were sown at early June directly in the field using recommended spacing. The spacing between rows was 30-40 cm Fig. 2(a,b). And seed rate was 15 kg per hectare.

Weeding: During implementation of the project weeding three times suppresses weed growth. Fig. 3(a,b). the first weeding was two to three weeks after planting. The second weeding was four to five weeks after sowing and the last weeding is two to three

Figure 1. Land preparation and layout, Source Own caption (2020)

Figure 2. Sowing method of Finger millet.

Figure 3. Weeding practices in the study area.

Figure 4 Monitoring

weeks after the second weeding.

Fertilizer Application: NPS are used during sowing with the ratio of 100 kg/hector by using Drilling application before the seed drilled and cover 2.3cm by wet soil. UREA is also used within the same procedure after the plant is germinated 30-40 days using Drilling application with depth of 3-5cm between the millet seedlings and cover with the soil to reduce the volatilization. Increases in production of millet must come largely from high yield/unit area/unit time, which require the application of better technology, particularly of fertilizer at the farmer's level.

Monitoring and follow up: Fig. 4. Monitoring and follow up was done starting from the Site selection up to harvesting. The following was done not only by the researcher but it was supported by DA of the Kebele.

Extension Methods Used

Individual extension method: During the project implementation the researcher made farm visit on target farmer's farm. The home and farm visit were used to monitor performance of the work, to evaluate the management status of the grown seed and finally to give technical support.

Group extension method: This method was use when selection of target farmers was making, during problem identification and prioritization, during different data collection, at the time of training and during field day.

Field Day: Field days are important activities to disseminate knowledge to the farmers. These are given farmers the chance to showcase their achievements, such as field experiments, best practice to others. The host farmers share information and farming practices with participants and engage in discussions to learn from each other.

Field day was conducted to accomplish the following objectives:-

1. To learn from the successes and good practices of other farmers
2. To get new ideas and new solutions to production and marketing
3. To discuss these ideas with other farmers and stakeholders

The field day was accomplished in November 13/2020 and the participants were 60 farmers (male 52 and female 8), 4 DAs of the study area and 2 woreda expert.

Consequently, 60 farmers participated in field day; observed and learned about improved Finger millet variety of Boneya, row spacing, sowing/planting, weed control, harvesting and threshing, storage& marketing, and identify the merit of new technology through discussion and field observation.

Harvesting and threshing: The finger millet was harvested from December to mid-January while threshing is done from January to March. Threshing of finger millet involves three steps, namely, whole threshing (separating the straw7 from the head), head threshing (separating the seed from the panicle) and finally husk threshing (separating the husk from the seed).

Storage: The target farmers were become changed their storage system, before we done this activity they store the products on the field and it is damaged by direct sun light. This value addition was achieved through making of a good storage for the product around their home by using local materials and store, the products without any damage up to market day. Farmers were identified their value addition gap, and the way of storage of the product. Farmers identify well how they added value, and they are used quality product. The target area of the farmers use value addition through time utility and they added value by the aiding of quality storage.

Marketing of Finger millet: In the study area the price of a quintal (=100 kg) of finger millet grain at harvest was much lower than the price of the same unit and quality of grain during the rainy season. Therefore, the farmers were stored the produced product for six more months. The action research was solved by improving awareness, advising the farmers, and making target farmers cooperation.

Result and Discussion

Characteristics of target farmers

Age of respondents: The results of households in the age group are presented in Tab. 3. The results revealed that (14)46.67% of the household's heads were in the age group of 20-35, (12)40% of the sample respondent were in the age group of 36-50 years, and (4)13.33% were above 51 years farmers from the respondents.

Sex of Respondents: The results of sex of farmers are presented in Tab. 4. The results revealed that out of 30 interviewed

Table 3. Age of respondents

Age	Frequency	Percent %
20-35	14	46.67
36-50	12	40
51 and above	4	13.33
Total	30	100

farmers 30 (100%) of them were male headed households. This might be due to the interests of the males farmers producing Finger millet were higher than the female.

Education level of Respondents: The results of education level of the respondents are presented in Tab. 5. The result showed that about 20, 40, 33.33, and 6.67 percent were farmers had adult education, attended elementary, junior School, and twelve complete, respectively. Therefore, educational status of the household head is also an important element in smallholder economic activities.

Land holding of the respondents: Tab. 6. shows that the respondent have 3(10%), 7(23.33%), 10(33.33), and 10(33.33%) hectare of land, 0.5, 0.5-1, 1-1.5 and greater than 1.5, respectively.

