Int.J.Curr.Microbiol.App.Sci (2019) Special Issue-8: 102-106

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-8 pp. 102-106**
Journal homepage: http://www.ijcmas.com

Original Research Article

Performance Evaluation of Developed Thresher Cylinder on Millet Crop

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A B S T R A C T

Millets are small grained cereals the smallest of them include finger, kodo, foxtail, proso, little and barnyard millets. In Madhya Pradesh kodo and kutki are mainly grown which contributes area of about 265 thousand hectare. The developed thresher was tested with three speed 580, 712 and 1066 rpm, seed moisture content (13.0% and 14.2%) and concave clearance (2mm and 5 mm). Performance parameter for study was threshing efficiency, cleaning efficiency and broken grain. The result indicated highest threshing efficiency 99.67%, highest cleaning efficiency 98.64% with zero seed damage. Average output capacity 19.68 Kg/ha. The performance was found to be influenced by all the study variables.

Keywords

Evaluation, Developed thresher cylinder, Millet crop

Introduction

Threshing as a post-harvest operation is as old as man as a human civilization. In India, threshing of cereal crops like wheat and paddy is mechanized to a greater degree however the threshing of crops like small millet is not mechanized to the level as required the farmers who mainly cultivate the small millet in tribal area threshed the crop by passing it between the stone roller or by beating by sticks tractor treading is also used where ever it is available. The thresher which are available in India are designed primarily for crops like wheat, paddy, jowar etc., that requires impact force to separate the grains from ear heads and are not suitable for threshing crop like small millet where rubbing and shearing force are required simultaneously to separate seeds from coating.

Minor millets are small sized cereal grains belonging to the family poaceae (Gramineae). These are grown mainly in America, Japan, China and India. India is a major millet growing country. Kodo (*Panicum sumatrense*), kutki (little millet, *Paspalum scrobiculatum*), Bajra (Peral millet), jower (Sorghum) are most commonly grown minor millets in India. Minor millets are grown in almost every state under rainfed area of about 2.29 million ha in India. Main minor millet growing states are Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Tamil Nadu, Gujarat, Maharashtra, Andhra Pradesh and Karnataka.

In Madhya Pradesh area under minor millets is 307 thousand hectare. Of the six minor millets kodo and kutki mainly grown in Madhya Pradesh which contribute area about 265 thousand hectare with the

production of 82.1 thousand tonne and yield 344 Kg/hectare. Minor millet are sown in June - July and harvested in September-December. It is estimated that harvesting and threshing of crops consume about one third of the total effort requirement of the production system.

Threshing process of the millets is a major constraint in this regard. The traditional method for threshing millets is generally done by hands. In many areas, the crop is threshed by being trodden underfoot by humans or animals (Kumar *et al.,* 2013). This method often results in some losses due to the grain being broken or buried in the earth. UACES (2004) reported that in many tooth-peg threshers grain damage was as high as about 4% and recommended a speed range of 600–750 rpm for soya beans, depending on the crop moisture content.

Harvest and post harvest operations were the second most energy consuming operations for both rainfed and irrigated crops, since in traditional agriculture, more human power was used for these operations (Chowdegowda *et al.,* 2010). Pandey (2016) evaluated that The operational cylinder speed for threshing gram crop was found 600 rpm at feed rate 21q/hr. threshing efficiency 98.99% and cleaning efficiency 97.30%.

Materials and Methods

This chapter deals with the materials used and method applied for the experimental. Thus, testing and evaluation of threshing methods for millets crops with respect to grain moisture content, threshing efficiency, cleaning efficiency, output capacity and Broken grain percentage. To study the performance of developed cylinder, the variables under study were classified as:-

Drum speed: The developed cylinder was tested at three different speeds for determining the performance of cylinder on millets crop. The selected speed for millet crop was 580 rpm, 712rpm, and 1068 rpm. The speed of cylinder was calculated with the help of tachometer, the speed of threshing drum was noted after thresher attained constant speed.

Moisture content: The moisture content was varied by adding water to the sample. Before each experiment required amount of samples were taken out and allowed to warm up to the room temperature (Goyal *et al.,* 2008). The moisture content was determined by the following equation (ASAE, 1999).

$$MC = \frac{(w1-w2)}{w2} \times 100$$

Where,
MC= Moisture content % (wet basis)
W_1= Initial weight of the sample
W_2= Final weight of the sample

Measurement parameter

Threshing efficiency

Threshed grain received from all outlet with respect to total grain input expressed as percentage by weight.

Cleaning efficiency

Clean grain received at the main grain outlet with respect to total grain mixture received at main outlet expressed as percentage by weight.

Output capacity

Total quantity of threshed grain received at the main grain outlet for test duration and expressed as kg/h.

Broken grain percentage

It is observe that breakage loss was inversely proportional to the moisture content and directly proportional to the drum speed (Mohan 1971). Mass of broken grains from main grain outlet with respect to total clean grain received at main grain outlet expressed as percentage by mass.

