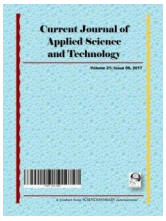

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A Comparative Study of Plot Size Thresher over Traditional Method of Threshing Kutki

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

This research was based on efficiency of plot size millet thresher over traditional method of threshing Kutki millet. Kutki millet (little millet) is one of the most important small millet crop grown in rainfed area of Madhya Pradesh India. Traditionally in tribal and hilly area, threshing of Kutki millet crops is done by beating sticks and tractor bare operation which is more time consuming, energy intensive, labour intensive and uneconomical. The plot size millet thresher can reduce the drudgery of farmers, labours improve the quality of product, with existing socio economic condition of millet growing tribal farmers. Thus, the plot size millet thresher was found best with 99.6% threshing efficiency, 98.9% cleaning efficiency, 20.2 kg/h output capacity, 0.45% un-threshed grain percentage and 0% broken grain.

Keywords: Kutki millet; plot size thresher; traditional threshing.

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1. INTRODUCTION

Kutki (*Panicum sumatrense*), is one of the important millet mainly grown in tribal and hilly area of Madhya Pradesh, India. Kutki millet crops are harvested manually and then transported to threshing yard, where, the harvested crops are threshed by treading under tractor tyres. This is a practice followed by small and marginal farmers. Threshing is the process of separating grains from dry heads accomplished by impact of a fast moving element, rubbing, squeezing or a combination of these method on the heads [1]. The traditional method for threshing of kodo millet and Kutki is generally done by hand. In many areas, the crop is threshed underfoot by human or animals [2]. The traditional methods result in some losses due to the grain being broken or buried in the earth. Often this local method of threshing processes decrease the quality of the product due to the presence of impurities like stones, dust and chaff. In the case of large scale threshing, bullock stone roller or a tractor with or without a stone roller is passed over the crop spread uniformly on the floor. These practice are time consuming, tedious and uneconomical also leading to considerable amount of loss of grain during the threshing process. Further, rains cause damage to the threshed crop if it is not cleaned, dried and stored quickly. The thresher to be designed for Kutki millets must incorporated the moving elements that may provide the impact on the feeding material for detachment of grain from earheads, rubbing/shearing action to remove husk/outer coating from the grain [3]. Irtwange [4] 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% cleaning efficiency and loss of grain 95.60 and 3.71 per cent respectively, was observed indicating the use of a star shaped beater, Additionally, this method can reduce the drudgery and cost to a minimum yet achieving good quality products. Adaptation of plot thresher finger millet was found with 94.15% threshing efficiency and 2.59% seed damage [5].

The aim of this study is to evaluate the threshing of Kutki millet by traditional methods and in plot size thresher, and to study optimum operating parameters for obtaining maximum threshing efficiency and output.

2. MATERIALS AND METHODS

To evaluate traditional method of threshing, Kundam village was selected for conducting survey to study the threshing practices of Kutki millet. There are two traditional methods followed for threshing Kutki millet i.e. hand beating and tractor bare passing method. The threshing done by using plot thresher was conducted at the Department of farm machinery and power Engineering, Jawaharlal Nehru krishi vishwavidhalaya Jabalpur. The two methods of threshing Kutki crop were selected and their threshing efficiency, cleaning efficiency, output capacity, broken grain percentage, un-threshed grain percentage were compared with the plot millet thresher. In this method, the plot size thresher were tested in optimum condition which are 1053 rpm and 712 rpm with 2 mm concave clearance Table1 shows the terminology which were used in the study.

3. RESULTS AND DISCUSSION

The performance of plot size thresher was compared with the local practices for threshing Kutki millet.

3.1 Threshing Efficiency

In Fig. 3.1 the performance of plot size thresher was compared with the existing practices like hand beating manually and passing bare tractor. The threshing efficiency with manually hand beating was found 95.08%, threshing efficiency with tractor bare passing was 97.31% and threshing efficiency with plot size thresher was 99.57%. Threshing efficiency mainly depends on the force applied. The highest threshing efficiency was obtained threshing in plot size thresher thus, the rotating cylinder drum in plot size thresher created impact and shearing force sufficient enough for separation of grain from the crop, when it moves in a restricted passage between rotating cylinder and stationary concave leading to higher threshing efficiency.

3.2 Cleaning Efficiency

In Fig. 3.2 the performance of plot size thresher was compared with the existing practices like hand beating manually and passing bare tractor. Thus, the cleaning efficiency with manually hand beating was found 88.05%, cleaning efficiency with tractor bare passing was 87.80% and cleaning efficiency with plot size thresher was 98.94%.