Development Objective: The results of Finger millet Yield obtained during the project implementation of 30 households are presented in Tab. 7. The result showed that the productions of Finger millet (Bonaya varieties) were ranged between 17.44-19.92(Qt/ha) with an average of 18.20 (Qt/ha) while ranged 2.18-2.41 at site plot of 0.125 with average of 2.27 in Gute Badiya kebele, Wayu Tuka Woreda, East Wollega Zone of Oromia Regional state. Thus, totally the yield produced by all target household heads (30 farmers) was 68.08qt/ha from the cultivated area of 3.75ha. This indicates the effectiveness of training, demonstration and farm round visit in the project implementation and Finger millet can plays a critical role in smaller holder livelihood and food security.

Learning: Tab. 8 shows the results of knowledge assessment 30 targeted farmers during project implementations. Knowledge

Table 4. Sex of target farmers

Variables	Items	Frequency
Sex	Male	30
	Female	0
	Total	30
	30	100

Table 5. Education level of Respondents

Education	Frequency	Percentage
Adult education -	6	20
Elementary	12	40
Junior high school	10	33.33
Twelve complete	2	6.67
Total	30	100

Table 6. Land holding of the respondents

Land size of target famers(ha)	Frequency	Percentage
0.5	3	10
0.5-1	7	23.33
1-1.5	10	33.33
>1.5	10	33.33

Table 7. Yield (output) obtain during the project implementation among target farmers

No	Target Farmers	Size plot/ha	Types of Seed varieties	Yield/output in Qt/plot	Total yield(Qt/ha
1	TD	0.125	Bonaya	2.4	19.2
2	DM	0.125	Bonaya	2.35	18.8
3	TT	0.125	Bonaya	2.25	18
4	TW	0.125	Bonaya	2.23	17.84
5	BH	0.125	Bonaya	2.25	18
6	MT	0.125	Bonaya	2.26	18.08
7	DT	0.125	Bonaya	2.27	18.16
8	AM	0.125	Bonaya	2.25	18
9	AS	0.125	Bonaya	2.24	17.92
10	GM	0.125	Bonaya	2.25	18
11	QW	0.125	Bonaya	2.23	17.84
12	DK	0.125	Bonaya	2.21	17.68
13	MR	0.125	Bonaya	2.27	18.16
14	AH	0.125	Bonaya	2.24	19.92
15	TW	0.125	Bonaya	2.41	19.28
16	TM	0.125	Bonaya	2.31	18.48
17	MS	0.125	Bonaya	2.3	18.4
18	MR	0.125	Bonaya	2.31	18.48
19	CA	0.125	Bonaya	2.36	18.88

20	WT	0.125	Bonaya	2.32	18.56
21	CB	0.125	Bonaya	2.21	17.68
22	DG	0.125	Bonaya	2.24	17.92
23	MA	0.125	Bonaya	2.26	18.08
24	KH	0.125	Bonaya	2.18	17.44
25	DB	0.125	Bonaya	2.2	17.6
26	NT	0.125	Bonaya	2.22	17.76
27	MY	0.125	Bonaya	2.22	17.76
28	SD	0.125	Bonaya	2.21	17. 68
29	BT	0.125	Bonaya	2.2	17.6
30	EB	0.125	Bonaya	2.27	18.16
Average		**0.125**		**2.27**	**18.20**
Total		**3.75**		**68.08**	**527.68**
Max.		**-**		**2.41**	**19.92**
Min		**-**		**2.18**	**17.44**

Table 8. Knowledge assessment before and after training

Measuring point on farmers	Before training				After training			
	M (30)	F (0)	Total (30)	%	M (30)	F (0)	Total (30)	%
Knowledge on improved seed variety of finger millet (Boneya)	17	-	17	60	26	-	26	86.67
Knowledge on row spacing	18	-	18	53.33	27	-	27	90
Knowledge on fertilizer rate	16	-	16	73.33	24	-	24	80
Seed rate	22	-	22	70	27	-	27	90
Knowledge on sowing/planting	21	-	21	63.33	26	-	26	86.67
Knowledge on weed control	19	-	19	60	29	-	29	96. 67
Knowledge on harvesting and threshing	18	-	18	60	25	-	25	83.33
Knowledge on storing	20	-	18	60	26	-	26	86.67

assessment test which was evaluated just before training session indicated that, 50%, 56.67%, 53.33%, 60%, 56.67%, 66.67%, 63.33%, and 60 of farmers have knowledge on improved maize seed variety (30G19, limu), row spacing, fertilizer rate, seed rate, sowing/planting, weed control and harvesting/threshing, respectively. On the other hand, after training session, the targeted farmers increased their knowledge to 86.67, 90, 80, 90, 86.67, 96.67, 83.33, and 86.67% on improved Finger millet seed variety (Boneya), row spacing, fertilizer rate, seed rate, sowing/planting, weed control and harvesting/threshing, respectively.

Value Addition and Marketing:

- By Place=selling in favourable market and better price.
- By Time=harvesting on time, storing perfectible condition when there is a favorable storage (Gotera)
- By Form=change in to local brewery, mixed with teff for preparation of Enjera.

