Mini Thresher Machine

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Abstract- *Rice imports in Sub Saharan Africa accounts for more than 30% of the world's imports even though it grows a lot of rice. In considering the evaluation of the hand and foot operated threshers suitable for small-scale rice farms, the threshing speed, threshing losses, drudgery, threshing efficiency and threshing capacity were the key factors.*

This study therefore evaluated the hand and foot operated manual threshers to suggest the better method of threshing rice. The tests were carried out at punjab & west Bengal to assess the hand and foot & manual operated rice threshers. Materials used in carrying out the tests included plastic sampling bags, a weighing scale, a tachometer and a pressure monitor. The tests recorded the average speed in using the foot operated thresher to be 158.3 rpm, relatively higher than the average speed recorded in using the hand operated rice thresher which was 136.6 rpm.

Loss recorded was 12% in using the hand operated rice thresher whereas loss recorded in using the foot operated thresher was 29.6%. The heart rate per kg in using the foot operated thresher was recorded as 32 beats/kg, whereas the hand operated rice thresher recorded a heart rate per kg of 35.8 beats/kg. The hand operated rice thresher had an efficiency of 88% whereas the foot operated thresher had an efficiency of 70.4%. The tests suggested that, the size of the foot operated rice thresher drum length should be increased from 450mm to 545mm, which is equivalent to the drum length of the hand operated rice thresher, to increase the threshing capacity. The test also suggested that the hand operated rice thresher should be covered at the top to prevent spillage losses.

Keywords- speed, losses , efficiency, capacity, drudgery.

I. INTRODUCTION

Rice, as a cereal grain is the most widely and commonly consumed food by an enormous part of the world's population. Rice a crop ranked third in worlds most produced crops, behind sugarcane and maize. Rice provides caloric nutritional needs and hence, grown in different environments where water is readily available for irrigation. Rice requires sufficient water to grow. The general name for machines that involve the process of removing grains from ear heads of crops is a thresher. Threshers were first invented by Scottish mechanical engineer. The thresher was invented to separate grains from stalks and husks. Mechanical threshers could be manually operated or motorized. The manual rice threshers, which included the hand operated, and the foot operated rice threshers were evaluated to determine threshing speeds, losses and drudgery in the process of threshing.

In considering the evaluation of the hand and foot operated threshers suitable for small-scale rice farms, a number of key factors would be considered. These may include comparing their threshing rates, their threshing losses, their output quality and their ease of use as well. The hand and foot operated rice threshing machines were tested with the aim of assessing the threshing performance. and gathering feedback from farmers to evaluate the efficiencies of the hand and foot operated rice threshers to determine which will be suitable for local rice farmers.

1.1 Specific objectives

The specific objectives of this study are to:

1) To determine the capacity and threshing efficiencies of the hand and foot operated manual rice threshers.
2) To measure the drudgery associated with operating the hand and foot rice threshers.
3) To measure the threshing speed and losses during threshing, by the hand and foot rice threshers.

1.2 Threshing Operation

Threshing operation involves the detachment of paddy kernels or grains from the panicle. Depending on the influence of agronomic, economic and social factors, threshing is done in different ways. It can be achieved by rubbing action, impact and stripping. The rubbing action occurs when paddy is threshed by trampling by humans, animals or tractors. The impact method is the most popular method of threshing paddy. Most mechanical threshers primarily are the impact principle for threshing, although some stripping action is also involved.

The difficulty of the process depends on the varieties grown, and on the moisture content and the degree of maturity of the grain.

II. THRESHING TYPES

2.1 Manual threshing

One of the simplest systems for threshing rice is to pick up the sheaf of rice and strike or beat the panicles against a hard surface such as a tub, threshing board or rack; or beating the sheaves spread out on a threshing-floor with a flail or a stick or tramples it underfoot. The threshing-floors on which the sheaves are spread must have a hard, clean surface**.**

2.2 Threshing with hand-driven machines

Machines driven by a manual device or a pedal are often used to improve yields and working conditions during threshing. By means of the handle or pedal, a big drum fitted with metal rings or teeth is made to rotate. The rice is threshed by hand-holding the sheaves and pressing the panicles against the rotating drum.

2.3 Threshing with animals or vehicles

If draught animals are available and there are large quantities of rice, threshing can be done by driving the animals in the form of harnessing; in that case, to threshing devices over a layer of sheaves about 30 cm thick. This method of threshing rice is adopted in some Asian countries, using a tractor for power instead of draught animals. Paddy is obtained by running the tractor twice over sheaves of rice that are spread in layers on a circular threshing- floor 15-18 m in diameter.

2.4 Threshing with motorized equipment

Although they are gradually being replaced by combine-harvesters, motorized threshing- machines still have an important place in the postharvest production process, especially for their convertibility. By the simple replacement of a few accessories and the appropriate changes in settings, these machines can treat different kinds of grain (e.g. rice, maize, sorghum, beans, sunflowers, wheat, soybeans, etc.).

