Pre scaling up of Teff Thresher in Selected districts of West Shewa and East Wollega Zones

Aliyi Abdulah[1] and Merga Workessa[1]
[1]*Bako Agricultural Engineering Research Center, Oromia Agricultural Research Institute*
Corresponding author: aliyiabdulahi@yahoo.com

Abstract

The pre-scaling up of engine driven teff thresher was conducted in 2021 with the objectives of promoting and popularize improved engine driven teff thresher and to create wider awareness through giving training and enhance stakeholder's participation. Two districts from each zone, one kebele from each district, were selected purposively from West Shewa and East Wollega zones with the cooperation of woreda BoANR. Accordingly, From East Wollega Leka Dulecha woreda (Hordaa Kawisa) and Digga (Jirata kebele) and From West Shewa Zone Dandi (Loqloqa Abba Kebele), and Liban Jawwii (Munyoo Tuuttoo). Twenty (20) farmers per kebele were selected purposively based teff production potential. Awareness created among more than 200 farmers (Table 2) on the availability and importance of teff thresher. Training was given for 60 farmers, 9 DAs and 11 SMS working West shewa and East Wollega zone. Farmers, experts and DAs feedback were also collected on performances of the machines, their perception in terms of time and labor-saving during Focus Group Discussion. The collected data was grouped, summarized, discussed and interpreted. Data was analyzed qualitatively based on the findings. Postharvest losses during traditional threshing were quite significant but were considerably reduced if the teff thresher will be employed. Farmers emphasized the need for the abundant availability of the machines. Building capacity among local manufacturers for teff thresher would increase their accessibility and get repair and maintenance for service providers. Non-availability of maintenance service at the nearby villages are major problems faced by farmers. Machine breakdowns and subsequent absence of maintenance and service providers led to low adoption.

Key words: *Demonstration, Teff thresher, thresher, teff, trainig*

Introduction

The cereal grain teff (Eragrostis teff [Zucc.] Trotter) is one of the major cereal crops of Ethiopia, where it is believed to be native to Ethiopia Teff Vavilov (1951) cited in Ketema (1997). Teff is Ethiopian's most important crop by area covered (23.85% of all land under cereal cultivation) and volume of production (52.8 million quintals), and the second most important cash crop after coffee (CSA,2018).

Some reports indicated that Teff is getting wider acceptance in international market, too. As gluten-free cereal, it is getting global attention and becoming one of the healthy grains (The Guardian, 2014). Therefore, there is potential for Teff to be the second gift of Ethiopia to the world after coffee.

Crop production in Ethiopia is small-scale. It is non-mechanized and well known for its large amount of human and animal power requirements. Traditional animal threshing in Ethiopia remains to be a major component of postharvest activities. Traditional methods of threshing by live animals and humans result not only in significant quantity and quality losses but are also time consuming and arduous (Asfaw et.al, 2011). Despite the important benefits of improved technologies to farmers, their use is limited in the Ethiopian agriculture. This imply a need for an improved technology to curtail this practice.

Regardless of its economic contribution and potential, Teff is a very tiny cereal, which is produced in a very drudgery system and has a number of problems in production and postharvest management. In production, the system is very drudgery and the yield was one of the lowest compared to other world cereals (Assefa et al., 2013). On the other hand, Teff is also a cereal that was subject to loss particularly during the harvesting and threshing processes.

The Teff threshing process is arduous, time intensive, and often keeps children out of school during harvest. In addition, grain is mixed with dirt, stones, and animal feces, making it unsanitary and unhealthy, and much grain is left on the stalk. Threshing is one of the postharvest operations that is mainly done in a traditional way in Ethiopia. Harvested teff, for example, is threshed using oxen or by beating the crop with a stick. This way of processing results in high losses and low-quality produce as grains get mixed with sand and other impurities (Dejene and Wondwossen, 2008). Moreover, time and labor required to thresh teff are high and farmers regard this activity as arduous but yet unavoidable. Threshing is accomplished by trampling a number of oxen or donkeys, treading around on a pile of the materials, or it requires four to six oxen working for three to four days to thresh crop harvested from a hectare. These are some of the bottlenecks during the harvesting season as human and animal labors are not easily available. Improved threshing techniques are required to minimize the loss.