3.3 Output Capacity

Fig. 3.3 shows that the output capacity showed a considerable variation among the all methods of threshing. Using plot size thresher over the uniformly spread Kutki millet ear heads was found to be threshed faster than manually hand beating and passing bare tractor respectively. The output capacity recorded by passing bare tractor was 90.5 kg/hr the output capacity was found higher in tractor bare passing method because of the higher capacity of tractor. Manually hand beating the result was 15.58 kg/hr. More over these two methods need farm yard, labour and time. In plot size thresher output capacity was recorded 20.2kg/hr. For threshing in plot size thresher there was no need for preparation of threshing yard and labour which were required for transportation thus, it is time saving operation.

3.4 Broken Grain Percentage

In Fig. 3.4 the performance of plot size thresher was compared with the existing practices like hand beating manually and passing bare tractor. Thus, the broken percentage of manually hand beating was found 1.60%, broken percentage in tractor bare passing was 2.79% and broken percentage in plot size thresher was found 0%. Tractor bare Passing method threshed over the material spread on the threshing floor recorded a higher percentage of damage to the seeds compared to manual method and plot size threshing method due to an immediate shearing action of the heavy tyre on the crop after passing the tractor.

3.5 Un-threshed Grain Percentage

In Fig. 3.5 the performance of plot size thresher was compared with the existing practices like hand beating manually and passing bare tractor. Thus, the un-threshed grain percentage of manually hand beating was found 1.92%, un-threshed grain percentage in tractor bare passing was 2.90% and Un-threshed grain percentage in plot size thresher was found 0.45%. As stated previously in the research, separation of grains from Kutki ear heads required impact and shearing force. In the plot size thresher, the separation of grains from the ear heads was done on impact and shearing forces leading to effective separation. But in tractor bare passing force is the major for threshing grains. However the un-threshed grain percentage is higher in tractor bare passing method.

3.6 Cost Evaluation

The estimated cost of thresher was worked out to be Rs 25,000 with hourly cost of operation 4.36 rs/kg. The cost of operation of manual hand beating was computed to be 8.25rs/kg and required a total of 5 man per hours. While calculating operational cost labour charge at Rs. 260.00 per day of 8 hours of operation. Thus, the cost of operation of tractor bare passing was calculated 14.65 rs./kg. Thus, the cost wise threshing in plot size thresher was also beneficial due to low cost of operation.

Table 1. Terminology used for threshing performance

1.	**Threshing Efficiency**	$TE = \frac{M_T}{M_A} \times 100$	where, TE= Threshing Efficiency (%) M_T= Mass of threshed millet(kg) M_A= Mass of total millet panicle(kg)
2.	**Cleaning Efficiency**	$CE = \frac{M_{SI}}{M_{UI}} \times 100$	where, CE= Cleaning Efficiency (%) M_{SI}= Mass of separated impurities (kg) M_{UI}= Mass of total un-separated impurities (kg)
3.	**Output Capacity**	$OC = \frac{M_T}{T_t} \times 100$	where, OC= Output capacity(kg/hr) M_T= Mass of total grain (kg) T_t= Time taken (h)
4.	**Broken Grain Percentage**	$BGP = \frac{M_D}{M_T} \times 100$	where, BGP= Broken grain percentage (%) M_D= Mass of damaged grain collected at all outlets per unit time (kg) M_T= Mass of total grain output per unit time (kg)
5.	**Un-threshed Grain Percentage**	$UGP = \frac{M_U}{M_T} \times 100$	where, UGP= Un-threshed grain percentage (%) M_U= Mass un-threshed grain per unit of time at all outlets (kg) M_T= Mass of total grain input per unit time (kg)

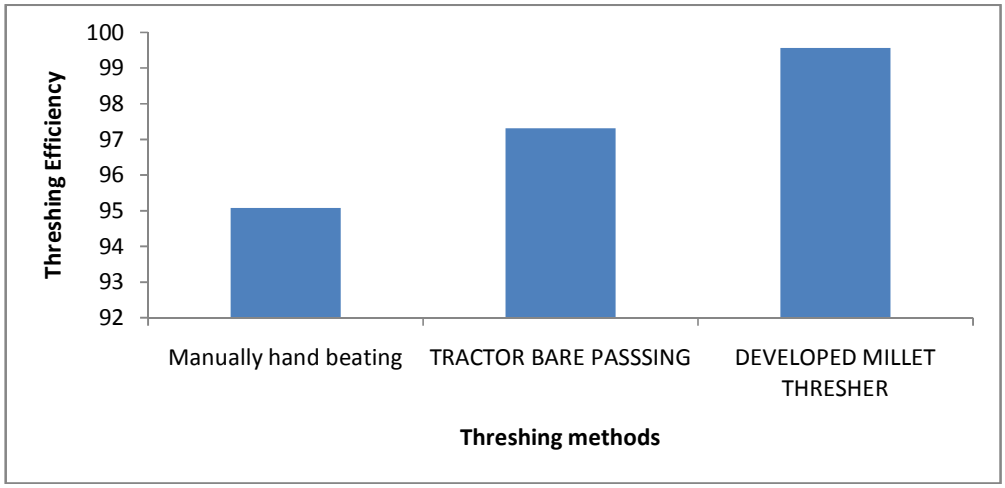

Fig. 3.1. Comparision of threshing efficiency with traditional method of threshing

