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COMPARISON STUDY OF PROTOTYPE THRESHER WITH DIFFERENT METHODS OF THRESHING WHOLE CROP FINGER MILLET

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Abstract: Adoption of prototype thresher for Finger Millet threshing found to be no use of threshing yard, avoids the transportation of harvested crop from field to the threshing yard, grain damage (2.59 per cent), higher threshing efficiency(94.15 per cent) and lower percentage of unthreshed grain during threshing(5.80 per cent)as passing tractor with or without stone roller wherein it requires specially prepared threshing yard, transportation of harvested material from field to the threshing yard, more men power for threshing and waiting for natural wind breeze to winnow the threshed material.

Introduction

Finger millet (*Eleusinecoracona* Gaertn) is one of the important small millet in the tropics (12 per cent of global millet area) and is cultivated over more than 25 countries in Africa (Eastern and Southern) and Asia (from near East and far East), predominantly as a staple food grain. Whole crop Finger millet was harvested manually and transported to threshing yard, where it is threshed by a tractor with or without a stone roller was passed over the crop spread uniformly on the floor. It is estimated that harvesting and threshing of crops consume about one third of the total requirement of the production system (Ojha and Devnani, 1987). 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). Mahmoud and Buchele (1975) found that, ear axis parallel to cylinder axis orientation suffered the least damage at all moisture content levels tested, followed by ears fed randomly to the cylinder. The highest damage was suffered by ears fed with their axis perpendicular to the cylinder. The minimum damage for all orientations was at 20 to 22 per cent moisture content. They found that the corn kernel damage increased with an increase in moisture content and cylinder velocity.

Mechanical damage, threshing effectiveness and power required in threshing wheat were measured for different types of cylinders, cylinder speeds and concave clearances. The data indicated that cylinders fitted with rasp-bar found to be less power requirement than other types

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(Singh and Kumar, 1976). Dhand (1980) modified a commercial paddy thresher with rasp-bar type cylinder for threshing wheat and found that this machine could handle paddy as well as wheat with minor adjustments.

The studies made by Singh and Kumar (1976) showed that increasing cylinder tip speed increases threshing efficiency. Irtwange (2009) stated that beater and fan speeds of 500 rpm and 1400 rpm respectively indicated average threshing efficiency of 96.29 per cent, percentage of damage 3.55 per cent and percentage of threshed grains of 92.74 per cent. A cleaning efficiency and loss of grain 95.60 and 3.71 per cent respectively, was observed indicating that with the use of a star shaped beater, drudgery and cost can be reduced to a minimum and yet achieving good quality products.

MATERIAL AND METHODS

To study the threshing practices of finger millet, Kadanur village in Doddaballapurataluk of Bangalore Rural district was selected. The mechanical thresher was conducted at Department of Agricultural Engineering, University of Agricultural Sciences, G.K.V.K, Bangalore during 2011-12. The experiment was laid out in Completely Randomized Block Design with 3 replication. The two methods of threshing whole crop were selected and their output capacity, broken grain percentage, unthreshed grain percentage, threshing efficiency and germination percentage were compared with the developed prototype thresher. In this method the prototype tested in optimum condition like 1050 mpm cylinder speed with 4 mm concave clearance and procedures fallows has detailed below:

i. Output capacity

The output capacity was estimated by weighing the total grain (whole and damaged) received per hour at main grain output of the thresher (Anon., 1983):

$$\text{Output capacity (kg/h)} = \frac{\text{Weight of grains threshed (kg)}}{\text{Time taken (h)}} \qquad \ldots\ldots\ldots 3.9$$

ii. Broken grain

The percentage of broken grains was estimated by separating the damaged and broken grains from the sample collected at all the outlets using the formula:

$$\text{Percentage of broken grain (\%)} = \frac{E}{A} \times 100 \qquad \ldots\ldots\ldots 3.10$$

Where,

E = Quantity of damaged grain collect at all outlets per unit time

A = Total grain output per unit time by weight

iii. Unthreshed grain

The per cent of' unthreshed grain was estimated by separating by the whole grains attached to the threshed earheads of known quantity manually using the following formula (Anon., 1983):

$$\text{Percentage of unthreshed grain}(\%) = \frac{H}{A} \times 100 \qquad \ldots\ldots\ldots 3.12$$

Where,

H = Weight of unthreshed grain per unit time at all outlets

A = Total grain input per unit time by weight

iv. Threshing efficiency

The threshing efficiency was estimated by using the formula and expressed in percentage (Anon., 1983):

$$\text{Threshing efficiency}(\%) = \frac{(A\text{-}H)}{A} \times 100 \qquad \ldots\ldots\ldots 3.13$$

Where,

H = Weight of unthreshed grain per unit time at all outlets

A = Total grain input per unit time by weight

v. Germination percentage

Hundred seeds were randomly collected from the bulk of threshed material and placed on paper towels, rolled the towels and placed in the BOD incubator maintaining 25±1°C temperature and 90 per cent relative humidity (Anon., 1985). The viability of the seeds were counted on fourth and eighth day and expressed in percentage.

