Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 3159-0040
Vol. 2 Issue 7, July - 2015

Evaluation Of Existing Threshers For Threshing Triticale Crop

Teka Tesfaye
Oromia Agricultural Research Institute
Jimma Agricultural Mechanization Research Center
Jimma, Ethiopia
tekamen@yahoo.com

Tamiru Dibaba
Oromia Agricultural Research Institute
Jimma Agricultural Mechanization Research Center
Jimma, Ethiopia
tamdibaba@gmail.com

***Abstract*—The ever growing need for cereals all across the globe has instigated numerous forms of research and development from various researchers. Crop diversification and use of introduced adaptable crops are the systems, which could alleviate the food shortage in drought-affected areas. Evaluation of the existing multi-crop threshers for this new variety is the aim of this research since no triticale threshing machine is available. The effect of three multi crop thresher namely Assela model 2 Axial Flow multi crop thresher, Fadis research center multi crop thresher and Jimma Replaceable Drum Multi-Crop thresher on breakage, threshing capacity, cylinder loss, separating loss and threshing efficiency were investigated.**

The maximum threshing capacity was observed from Assela model 2 Axial Flow multi crop thresher which is 62.6 Kg/hr, broken(damaged) grain was 29.03% from Fadis research center multi crop thresher and threshing efficiency of 87.8% from Assela model 2 Axial Flow multi crop thresher. Considering the technical performance measuring parameters Assela model 2 Axial Flow multi crop thresher is preferred. But to increase the threshing capacity and decrease cylinder loss it needs modification.

Keywords—Thresher; multi crop; threshing capacity; threshing efficiency; breakage

I. INTRODUCTION

The ever growing need for cereals all across the globe has instigated numerous forms of research & development from various researchers. Cereals usage ranges from being used as raw materials in industries for production of malt, beverages, beer, etc to being consumed directly as food. Its post harvest processing could be done through traditional method (manual) or modern method. However, manual system of threshing cereal failed to meet up with this growing demand of cereals and is labour intensive [1].

Crop diversification and use of introduced adaptable crops are the systems, which could alleviate the food shortage in drought-affected areas. Triticale (Triticosecale wittmack) is one of the introduced crops that possess the yield potential of wheat and hardiness of rye. It can adapt easily in extreme cold, drought, and acidic soils conditions. Triticale could successfully grow in almost all environmental conditions where its parental species are grown. In addition, triticale has a multipurpose use for human consumption and animal feed [2].

Among various post harvest activities threshing is one of the most important post harvest operations of grains. The removal or separation of grains from the panicles of the stalks is called threshing. In Ethiopia, the common methods of threshing are hand beating, animal treading, and use of mechanical thresher. Presently different types of mechanical threshers are being extensively used at farmer's level. The common models are Assela model 2 Axial Flow multi crop thresher, Fadis research center multi crop thresher and Jimma Replaceable Drum Multi-Crop thresher manufacturing at different research centers of the region [3].

The introduction of, drought tolerant and high yielding variety of triticale in the country affected by none thresh ability of the crop using traditional system. This has generated an increased demand for mechanical threshers having higher capacity and the potential to thresh this crop without extensive grain losses [4].

As a result of an informal survey made by a team of professionals from harvest and post harvest research division of the centers displays the threshing problem this crop have had limited the farmers from cultivating their land and covering it with this crop were it could have been more productive and profitable for both the farmers and their customers.

The study includes a detail performance test of the existing multi crop threshers (Assela model 2 Axial Flow multi crop thresher, Fadis research center multi crop thresher and Jimma Replaceable Drum Multi-Crop thresher) available in the research centers for understanding of its technical performance in threshing triticale crop. The information would be helpful in formulating future mechanization policies and strategy formulation for Ethiopian agriculture with a view to increase crop yield and reduce post harvest losses. The objective of the study is to evaluate and select the existing threshing technologies for Triticale crop and to generate information for further research.

II. MATERIALS AND METHODS

The study was conducted at JAMRC (Jimma Agricultural Mechanization Research Center) in Harvest and Post harvest research division. The performance test had been done both at the center by taking the crop and at the site by selecting two FTC

(Farmer Training Centers) of Gechi wereda in Iluababora Zone.

The threshing units operates on the principle of axial flow movement of the material by the impact of a threshing drum equipped with a number of metallic bars and pegs mounted on its periphery. The crop mass is brushed into grains and fine straw, which resulted in well chopped material for animal feed. While being threshed, the material undergoes a spiral motion in a closed cylindrical casing the part of which is series of pegs for crop threshing. Finally, the grain and fine straw drops through the perforated concave, rolls over inclined sheet metallic pan which leads the grain out while the straw is delivered to the straw outlet where it is discharged out.

The power from 14HP ACME engine was transmitted to the threshing drum by V- belts. For measuring drum speed (rpm), a digital tachometer was used. For each experimental run, bundles of harvested crop were manually fed into the threshing chamber at a uniform rate and the time requirement for threshing was recorded. The portion of the material containing unthreshed grain was separated from straw and weighed after hand threshing and cleaning in order to determine the threshing efficiency in terms of percentage of the total grain recovered.

Fig. 1. *Assela model 2 Axial Flow multi crop thresher*

Fig. 2. *Fadis research center multi crop thresher*

Fig. 3. *Jimma Replaceable Drum multi crop thresher*

A. *Evaluation of Physical Parameters*

According to the test code data related to time of operation, total grain at main outlet, un-threshed grain, and loose grain with the straw and visible breakage of grain were collected for this study. The collected data were analyzed to find out the following key technical parameters for comparing performance of the selected threshers.

