Evaluation And Selection Of Existing Machines For Rice Threshing

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***Abstract*—The development of rice threshing machines are the major effort made to increase the production of rice and encourage the government policy. Hence, to do this the appropriate rice threshing machines should be needed. The selected rice threshing machine is increases the income of farmers by reducing the labor costs and the losses caused during threshing. During selection of the rice threshing machine, the three machines namely Assela multicrop thresher (AMT), Jimma made thresher (JMT) and Votex are tested to evaluate their performance by changing the speed of engine that is at low, medium and high. Finally, by using the parameters like threshing capacity, cleaning efficiency, percentage of breakage and losses the selection was done.therefore according to the results obtained Assela made multicrop thresher was better than other especially in minimizing breakageof grains.**

Keywords—Thresher; threshing capacity;threshing efficiency; loss; cleaning efficiency

I. INTRODUCTION

Cereals are the first cultivated grasses belonging to the poacae family. The popular cereal crops of the world include wheat, barley, oat, rice, maize, sorghum, and millets. But the major cereals of the developing countries like Ethiopia are maize, rice, sorghum, and millet.

Now day rice has became one of the major cereal crop produced in Jimma zone following maize, teff, sorghum, and wheat. The major growing areas are found in the north central highland of this zone which extend from east to north east and includes Gera, Gomma, Shebe Sombo, Limu-Kosa, and Limu-saka. Therefore to increase the production of rice, threshing machines are important.

Threshing is an integral part of post harvest activities for cereals and legumes crop. In many developing countries, threshing is carried out by traditional methods and by using threshing machines [5]. The traditional methods of threshing rice are pounding in mortar with pestle, beating with clubs on the floor, rubbing on the floor, beating gently with clubs in jute bags and threading under the feet of man or hooves of animals. In Ethiopia, the most common method employed by farmers, to thresh wheat is spreading the crop over a prepared floor and beating it with a stick repeatedly. The other widely used method of threshing is trampling by animals. In both cases, a circular plot of land, called 'awudma', 4-6 meters in diameter is cleared from grasses and plastered with thin layer of fresh cow-dung on which the harvested crop (wheat or barley) is spread for beating or trampling to thresh. The maize is also shelling by beating it by stick, by their hands and by mortar and pestle. [1] Unlike what is observed in mechanized farms where mowing and threshing could be undertaken simultaneously, grain harvesting by Ethiopian farmers takes place manually and involves hand mowing of crops using sickles and later threshing by letting a group of animals trampling upon it. Harvesting of maize is unique in a sense that it is undertaken by removing the ears by hand. Several days could elapse before mowed crops are threshed; i.e., crops stay piled for some time either around homestead or *in situ* before threshing. All these activities can be carried out by rural women and children. Since these activities time consuming, labor intensive and prone to post harvest lose, it is affecting the profitability and effectiveness of the production system and also it puts a lot of additional job burden on the rural women and children. In general, in many developing countries, labor intensiveness, low grain quality and widespread use of simple farm tools which result in low productivity and high post harvest losses are the common features occur. Therefore, to overcome the above problems and to increase the production of rice, the appropriate rice threshing machine is needed in these areas.

Objectives

- To select appropriate rice threshing machine

II. METHODS AND MATERIALS

The research was done in Jimma zone Shebe Woreda which was well known by rice production in the zone.

In order to select the appropriate rice thresher, three machines were taken to the farmers' field at Shebe woreda. The three machines which we took to the field are Assela WB thresher, Jimma made thresher and Votex thresher.

The following criteria [3] were used to evaluate the performance of the threshing machine on threshing efficiency (TE), separation efficiency and cleaning efficiency (CE):

A. Threshing capacity

$$C = \frac{W}{T} \qquad 1$$

Where: W_s is the weight of threshed kernel, kg or qui.
T is the duration of operation, hr.

B. Efficiencies:

1. Threshing efficiency

The threshing efficiency was calculated according to the following formula:-

$$threshing\ eff.(\%) = \frac{wd}{wt} * 100 \qquad 2$$

Where: Wd weight of threshed and wt weight total seed

2. Cleaning efficiency

It is calculated according to the following equation

$$cleaning\ eff.(\%) = \frac{W}{W_O} * 100 \qquad 3$$

Where:
W - Weight of grains from the main output opening after cleaning, kg.
W_o- Weight of grains and small chaff from the main output opening, kg.