RESULTS AND DISCUSSION

The performance of prototype thresher was compared with the local practices for threshing whole crop Finger millet.

Effect of different method of threshing Whole crop Finger millet on output capacity: The Table I shows that the output capacity varied significantly among the methods of threshing. Passing tractor with stone roller over the uniformly spread whole crop Finger millet was found to be 1.01 and1.76 times faster than passing bare tractor and threshing by prototype thresher respectively. Though the output capacity recorded by passing bare tractor and tractor with stone roller (1.76 to 1.88 times, respectively) was faster than the prototype thresher developed for Finger millet, these two methods required a specially prepared threshing yard and transportation of material from harvested field to threshing yard, the requirement of tractor, leading to involvement of man power, time, and hence cost of operation. On the other hand the prototype thresher needs no threshing yard and can be taken to the harvested field. For threshing there by minimizes the cost of preparation of threshing yard and labour required for transportation in addition to the saving of time.

TABLE I

Comparative performance of prototype thresher over existing practices for threshing whole crop Finger millet

Methods of threshing	Output capacity (kg/h)	Broken (%)	Unthreshed grain (%)	Threshing efficiency (%)	Germination (%)
Whole crop by bare tractor	112.50	2.05	8.19	91.89	94.95
Whole crop by passing tractor with stone	120.50	3.27	5.93	94.06	94.65
Prototype power thresher	63.40	2.59	5.80	94.15	90.04
F-value	*	*	*	*	*
SEM±	1.40	0.05	0.13	0.62	0.27
CD at 5%	3.44	0.14	0.32	1.53	0.66

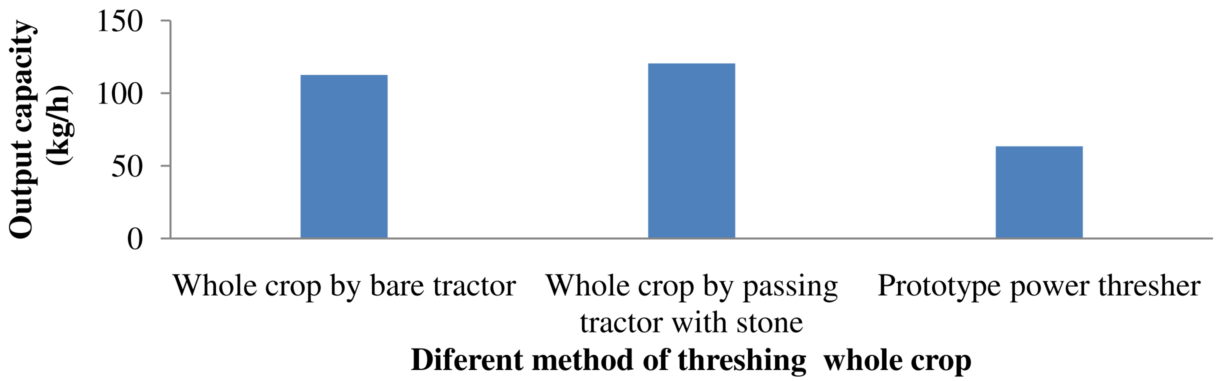

Fig.1. Effect of different methods of threshing whole crop Finger millet on output capacity

Effect of different method of threshing Whole crop Finger millet on damage of grain: The visible damage caused to the seeds recorded by naked eyes is presented in Table I. The data shows that the damage caused to the seeds vary significantly among the methods of threshing. From the Fig.2 the per cent of damage caused varied between 2.59 to 3.27 per cent. The damage was high (3.27 per cent) when tractor with stone was passed, closely followed by tractor without stone roller (3.05 per cent) and there was less damage by using prototype thresher. Passing tractor with stone roller over the material spread on the threshing floor recorded a higher percentage of damage to the seeds compared to passing bare tractor due to immediate shearing action of stone roller on the crop after passing the tyres cause damage to grain. However, the damage caused to the seeds in all the threshing methods under test are within the safer limits (±5 per cent).