According to the information obtained from the farmers, pre- and post- harvest losses account for more than 40% of yield loss in Teff. As the saying of Oromo people goes “Hamma ani badu otuu beekanii nan facaasani” jette xaafiini”. Meaning “Had they known how much of me is lost, they would not have grown me” said Teff (ATA; Teff Diagnostic Report; No, 2011). From this proverb, one can understand two important things: loss is serious problem of Teff farming system and knowing the exact loss amount is difficult. Therefore, there is clear call for the stakeholders to continue both in yield increasing efforts on one hand and reducing losses on the other hand.

To overcome the above-mentioned problem Bako Agricultural Engineering Research Center (BAERC) developed teff threshing machine to overcome teff threshing and cleaning challenges, thereby decreasing tremendous teff grain post-harvest loss because of traditional method of threshing and cleaning, due to lack of solely threshing machine of this Ethiopian golden crop.

The teff thresher is an engine-powered and portable mechanical “throw-in type” crop thresher equipment developed and modified by BAERC. Most of its parts are locally fabricated except for its power drive, diesel engine. The thresher can be loaded on donkey carts and can move from farm to farm. Outside a village, it can be transported from place to place in trucks and pick-up cars. It is, nevertheless, difficult to transport threshers to remote areas where the roads are not accessible to trucks or carts. The thresher machine has two outlets: the outlet for

teff straw and the outlet for grain. The threshing capacity of the machine is highly significant with both drum speed and feeding rate and not significant replication and any combination of the independent variables. As the feeding rate increased from 23 to 28 kg/min at constant drum speed of 700 rpm the threshing capacity increased from 314.1 to 366.9 kg/hr. respectively. The total grand mean of threshing capacity of the machine is 428.9 kg/hr. As drum speed increased from 700 to 800 rpm at constant feeding rate of 23 kg/min the threshing capacity of the machine increased from 314.1 to 448.2 kg/hr respectively. Increasing drum speed is attributed to the high threshing or beating force applied during threshing operation, that tend to consume more fuel and increase energy required (Merga W.,2016).

Pre extension demonstration of this teff thresher was conducted in West Shewa zone. The demonstration result shows that the thresher has the capacity to thresh 200 kg/hr. on average. The capacity of the machine depends on teff/grain straw ratio, feeding rate and teff variety. The maximum threshing capacity of the machine is 400 kg/hr. The thresher was recommended for pre scaling up based on farmers' feedback. Many demands are coming after the demonstration of the thresher. Therefore, this activity is aimed at pre scaling up of teff thresher.

Objectives

- ✓ To create wider awareness and demand on Bako model teff thresher
- ✓ To strengthen stakeholders' linkage and collaborations
- ✓ To identify bottlenecks for scaling up of teff thresher
- ✓ To collect feedback for further improvement of the teff thresher

Material & Methods

Description of the study area

The on-farm demonstration of the machines was conducted in Leka Dulecha and Diga districts of East Wollega zone and Dandi and Liban Jawi districts of West Shewa.

Diga district is approximately 346 kilometers from Addis Abeba and 15 kilometers from the town of Nekemte to the west. The area is bounded on the west by West Wollega Zone, on the east by Guto Gida district, on the south by Sasiga, and on the north by Leka Dulecha. Based on agro-climatic conditions, the study area is divided into two sections: middle altitude ranges (2100-2342 m.a.s.l.) and low land ranges (1200-2100 m.a.s.l.). Middle altitude accounts for 42 percent of total land area, while low land accounts for 58 percent. The district's total area is estimated to be 40788 hectares. This total land area is divided into arable land, grazing land, forest land, bushes and shrubs, construction, and other uses.