III. MECHANICS OF GRAIN THRESHING

The process of mechanical threshing involves the interaction of machine and crop parameters for the separation of the seed from the pod. Threshing is carried out between a stationary concave and a rotating cylinder. Different configurations of threshing devices have been used. The two types generally employed in present day stationary threshers and combines are rasp bar cylinders and spike tooth cylinders. The latter are used almost exclusively in pea threshers. Also, rubber covered flat bars have been employed on cylinders and concaves for threshing small seed legumes such as crimson clover, giving less damage and less unthreshed loss than the conventional spikes.

IV. DETERMINATION OF LOSS PERCENTAGE

The following relationship was used to calculate the percentage losses of the hand and foot and manual operated rice threshers.

total loss %=
Scattering losses percentage + Un-stripped grain percentage

Scattering losses percentage =
(Scattered Grain(Kg) X1000)/ Total seed (Kg)

Un-stripped grain percentage =
(Un-Scattered Grain(Kg) X1000)/ Total seed (Kg)

V. RESULTS

The rice threshers were installed on a level hard surface ground. Sufficient quantities of the Jasmine rice were made available for threshing. In the process of threshing, the threshing efficiency, the threshing speed, drudgery and losses involved in threshing rice using the hand and foot operated rice threshers were measured, recorded and compared.

5.1 Threshing speed

The speeds for which the hand and foot operated threshers operated for 10 test trials were recorded using a tachometer and compared

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During the experiment, the threshing speed of the foot operated rice thresher ranged from 139rpm to 183rpm with an average speed of 153.8 for ten test trials, whereas the threshing speed of the hand operated rice thresher ranged from 113rpm to 152rpm with an average speed of 136.6rpm also for ten test trials, indicating that the foot operated rice thresher would be favorable if higher threshing speeds would be required. Also from the recorded speeds , the coefficient of variation for the speeds of the hand and foot operated rice threshers were found to be 0.08 and 0.09 respectively which showing that, the hand operated rice thresher was able to keep threshing speeds constant for test trials as compared to the foot operated thresher.

5.2 Threshing capacity

The threshing capacities for the hand and foot operated rice threshers were calculated and compared.

From the experiment, the foot operated rice thresher had an average threshing capacity of 40.68 kg/hr after 10 test trials, with capacity readings ranging from 30 kg/hr to 46.15 kg/hr, whereas the hand operated thresher had an average threshing capacity of 43.25 kg/hr after 10 test trials, with readings ranging from 29.5 kg/hr to 48 kg/hr, indicating that the hand operated rice thresher will be able to thresh 43.25kg of rice in an hour, whereas the foot operated rice thresher will thresh 40.68kg of rice in an hour.

5.3 Threshing losses

The threshing losses for the hand and foot operated rice threshers were calculated and compared with results showing that the foot operated rice thresher had scattering losses of 0% after 10 test trials, whereas the hand operated rice thresher recorded scattering losses of 5% after 10 test trials, indicating that the hand operated rice thresher gave more room for scattering losses to occur, thus making the foot operated rice thresher preferred if scattering losses are to be kept at it's lowest possible level. Rice grains that were un-stripped were also classified as losses. 10kg of rice straw contained 3.89kg of rice grains. The hand operated thresher recorded 7% of un-stripped grains, whereas the foot operated rice thresher recorded 29.6% of un-stripped grains indicating that, the hand operated rice thresher was able to thresh more rice grains from straws as compared to the foot operated thresher.

The hand operated thresher thus provided a total loss of 12%, whereas the foot operated rice thresher gave a total loss of 29.6%.

5.4 Threshing efficiency

The threshing efficiencies for the hand and foot operated rice threshers were calculated and compared

Thresher	Mass of threshed rice (kg)	Mass of scattered losses(kg)	Massun-stripped losses (kg)	Efficiency (%)
Foot operated rice thresher	2.8	0	1.18	70.4
Hand operated rice thresher	3.5	0.2	0.28	88

From the experiment, the foot operated rice thresher recorded an average efficiency of 70.4% after 10 test trials , whereas the hand operated rice thresher recorded an average efficiency of 88% after 10 test trials, indicating that the hand operated thresher was much effective in threshing rice grains from straws than the foot operated thresher.

VI. CONCLUSION

The evaluation of the hand and foot operated threshers revealed the following.

1. The foot operated rice thresher had a capacity of 40.68kg/hr., whereas the hand operated rice thresher had a capacity of 43.25kg/hr. Also, the foot operated rice thresher had an efficiency of 88% as compared to the hand operated rice thresher with 70.4% efficiency.
2. The heart rate per kg in using the foot operated thresher was recorded as 32 beats/kg, whereas the hand operated rice thresher recorded a heart rate per kg of 35.8 beats/kg.

3. The foot operated rice thresher recorded an average speed of 158.3rpm in operation, whereas the hand operated rice thresher recorded an average speed of 136.6rpm. Also, the foot operated rice thresher recorded 29.6% losses during operation whereas the hand operated rice thresher recorded 12% losses.

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