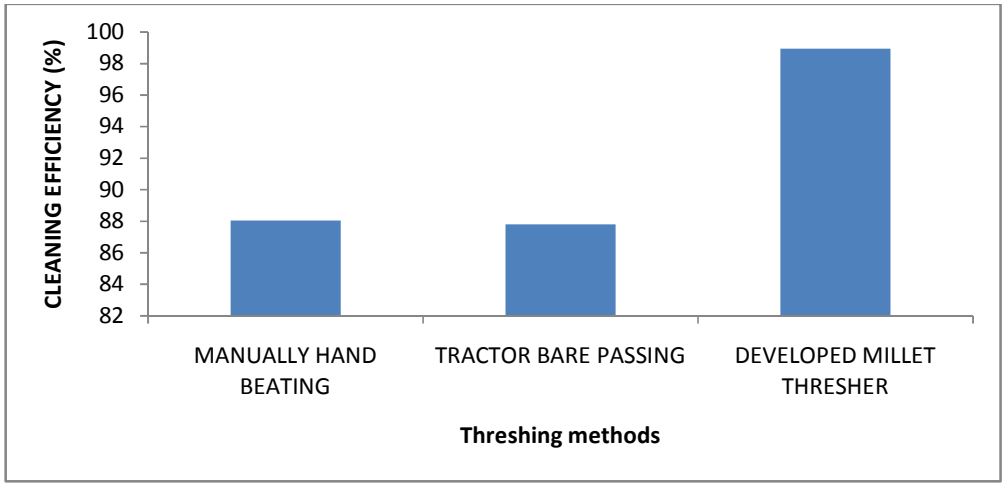

Fig. 3.2. Comparision of cleaning efficiency with traditional method of threshing