Leka Dulecha is one of the woredas in the Oromia Region of Ethiopia. It is part of the Misraq Welega Zone and it was part of former Diga Leka woreda. It's bounded by Nunu Kumba and Guto Gida in the east, Illubabor Zone in the west, Diga in the north, and Jimma Arjo to the south.

Dandi district is one of the West Shewa zone of Oromia regional state located about 80 kilometer away from Addis Ababa west side. The capital of the district is known as Ginchi. The altitude of the area ranges between 1200-3288 above sea levels and the average temperature is 16.55 degree centigrade with an annual average precipitation of 700-2300 mm per year. The major livelihood of the area is mixed farming which includes both cultivation of various crops and animal husbandry. However, crop cultivation is the major source of income for most farmers. The major crops grown in the area are cereals, pulses and root crops.

Liban Jawi district is One of the West Shewa Zone Oromia Regional State located to West. The farming system the district is mixed farming. Teff is one of the major crops grown in the district and threshing of the teff is traditional by animal trampling.

Material

The technology that was used for pre scaling up is teff thresher that was manufactured by BAERC. One teff thresher that was multiplied by the support of AGP II was delivered to an unemployed youth group.

Site and Farmers Selection

Two districts from each zone, one kebele from each district, were selected purposively from West Shewa and East Wollega zones with the cooperation of woreda BoANR. Accordingly, From East Wollega Leka Dulecha woreda (Hordaa Kawisa) and Digga (Jirata kebele) and From West Shewa Zone Dandi (Loqloqa Abba Kebele), and Liban Jawwii (Munyoo Tuuttoo). Twenty (20) farmers per kebele were selected purposively. One host farmer was selected based on their willingness, accessibility of their field. One group of unemployed youth was established to deliver a teff thresher that was multiplied by the support of AGP II.

Capacity building and wider dissemination methods

On farm demonstrations were organized in each *kebele*, and farmers came to learn about and evaluate the demonstrated engine operated teff thresher and farmers were able to compare with their traditional practices.

Approach in delivery of the thresher for the youth

Youth was selected with the cooperation of development agent and *kebele* representative in Lokloka abba, Dandi district. practical training was given for the youth on operation of the the machine for four consecutive days, memorandum of understanding was signed and the machine was handover to the youth.

Trainings of farmers and other stakeholders

Training was organized for farmers, DAs, SMS to upgrade their skills on importance, operation, management, and handling of teff thresher

Method of data collection

Both secondary and primary data were used. Primary data was collected through observation during demonstration and FGD after demonstration**.** The feedback was collected using focus group discussions (FGDs) in the demonstration site. One FGD was conducted in each kebele to learn about farmers' interests, perspectives, opinions and knowledge about teff thresher.

Knowing the perspectives, attitudes and desires is essential to know support services, and dissemination approaches.

Method of data analysis

The data was analyzed using descriptive statistics and through clustering the qualitative data. The result was interpreted and discussed in comparison with other findings. The data collected through focus group discussions were transcribed and translated. The results were organized using Microsoft Exce knowztttc Micro1-1((t)3)4(c)4wi wa(i)-2(t)-c-1(e)4(s)-1 intp diexmtta(i)

aba kebele and farmers in the kebele are interested and they take order from the youth to use the machine on hiring bases.

Farmer's feedback

They preferred to buy in groups but lack of supply is a big problem as private manufacturers are not interested in the manufacturing because most of them lacks a machine to manufacture the teff thresher and the other due to its huge size that consume their time and increase the cost of manufacturing of the thresher. Farmers indicated that the teff thresher have advantages over the traditional practice of threshing. But as the machine needs special skill technicians should be trained to repair and maintain machines and engines. The teff thresher will greatly reduce time spent and fatigue to farmers on the same operation. It is simple to use, completely threshes the heads, performs winnowing, and reduces fatigue especially to women. The FGD indicated that as youth, who are productive forces are not engaging in agriculture, this thresher is an opportunity to attract them to agriculture.

