Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.97, 2020

Pre-extension Demonstration and Evaluation of Engine Maize Sheller Technology in the Selected AGP-II Districts of Harari Region and Dire Dawa Administration

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Abstract
The pre-extension demonstration of engine driven maize sheller helps to separate maize from the cob. The fabricated design consists of a body casing, drum, shelling unit, grain and cob discharge unit, machine frame, hopper (Feeding chute), bearing as some of the major component, It is powered by Honda motor connected the shelling unit. The machines were fabricated by Fadis agricultural research center were demonstrated and found to be about 95.88-97.2% efficient with output capacity of about 1800 -2000kg/hr. The design is relatively cheap, simple and portable when compared to imported product of similar capacity. Two FRGs containing 80 farmers were established and one machine per FRG was given for free to create wider awareness.
Keywords: Maize Sheller, Engine driven, Demonstration, Harari and Dire Dawa
DOI: 10.7176/FSQM/97-03
Publication date: May 31st 2020

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops in the world agricultural economy. It is called as "Queen of cereals" and "King of fodder" due to its great importance in human and animal diet (B. Ashwin Kumar and Shaik Haneefa, 2014). Maize is next to *rice and wheat with* regard to area and production. It is being used for manufacturing industrial products like starch, syrup, alcohol, acids, etc. It is a rich source of starch (60-80%), protein (8-12%), fat (3-5%) and minerals (1-2%) (Ashwin and Shaik, 2014).In Ethiopia, maize grows from moisture stress to high rainfall areas and from lowlands to the highlands. It is one of the most important cereal crops grown in the country and is the main staple food in rural areas. It accounts over 14 % and 18% in terms of land area coverage and productivity respectively with higher annual growth rate (Demeke M, 2012). The overall productivity of maize is affected by many factors including lack of post-harvest technologies, such as shelling. Maize kernels should be removed from cob to be used as seeds, prepare value addition, improve handling and storage as well as maintain its quality. Maize shelling which refers removal of kernel from cob is an important post-harvest operation in maize production. Shelling can be carried out in the field or on the farm. A more efficient shelling is achieved when the grain has been suitably dry to 13 to 14 % moisture content (Danilo Mejia, 2003). Maize shelling in Ethiopia is mainly carried out using traditional methods. The most commonly employed methods include manual rubbing maize cobs against one another, using human finger, stone, biting the cob with wooden plank, treading with animal and wire mesh by using iron cylinder. All these are time consuming methods involving drudgery and exposure of crop over a time leads to natural hazards like rain, fire and also loss of grains to animals, birds and insects. It is also highly tedious, inefficient; do not support large-scale shelling of maize requiring a lot of labor and time with low productivity as a worker can only shell a few kilograms per hour (TASTRA, I. K., 2009.Therefore this proposal initiated to demonstrate engine Driven Maize Sheller Technology to alleviate farmers from those problems of traditional Maize shelling technologies in Harari region and Dire dawa administration council

Specific Objectives

To demonstrate and evaluate engine driven Maize Sheller technology.
To create awareness among farmers, developmental agents, subject matter specialists and other participant stakeholders on engine driven Maize Sheller technology.
To build farmers' knowledge and skill of production and management of the enterprise
To strengthen linkage among stakeholders

Materials and Methods

Description of the study area

Pre-extension demonstration of Maize Sheller technology was conducted in Agricultural growth program-II nationally selected districts of Harari region and dire dawa administration council. Harari regional state is located on distance of 526 kms from capital city Finfine in direction of country's eastern part; it is all in all bordered by Oromia region and hosts one capital town of Oromia Regional state's zone that is East Hararghe. The climatic

condition of the region includes highland, midland and lowland; the soil type exist in the region is different in different ecologies of the region that is clay, loam, sandy and black types. The selected districts are where the potentiality of the program was succeeded in consideration of residents' problems, potential succession of the technologies these fit problems and solve; including the outcomes prevailed in AGP-I. Dire Dawa Administration is located on distance of 515kms from capital city Finfine in direction of county's Eastern part; it is bordered by Somali, and Oromia regions in all directions. Dire Dawa Administration has both urban and rural set governance system. The climatic condition of Dire Dawa is almost dry land with the maximum and minimum temperature 38^{0c} and 25^{0c} respectively (EBC broadcasting on metrology allocated time). The selected districts are where the potentiality of the program was succeeded in consideration of residents' problems, potential succession of the technologies these fit problems and solve; including the outcomes prevailed in AGP-I.

Farmers Selection

Farmers were selected purposively based on their interest, innovation he/she has in using maize Sheller technology and willingness to use the technology in collaboration with the DAs and SMS. The selected farmers were grouped in the form of Farmers Research Group (FRG) with the member of 20 farmers per FRG in consideration of gender issues (women, men and youth). In the establishment of FRG in the study areas total of 4FRGs (2FRG/ PA) from one PA 40 farmers and a total of 40 farmers were grouped in 2 FRGs in two PA. For two FRG containing of 40 farmers one maize Sheller technology was delivered (25 male trial farmers and 15 female trial farmers) were participate in the operation of the machine.

Site Selection

Harari regional and Dire Dawa district were purposively selected by AGP-II nationally. PAs will be selected purposively based on the potentiality of Maize production, appropriateness of the area by considering lodging, slop's land escape, access to road. One district from Harari region (Sofi) was selected and Wahil selected from Dire Dawa purposively.