Results and Discussions

The performance of developed cylinder at three different speed, moisture content and concave clearance are given in table 1 and 2. The developed thresher is shown in figure 1.

Threshing efficiency

The results of threshing efficiency are presented in table 1 and 2. The threshing of millet observes at two moisture content i.e. 13.0% and 14.2% with three different speed i.e. 580rpm, 712 rpm, and 1068 rpm. The threshing efficiency range from 94.3% to 99.6% for the concave clearance of 2mm to 5mm, the result shows that as increasing in concave clearance and cylinder speed threshing efficiency threshing efficiency also increases but threshing efficiency decrease with increase in moisture content. This result is satisfied with the reference Kushwaha *et al.*, (2005). Developed an okra seed extractor and evaluated at different moisture content from which they got as extracting efficiency was decrease with increase in moisture content.

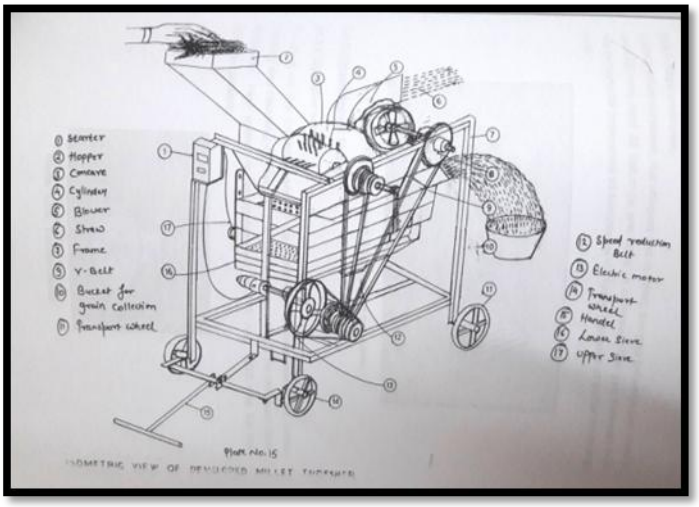
Cleaning efficiency

The results of cleaning efficiency of the developed cylinder are presented in table 1 and 2. The results shows that cleaning efficiency of thresher ranged from 92.0% to 98.6% for the concave clearance of 2mm and 5mm and two different moisture content 13.0% and 14.2%. Thus, the cleaning efficiency increases with increase in cylinder speed. The highest cleaning efficiency is found to be in 1068 rpm i.e. 98.6%. The result is satisfied as compared to reference Fulani *et al.*, (2013) reported that high cleaning efficiency obtained at higher cylinder speed.

Moisture Content: 13 %						
Observations	Cylinder speed: 580 rpm		Cylinder speed: 712 rpm		Cylinder speed: 1068 rpm	
Concave Clearance(mm)	2	5	2	5	2	5
Threshing Efficiency (%)	98.4	98.6	98.2	99	98.8	99.6
Cleaning Efficiency (%)	94	97.8	94.2	98.2	94	98.6
Output capacity (kg/h)	18.1	18.5	18.4	18.8	18.57	19.68
Broken Percentage (%)	0.37	0.20	0.40	0	0.32	0.28

Moisture Content: 14.2 %						
Observations	Cylinder speed: 580 rpm		Cylinder speed: 712 rpm		Cylinder speed: 1068 rpm	
Concave Clearance (mm)	2	5	2	5	2	5
Threshing Efficiency (%)	94.2	97.2	96.7	98.2	98.2	98.8
Cleaning Efficiency (%)	95.2	96.4	95.8	96.9	92.0	97.1
Output capacity (kg/h)	17.3	17.9	17.4	18.3	18.67	18.70
Broken Percentage (%)	0.39	0.25	0.58	0.18	0.62	0.43

Fig.1 The millet thresher



Output capacity

The output capacity ranges from 17.3 kg/hr to 19.68 kg/hr for the concave clearance 2mm to 5mm and moisture content 13.0% and 14.2%. Thus, the highest output capacity is found to be 17.3 kg/hr with 1068 rpm at 13.0% moisture content. Therefore, output capacity also found to be higher at higher speed.

Broken percentage

The broken percentage is shown in table 1 and 2. The minimum broken percentage is 0% with 712 rpm for 5 mm. Concave clearances at 13.0% moisture content. The result shows that broken percentage increase in concave clearance reduction.

In conclusion, the performance of developed cylinder is found to be best with speed 1068 rpm at 13.0% moisture content. The threshing efficiency is 99.6%, cleaning efficiency is 98.6%, output capacity 19.6 kg/hr for the concave clearance of 5mm.

The performance of thresher affected by moisture content, cylinder speed and concave clearance. Threshing efficiency,

cleaning efficiency output capacity are directly proportional to the cylinder speed and inversely proportional to the moisture content.

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