Value addition means the entire system of production, processing and marketing of a particular product, from the inception to the final product through the value chain actors. It includes all the activities starting from seed supply until the crop is used by the consumers. Basically, when the above agronomic practices have been conducted properly easily we can add a value to our products. Throughout the project implementation the value addition was started by introducing Finger millet(Boneya varieties), improved seed variety, awareness creation on how they prepare the land, sowing method, fertilizer used and amount of application, weeding management, harvesting and storage techniques are given to farmers.

In order to improve marketing system of the farmers 'of Finger millet production, the training or awareness creation was provided to the target farmers how to cooperate, when to sell or at the price becomes high and direct contact with the users.

Deliverables (Expected results): Expected results can be viewed as what the project is trying to 'change' e.g. Change in income level, living standards and awareness level. It can be classified in two major groups.

Project Outputs: 56.25kg of improved Finger millet variety (Boneya) were disseminated to participating farmers and thus finger millet were increase from 17.44- 19.92(Qt/ha). Then the produced Finger millet were sold to cooperatives and neighbouring farmers. The participating farmers were collecting a profit of 2534.68 birrs throughout the project period. The farmers were also being benefited project from the technical support like training and awareness creation. Hence, these farmers can capacitate their ability of purchasing others for their children, use the Finger millet for house hold, food and use the maize stalk fire wood and as animal feed. (Tab. 9, 10).

Any benefit was seen regarding in its cost and benefit for the sustainability of project, the project's cost and benefit was done at starting up to the final stage. The cost of each management was recorded, that is 8770 birr per hectare. The general cost of the

whole plots was 32887.75 birrs, but income obtained was 108,928 birrs gross incomes thus the farmers are benefited from this project.

Gross Income = (Yield Produced*Price /qt)

68.08qt *1600birrs = 108,928

Net income= gross income – total cost

= 108,928 - 32887.75 = 76040.5 birrs

Therefore, each target farmer can obtain the net profit 2534.68 birr from 0.125heck.

Project Outcomes: Farmers were developed their knowledge and skill from the project. This was assured after the outcome of the project implementation. Thus, it has a vital role in their attitudinal change and benefited in their livelihood such as; -

- home consumption
- Increased income
- Educing of household debt and etc.

Knowledge Dissemination Used:

Table 9. Knowledge Dissemination used the following scheme were used to popularize the technology at larger scale.

Activity	No.	Key Messages
Training of target farmers	Individually	Starting from land preparation up to Harvesting to marketing
Community field days	1days	Show the difference b/n indigenous and new technology on d/t farmers field (On Finger millet preparation)
Extension material dissemination		Fertilizer (UREA, and NPS) and Finger millet
Trained farmers	30	Promotion Finger millet importance to farmers Promoting Finger millet variety in terms of production Management practice like: Land preparation, Sowing method, weeding fertilizer application rate and amount, Harvesting time, Marketing awareness.

Cost Benefit Analysis:

Table 10. Cost benefit analysis

No	Input/ha	Unit	Amount	Price	Total cost
1	Site selection	No	1	200	200
2	Land preparation	“	3	3*40*8	960
3	For sowing	“	16	50	800
4	Improved variety seed(10kg/ha)	Kg	10	30	300
5	Fertilizer	“			
	NPS	“	100	15	1500
	UREA	“	100	14	1400
6	Weed control	No	3	3*12*30	1080
7	Disease control	“	1	155	155
8	Control of storage insect pest	gm.	750	35/50gm.	525
10	Care and maintenance		1	400	400
11	Trashing	No	1	800	800
12	Storage	“	1	650	650
	Total cost	**-**	**-**	**-**	**8770**

Net income=gross income_ total cost= 45500-14500= 31000 birr
Benefit gained from this project was=31000birr

Conclusions

Based on the results obtained, the productions and productivity of improved Finger millet (Boneya) were increased because of increased knowledge of targets farmers through training on importance and objectives of project, land preparation, way of sowing or planting (time, spacing, amount of fertilizer used, seed rate), Management system (weed control, urea application, harvesting time, storage system) and the way of reducing postharvest loss. Similarly the value additions of the improved Finger millet increased due to awareness created during the project implementations. Regarding then the project contributed the output to the target farmers through generating income and disseminating new technology which used to change livelihood of farmers. Generally from this specific project, the respondents could benefit 31000 ETB.

Recommendations

Based on the obtained result from this action research:

- The farmers in the study area should be adapting to the project activities to increase their productivity and the production.
- The woreda agricultural office should take over the additional responsibility for the sustainability of the project through extension service so as to solve the problem of low income.
- Value addition and marketing information should be integral part of every extension activities at grassroots level.
- They must join forces and work together in forms of cooperatives to be able to benefit.

Competing Interests

The authors declare that they have no competing interests.

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