Table 1: Summary of selected site and farmers

Districts	PAs	Number of trial farmers	Male	Female
Wahil	Wahil	40	25	15
Sofi	Kile	40	25	15

Technology evaluation and demonstration methods/technique

The evaluation and demonstration of the technology was conducted on farmers' fields to create awareness about the maize Sheller technology operation.

Data Collection

Quantitative data Output capacity (kg/h), threshing efficiency (%), grain damage (%),number of farmers participated in FRG, number of stakeholders participated on the training and qualitative data were collected through personal field observation, individual interview, Focus Group Discussion by using checklist and data sheet tools. While qualitative data were farmers' perceptions towards the new technology and ranked using pair wise ranking and Matrix ranking.

Data analysis

Quantitative data was summarized using simple descriptive statistics (Mean, Frequency and Percentage) while the qualitative data collected using group discussion and field observation and oral histories was analyzed using narrative explanation. Finally, data from different sources was triangulated to get reliable information.

Results and Discussion

Training of farmers and other stalk holders

Multidisciplinary research team; Agricultural mechanization, Crop, extension and socio-economic research team and other stakeholders (Offices of Agriculture and Natural Resource) actively participated by sharing their experience and knowledge and journalists for the sake of publicity of the work done .Development agents, experts and farmers were participated on the training given on maize Sheller operating and management, post-harvest handling of maize.

Table 2: Type of profession and number of participants during the training at the two Districts, 2018/19

		Kile		Wahil		
No.	Participants	Male	Female	Male	Female	Total
1	Farmers	40	20	60	40	160
2	DAs	7	-	5	-	12
3	District experts	4	1	5	-	10
4	Journalist	3	0	3	-	6
	Total	37	7	73	40	188

Among the training participant stakeholders, 85.1% were farmers. From those farmers, 37.5% are female farmers' participant. Different extension materials were utilized and distributed for the participants. For those individuals, 70 leaflets and 40 small manuals on the technology that are organized in Afaan Oromoo and English languages were distributed. During the training different questions, opinions and suggestions were raised and reacted from the concerned bodies. Most farmers showed high interest towards the technology. Therefore, all concerned bodies were shared their responsibility for the future intervention and wider reach out of the technology.

Table: 3.The performance of engine driven maize sheller machine

Descriptions		**Dimension**
Over all dimensions	Length(mm)	920
	Width(mm)	1050
	Height(mm)	1130
Power source		Honda engine
Power requirement(HP)		5
Fuel consumption(lit/qt)		0.1
Drum concave clearance	Inlet (mm)	60
	Out let (mm)	50
Recommended drum speed(RPM)		500
Performance of the machine	Output capacity (kg/h)	1800-2000
	6-8.36	
	Threshing efficiency (%)	95.88-97.2
	Grain damage (%)	Negligible

Farmers' Opinion/Perception

The opinion of those farmers on the maize sheller performance was collected from participants during machine demonstration. The major criteria used by farmers were the machine capacity, threshing efficiency, grain damage, reduce labor, minimize human effort/tiredness and reduce time of thrashing. Therefore, most farmers preferred engine driven maize sheller than traditional shelling mechanisms

Table 5: Ranks of the varieties based on farmers' selection criteria**.**

Implements	Farmers rank	Reasons
Engine Driven maize sheller	1st	High Machine capacity, high threshing efficiency,low grain damage, reduce labor, minimize human effort/tiredness and reduce time of thrashing
Traditional Maize shelling	2nd	Low threshing capacity, low threshing efficiency, high grain damage, maximize human effort/tiredness and increase time of thrashing

Table 6: Pair-wise ranking matrix result to rank variety traits.

Code no.	Traits	Machine capacity	Threshing efficiency	Reduce labor	Minimize human effort/tiredness	Reduce time of thrashing	Reduce grain damage	Frequency	Rank
1	Machine capacity		2	1	1	1	1	4	2nd
2	Threshing efficiency			2	2	2	2	5	1st
3	Reduce labor				3	3	4	2	4th
4	Minimize human effort/tiredness					5	5	1	5th
5	Reduce time of thrashing						5	3	3rd
6	Reduce grain damage							0	6th

Discussion

The demonstration of engine driven maize sheller reducing human interaction with the process. The machine has a great future scope for farmers due to its ease of use. The main the advantage is its low operating costs, tame and energy saving. Savings of money resulting from the use of machine can pay for itself within the short period of time.

Conclusion and Recommendation

Maize harvesting and post-harvest operation usually consists of a series of operations comprising removal of kernel from cob. Traditionally maize shelling carried out manual rubbing maize cobs against one another, using human finger, stone, biting the cob with wooden plank, treading with animal this is inefficient; do not support large-scale shelling of maize requiring a lot of labor and time with low productivity and also it is one of the major problems which facilitate physical damage. Hence the available engine driven maize sheller important to harvest maize and

the technology on farm evaluation and demonstration best solution for alleviating maize post-harvest loss, increase production and productivity constraint under smallholder. In addition less labor and time consumption was observed when compared with manual shelling. Therefore based on farmer's idea and importance of this technology the following recommendations were drawn:

- More popularization and scaling up is necessary
- Capacity building (training) could be required for farther promotion

More Effort is required on availability, distribution and demonstration of the technology should be made on .Future study could require on technology in different area for more post-harvest loss minimization and busting production and productivity

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