Selam type is giving threshing services in the area. However, the farmers preferred BAERC teff thresher as it has a winnowing mechanism. Consumers have developed a preference for machine-threshed teff because it is not contaminated by soil and animal excretions. Farmers indicated that they prefer to use teff thresher instead of the time consuming and labor-intensive traditional method. Saved time will allow them to do other agricultural activities. Many therefore still depend on oxen threshing although readily willing to use the machines. For lokloka aba kebeles that are recently introduced to the machines, there is a growing demand for the service as well as teff thresher.

Farmers realized the fact that teff threshing machine leads to labor and time saving at the same time profitable. The price of oxen was on the rise and many farmers kept their oxen away from threshing so that they gain better fattening and dairy outputs. Speed of threshing which saves time – four hours of threshing that used to take about 3-4 days under traditional methods; Labor cost is significantly reduced – only four persons are required unlike the traditional method which requires a larger number (about 8 persons) for effective threshing of similar amount of cereals. The quality of crop threshed is highly enhanced as there is no mixing with sand, soil, urine and dung of animals as was the case in the traditional method; The crop loss in the threshing process is highly reduced due to effective threshing which reduces un-threshed seeds, produce eaten by animals, losses in earth cracks in the threshing areas and spillovers.

Strengthening linkage

One of the objectives of pre scaling up activity was to create linkage among stakeholders. We attempted to build linkage with farmers and zonal and districts of BoA. The big challenge was to identify local fabricators of the teff thresher who could fabricate the machine, as multiplying is not the mandate of our center. This was planned to tarin local manufacturers so that private service providers could buy the thresher from them. Unfortunately, we didn't get interested manufacturers in the mandate area, their reason not to multiply the thresher is the material cost due to hugeness of the machine, lack of machines and etc. However, we didn't get manufacturers in the mandate area due to different reasons. In order to overcome this challenge local fabricators should be capacitated and supported to get machines at low prices materials such as steel products and machine elements

Challenges and Constraints for wider scaling up of the teff thresher

Some of the constraints identified during FGD are listed below

Susceptible to frequent failures and interruptions during operation. Frequent machine breakdowns especially, Arms of teff threshing machines, due to high vibration of the machine, However, repair and maintenance services are not available near to the farmers. Additionally, CHANFA diesel engine, 6.7 hp, which was used on the machine is low speed and it damaged frequently. The recommended engine ATMA is currently not available on market in Ethiopia. availability of market for spare parts, maintenance and entrepreneurs encourages farmers to invest on the machines.

lack of maintenance and repair services center for the thresher and engines. Lack of skilled individuals to maintain the machines and limited access to spare parts. The presence and active role of private owners and repair and maintenance service providers. Low purchasing power of farmers and non-availability of teff thresher near to farmers; Limited access to agricultural credit for farmers and local fabricators; High local production cost due to imported materials

Conclusions and Recommendations

Postharvest losses during traditional threshing were quite significant but were considerably reduced if the teff thresher will be employed. Farmers emphasized the need for the abundant availability of the machines. Building capacity among local manufacturers for teff thresher would increase their accessibility and get repair and maintenance for service providers. Non-availability of maintenance service at the nearby villages are major problems faced by farmers. Machine breakdowns and subsequent absence of maintenance and service providers led to low adoption. Teff threshing machine, tackles the next stage of the farming economy, introducing better threshing service – so that teff is not eaten by animal – and to save labor and improve post-harvest loss. The teff thresher is powered by petrol engines, and they are mobile, so they can be transported from farm to farm, or village to village. This facilitates the emergence of teff threshing youth, providing service to farmers, while local fabricators are taught how to build and repair the machines. The crop productivity of the area was also very high and hence potentially profitable for private thresher service providers. Farmers should mobilize themselves into groups would help them join effort to purchase one teff thresher that can serve 10-15 people. Promotion of teff threshing machines require joint efforts of researchers, farmers and implement manufacturers and private service providers