1) *Broken/damaged grain*

From each of the threshed crop sample were randomly selected. All physically damaged/broken grains were visually observed, manually sorted and weighed using digital balance. Damage due to mechanical threshing was determined as the ratio of weight of the actual damaged kernels to the weight of a sample taken [5].

$$\text{Broken grain } (\%) = \frac{\text{Weight of broken grains(g)}}{\text{Weight of sample taken (g)}} * 100$$

2) *Determination of threshing capacity, Cylinder loss, separating loss and threshing efficiency*

Threshing capacity, cylinder loss, separating loss and threshing efficiency of the thresher were calculated following the procedure of [3,6].

a) *Threshing capacity*

The weight of grains (whole and damaged) threshed and received per hour at the main grain outlet is called capacity. At the end of each test, total threshed grain was collected from the main grain outlet. The capacity was calculated from the following expression:

$$TC = \frac{WG\,(kg)}{\text{recorded threshing time(min)}} * 60$$

Where: TC – Threshing capacity (kg/hr)
WG – weight of total output grain at main outlet (kg)

b) Cylinder loss

After threshing, the whole grain still attached to the straw is called cylinder loss. The percent of cylinder loss was calculated as:

$$CL(\%) = \frac{WCL\ (kg)}{WG + WSL + WCL\ (kg)} * 100$$

Where: CL – Cylinder loss (%)
WCL– Weight of cylinder loss grain (kg)
WSL– Weight of separating loss grain (kg)

c) Separating loss

The loose grain collected from threshed straw is called separating loss. The percentage of separating loss was calculated as follows:

$$SL(\%) = \frac{WSL\ (kg)}{WG + WSL + WCL\ (kg)} * 100$$

d) Threshing efficiency

The net threshed grain received at main outlet with respect to total grain input was expressed as percent by weight was termed as threshing efficiency. The threshing efficiency was calculated from the following expression:

$$TE(\%) = \frac{WG\ (kg)}{WG + WSL + WCL\ (kg)} * 100$$

III. RESULT AND DISCUSSION

The selected three models of the thresher were tested to evaluate the comparative performance of threshing operation. After through calculation, the mean of breakage, threshing capacity, cylinder loss, separating loss and threshing efficiency of the threshers are shown in Fig. 4.

A - Assela model 2 Axial Flow multi crop thresher
F - Fadis research center multi crop thresher
J - Jimma Replaceable Drum multi crop thresher

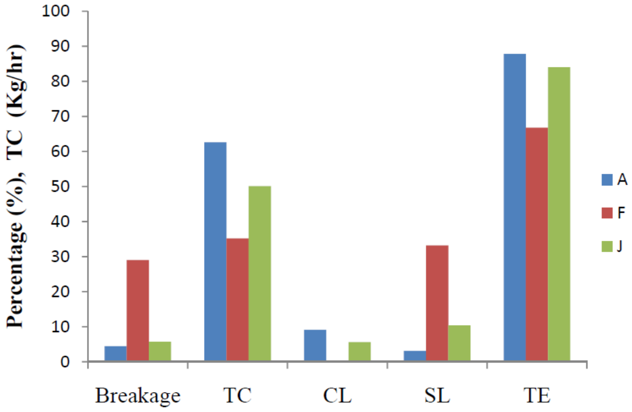

Fig. 4. *Performance of the threshers*

The results indicated that the percentage of grain damage increased highly for Fadis research center multi crop thresher due to the energy transferring ratio between the motor to the threshing drum increasing the drum speed. This is because increasing the speed increased frequency of impact between the crop and the threshing members and hence, rubbing of the pods were more severe.
The threshing capacity and threshing efficiency of Fadis research center multi crop thresher model highly differed from the Assela model 2 Axial Flow multi crop thresher. This was due to the increasing of grain going through straw outlet instead of the grain outlet, indirectly increasing the separation loss. But the cylinder loss of the threshers is low except for Assela model 2 Axial Flow multi crop thresher.

IV. CONCLUSION AND RECOMMENDATION

By evaluating the above performance parameters and farmers comment Assela model 2 Axial Flow multi crop thresher was selected for Triticale threshing. But to increase the capacity and decrease cylinder loss it needs modification.

ACKNOWLEDGMENT

Authors Acknowledge Oromia Agricultural Research Institute (OARI).

REFERENCES

[1] C.O.Osueke,"Simulation and Optimization Modeling of Performance of a Cereal Thresher," International Journal of Engineering & Technology, vol. 11, pp. 143-152, June 2011.

[2] Minale Liben, Alemayehu Assefa and Tilahun Tadesse and Belstie Yeshealem, "The Influence of Seed Rate on the Grain Yield and Yield Components of Triticale (Triticosecale wittmack)," In Proceedings of the 1st Annual Regional Conference on Completed Crop Research Activities; Bahir Dar, Ethiopia: Adet Agricultural Research Center, pp. 1-110.

[3] M.M. Alam, C.K Saha, M.LN. Khan and M. Al-Amin, "Comparative Performance of Commonly Used Open Drum Threshers for Rice In Bangladesh," Bangladesh I. Agri. Engg, pp. 1-14, 2007.

[4] GOBEZE LOHA, Waga Mazengia and Legese Hidoto, “Effect of varieties and seeding rates on grain yield of triticale (Triticosecale wittmark) in different agro-ecologies of Southern Ethiopia”, African Crop Science Conference Proceedings, vol. 8, pp. 41-44, 2007.

[5] A.Candia, A.R.Saasa,J.Muzei and P.Ocen, “ Improving the AEATRI- motorized maize sheller to meet the market demands of commercial maize farmers”, Uganda Journal of Agricultural Sciences, vol. 9, pp. 569-573, 2004.

[6] D.W. Smith, B.G. Sims, D.H. O’Neill, “Testing and evaluation of agricultural machinery and equipment, Principles and practices”, FAO Agricultural Services Bulletin, 110, Rome, Italy, 1994.