3. *Separation efficiency (SE)**):***

It was calculated according to the following equation;

$$SE(\%) = \frac{S_1+S_2}{S} * 100 \qquad 4$$

Where:
S1: weight of seed from the out let (g),
S_2: weight of seed from the straw outlet (g), and
S: Total weight of seed (g).

C. *Seed losses**:***

1. Drum losses (DL):

It was calculated according to the following formula:

$$D_L(\%) = \frac{W_{uns}+W_{unt}}{W_t} * 100 \qquad 5$$

Where:
W_{Uns}: weight of un-stripped seed (g)
W_{unt}: Weight of un-threshed seed (g), and
W_t: Total weight of input seed (g).

***2.** Separation losses* (S_L)

It was calculated according to the following formula;

$$S_L(\%) = \frac{W_{unsa}}{W_t} * 100 \qquad 6$$

Where:
W_{Unsa}: weight of un-separated seed

3.** Total seed losses (TL**):

It was calculated according to the following formula;

$$TL,(\%) = \frac{D_L+S_L}{W_t} * 100 \qquad 7$$

D. Damage

There are two types of damage occurring during threshing of the grains.
These are visible damage and invisible damage.

i. Visible damage

This damage is determined by taking the samples of threshed grains and isolated the broken grain from unbroken grain.

$$broken\ grain,(\%) = \frac{Q_{bg}}{T_{qg}} * 100 \qquad 8$$

ii. Invisible damage

The invisible damage was determined by calculating germination rate of threshed rice

Fig. 1.*Assela multicrop thresher*

Fig. 2. *Jimma multi-crop thresher*

Fig. 3.*Votex thresher*

III. RESULT AND DISCUSSION

As we see from the following figures, the feeding rate of the Jimma made multicrop thresher was higher than others (760.56kg/hr, 947.37kg/hr at medium and high engine speed respectively) except at low engine speed. Asella multicrop thresher had higher feeding rate (482.14kg/hr) than other at low engine speed. But the threshing capacity of Jimma multicrop thresher was higher than others at all engine speeds (table, 1, 2, 3). The percentage of breaking of Jimma made multicrop thresher was high which was not good as compared to standard (0.2%) as set by Ethiopian commodity exchange [2].

But in cleaning efficiency, the votex was better than others as we saw from the following tables in all engine speeds. But the percentage of breaking of votex was higher than other in all engine speeds. The Asella multicrop thresher was good in all parameters especially in percentage of breakage at low and medium engine speed as saw in tables below. Therefore, the Assela WB thresher is better for rice threshing from Jimma multi-crop and Votex thresher due to it had low percentage of breakage.

Table 1. Average values of the threshing parameters of each machine at low engine speed

Trt	feeding rate (kg/hr)	Threshing cap.(kg/hr)	cleaning eff.(%)	%age break
AMT	482.14	178.4	62.33	0.16
JMT	372.4	193.24	61.9	1.45
Votex	458	175.42	88.73	9.52

Table 2. Average values of the threshing parameters of each machine at medium engine speed

Trt	feeding rate (kg/hr)	Threshing cap.(kg/hr)	Cleaning eff.(%)	%age Break
AMT	650.6	229.15	82.9	0.12
JMT	760.56	380.28	65.6	1.52
VOTEX	642.45	215.5	96.25	10.28

Table 3. Average values of the threshing parameters of each machine at high engine speed

Trt	feeding rate (kg/hr)	Threshing cap.(kg/hr)	Cleaning eff.(%)	%age Break
AMT	750	264.17	59.6	0.5
JMT	947.37	386.32	67.6	1.48
VOTEX	745.86	358.85	84.35	12.36

IV. CONCLUSION

The threshing capacity of thresher was identified by using performance parameters such as threshing effeciency, cleaning effeciency, pecentage of breaking and feeding rate. According to the result, the Assela multicrop thresher had low percentage of breaking at low and medium engine speeds. Therefore, it was good if this machine used than others.

RECOMMENDATION

- The selection of machines for rice thresher was done at one location and by one variety of rice. Therefore, it was recommended that it was better to test them by other variety of rice under different climate condition.

- The selection of these machines were made on the percentage of breakage due to the broken seed was not important. Hence, accordingly it was better to use the Asella multicrop thresher than other.

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