Based on the findings of Pre scaling up, the following points are further suggested for further scaling up of the thresher

- Efforts should be made by the BAERC to continue improvement and to popularize good quality threshers among smallholder farmers;
- There should be a continues attempt to improve the overall performance of the machines. (E.g., frequently broken parts).
- Operators of teff thresher and farmers should undergo appropriate trainings in order to gain the required skills, techniques and knowledge of proper operation. Training and support should be focused on capacitating the operators and farmers to maintain minor failures by themselves.

References

Adelaide, Institution of Engineers, Australia, Confrence publication No. 86/9, 258-263.

Afify, M. K. (1998): Development of a simple flax thresher. Ph.D. Thesis. Agric. Eng. Dep., Fac. of Agric. Zagazig Univ. Ajayi, A. O. (1991): Design of a thresher for locust bean.

Asfaw Negassa, Wondwossen Tsegaye, Roberto La Rovere, Dejene Aredo, Matteo Giancristofaro (2010) The Adoption and Impacts of SG2000 Promoted Tef Thresher in Shashamene District of Ethiopia. New Hopes for Revitalizing Tef Based Rural Economy. CIMMYT/SG2000 Technology Impact Brief No.1.

Assefa K, Chanyalew S, Tadele Z (2013). Achievements and Prospects of Tef Improvement, International Workshop Proceedings, University of Bern, Institute of Plant Sciences, Switzerland.

Bekabil Fufa, Befekadu Behute, Rupert Simons and Tareke Berhe , ATA, Teff Diagnostic Report No. 2011.

CSA (2018). The Federal Democratic Republic of Ethiopia Central Statistical Agency Agricultural Sample Survey: Area And Production Of Major Crops.

Dejene Aredo, Wondwossen Tsegaye, and Roberto La Rovere (2008). The Adoption of Tef-Threshers in Shashemene District, Southern Ethiopia: A Situation Analysis. IA Research Report No. 10. CIMMYT/ SG2000 Monitoring and Impact Assessment (IA) Project, Ethiopia

El-Hadad, W.Z. (2000): A simplified design and performance study of threshing and winnowing machine suitable for small holdings. M. Sc. Thesis. Agric. Mech., Fac. Of Agric., Kafr El-Sheikh, Tanta Univ. El-Nono, M. A. and A. H. A. Mohammed (2000): A study on power requirements for wheat threshing. Egypt. J. Agric. Res. 78(5): 2169-2176.

Enternet web site Moisture-Dependent Physical Properties of Tef Seed, A.D. Zewdu; W.K. Solomon, Food Science & Postharvest Technology, Haromaya University

Enternet web site, Institute of Agricultural Research Organization, Holetta Agricultural Research Center (IARO),Alemayehu Refera

FAO, 1997. Agricultural Mechanization strategy preparation: A Guide. Agricultural Engineering service. Rome, Italy.

Institute of Biodiversity Conservation (IBC)Ethiopia,
Third Country Report On The State Of Plant Genetic Resources For Food And Ag riculture, Addis Ababa, October 2012.

Merga W.,2016. Development and Evaluation of Teff Threshing Machine. International Journal of Engineering Research & Technology (IJERT) http://www.ijert.org ISSN: 2278-0181 IJERTV5IS110250 Vol. 5 Issue 11, November-2016

Parkhiil, G.J.,(1986) A computer simulation of Tractore drawbar performance; conference on Agricultural Engineering,

Rijk, A.G. (1989). Agricultural Mechanization policy and strategy. Asian Productivity Organization, Tokyo.

The Guardian (2014). Move over quinoa, Ethiopia's Teff poised to be next big super grain:http://www.theguardian.com/global-development/2014/jan/23/quinoa-ethiopia-Teff-super-grain