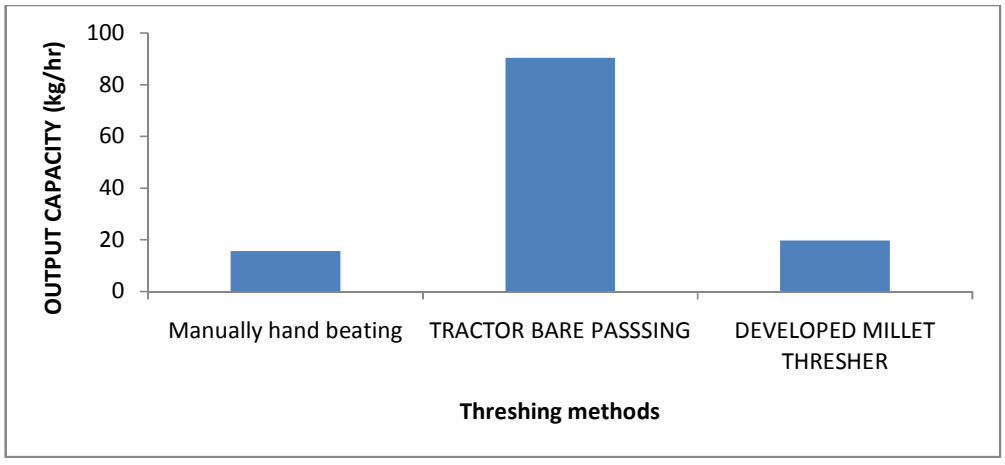

Fig. 3.3. Comparision of output capacity with a traditional method of threshing

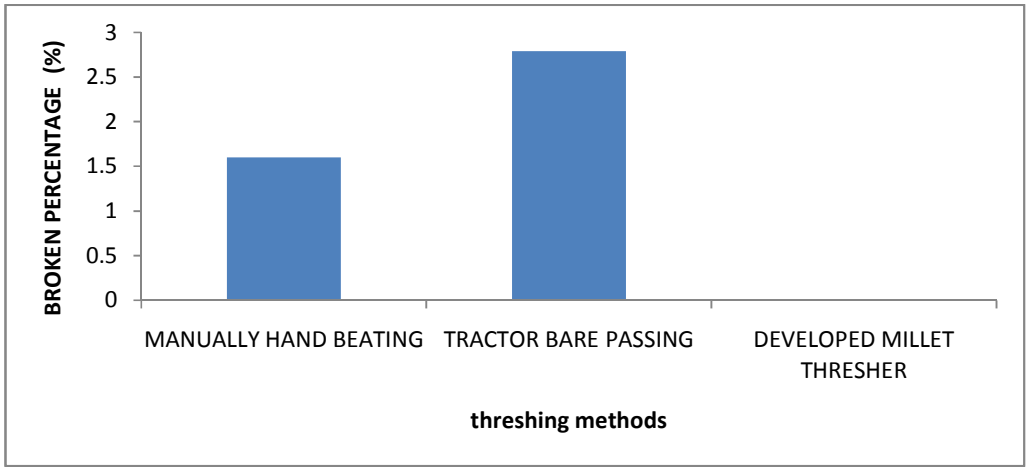

Fig. 3.4. Comparision of broken percentage with traditional method of threshing

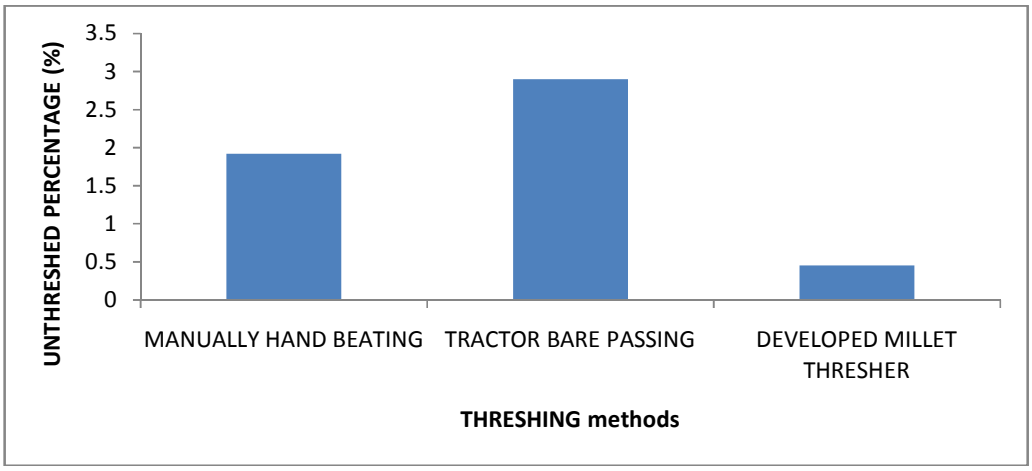

Fig. 3.5. Comparision of un-threshed grain percentage with traditional method of threshing

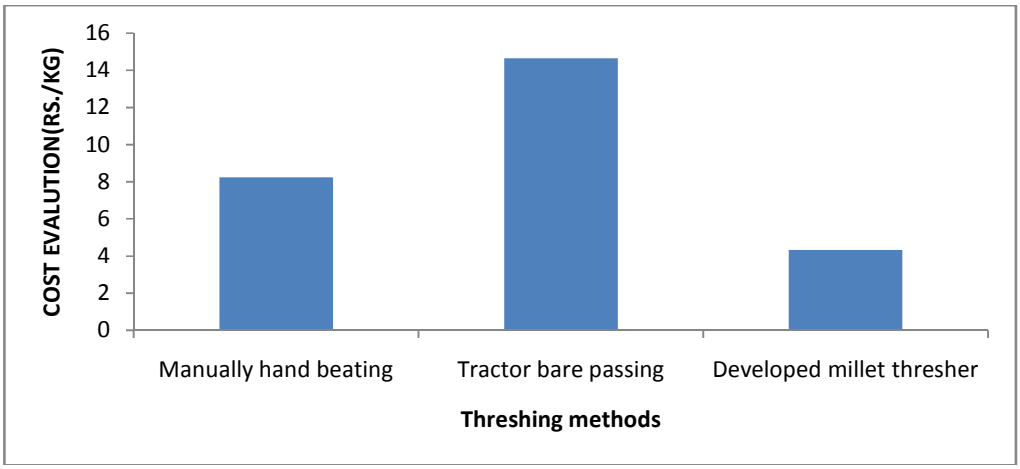

Fig. 3.6. Comparision of cost with traditional method of threshing

4. CONCLUSION

The performance of plot size thresher was best with threshing efficiency 99.57%, cleaning efficiency 98.84%, un-threshed grain percentage 0.45% and zero percent broken grain percentage. The plot size threshing is best as compare with manually threshing and tractor bare passing, because the availability of labour is decreased now a days and tractor, are not found to be easily available in tribles area so, the crop gets damaged. Thus, the plot size thresher having low operating cost, zero percent damage for threshing Kutki millet. This proves that the plot size thresher is more efficient, due to a low cost of operation it is economical and precise then other traditional methods.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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