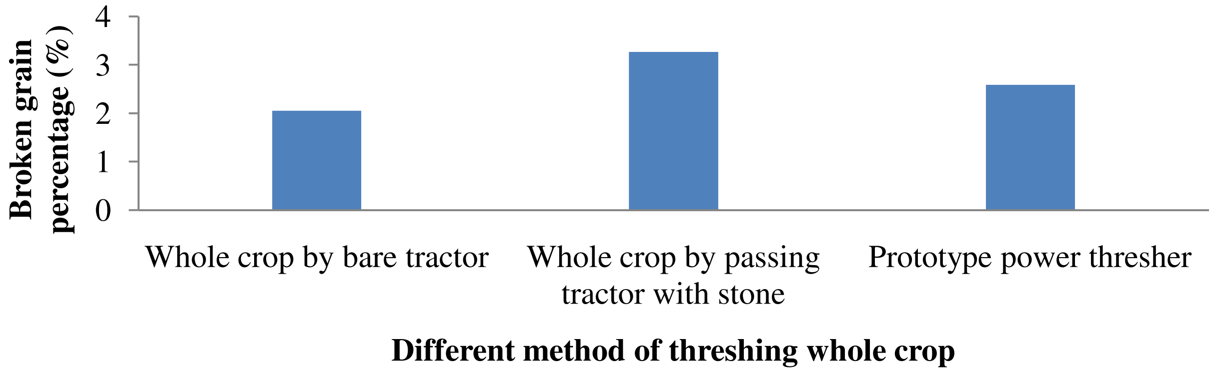

Fig. 2. Effect of different methods of threshing whole crop Finger millet on broken grain percentage

Effect of different method of threshing whole crop Finger millet on unthreshed grain: The samples of threshed earheads were analyzed to find out the grains intact with them. The data presented in Table I indicates that the unthreshed grain left over in the earheads vary significantly among the methods of threshing. The intact unthreshed grains in the earheads ranged between 8.10 - 5.80 per cent. The highest percentage (8.1 per cent) of unthreshed grain left over in the ear heads was recorded in the samples threshed passing bare tractor and the least one by using prototype thresher. As stated elsewhere in the text, separation of grains from Finger millet ear heads required impact and shearing force. In the prototype thresher, the separation of grains from the ear heads was done on impact and shearing forces leading to effective separation. But in passing bare tractor and also bare tractor with stone roller shearing force is the major force for threshing the grains. However, the unthreshed grains left over in the ear heads was found to be within the allowable limits of ±5 per cent.

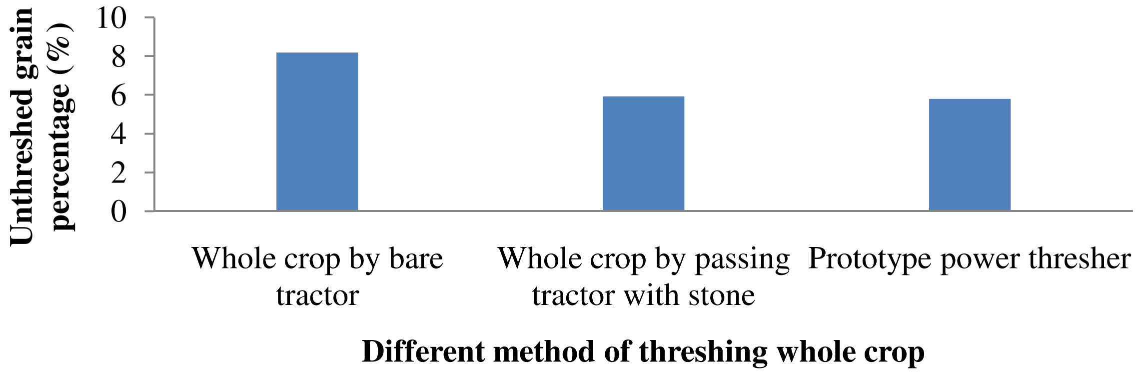

Fig. 3. Effect of different methods of threshing whole crop Finger millet on unthreshed grain percentage

Effect of different method of threshing Whole crop Finger millet on threshing efficiency: Threshing efficiency mainly depends on the moisture content of the crop and the force applied on it. The data in Table I show that the threshing efficiency varies significantly among different methods of threshing. Highest percentage of threshing efficiency (94.15 per cent) was recorded by prototype thresher fallowed by passing tractor with stone roller and in the passing bare tractor. As stated earlier, the rotating cylinder drum in the power thresher created the impact and shearing force sufficient enough to separate grains from the crop when it moves in a restricted passage between the rotating cylinder and the stationary concave leading to higher threshing efficiency. On the other hand material spread on a threshing yard acts as a cushion when tractor with or without stone roller passed over it leading to left over unthreshed grain and hence recorded comparatively lesser threshing efficiency. However the threshing efficiency was found to be within the allowable limits of ±5 per cent.

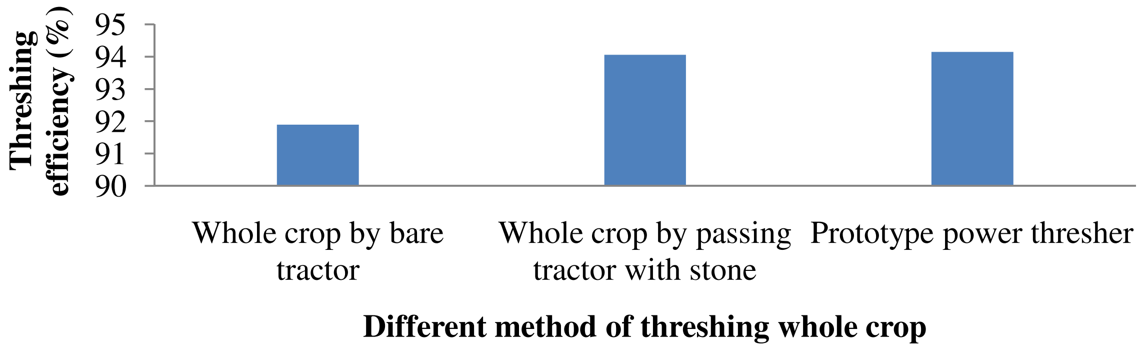

Fig. 4.Effect of different methods of threshing whole crop Finger millet on threshing efficiency

Effect of different method of threshing Whole crop Finger millet on germination percentage:The data in the Table I indicates that the viability of grain varies significantly among the method of threshing. From the Fig.5 it shown to be highest when the seeds were threshed by bare tractor and least in threshing by prototype thresher. This may be due to the non-visible damage caused to the seeds by impact force of the rotating cylinder. However the viability recorded was found to be within the safer limits (85 per cent and above) in all the methods of threshing under test.

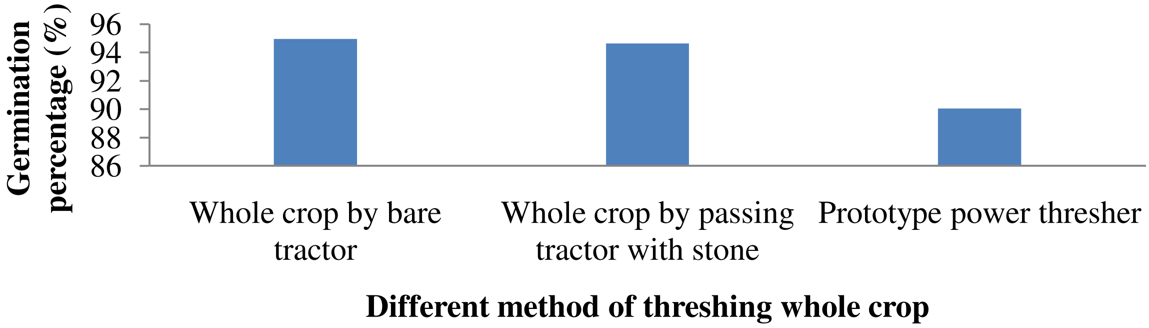

Fig. 5. Effect of different methods of threshing whole crop Finger millet on germination percentage

From the data adoption of prototype thresher for Finger millet threshing found to be cheaper, needs no threshing yard, needs no transportation of harvested crop from field to the threshing yard, lesser damage to the grain, higher threshing efficiency and lower percentage of unthreshed grain than passing tractor with or without stone roller wherein it requires specially prepared threshing yard, transportation of harvested material from field to the threshing yard, more men power for threshing and waiting for natural wind breeze to winnow the threshed material.

CONCLUSION

Considering the need of preparation of threshing yard, transportation of harvested crop to the threshing yard , peak threshing period availability of tractor and simplicity of prototype thresher, its low operating cost, higher threshing performance it's better to adopt power operated prototype thresher for Finger Millet threshing .

REFERENCES

[1] CHOWDE GOWDA, M., SREENATHA, A., RAMYA, H.N. AND JAYAMALA, G.B., 2010.Estimation of Energy Requirement for Finger millet (Eleusine G.) Cultivation in Karnataka (India). International Journal of Applied Agricultural Research, **5(1)1**-8

[2] DHAND, N.K., 1980, Modification of an existing rasp bar paddy thresher for wheat. *B. Tech. Project Report,* College of Agricultural Engineering, PAU, Ludhiana, India.

[3] IRTWANGE, S.V., 2009, Design, fabrication and performance of a motorized cowpea thresher for Nigerian small-scale farmers. *African Journal of Agricultural Research*. **4(12)**: 1383-1391, December.

[4] MAHMOUD, A.R. AND BUCHELE, W.F., 1975, Distribution of shelled corn throughput and mechanical damage in a combine cylinder. Trans. of the ASAE **18(2)**: 448-452.

[5] OJHA, T.P AND DEVNANI 1987, status of harvesting machinery in India-a Country report 'Regional work shop on Design and Development of harvesting and Threshing Equipment' IARI, New Delhi, October 4-14.

[6] SINGH, B. AND KUMAR, A., 1976, Effect of cylinder type on threshing effectiveness and damage of wheat. *J. Agril. Engg.,***13(3)**: 124-129.