



Research Article

PERFORMANCE EVALUATION OF HAND OPERATED MAIZE SHELTER

RAJENDER G.^{1*}, ANUBABU T.², KRISHNA CH.², ALI MD. MAJEED², THIRUPATHI CH.² AND VINOD V.²

¹Department of Agricultural Process & Food Engineering, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, 500030 Telangana

²College of Agricultural Engineering, Sangareddy, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, 500030 Telangana

*Corresponding Author: Email-raju1231123@gmail.com

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Abstract- The most important aspect of post-harvest operation of maize is maize shelling or simply maize threshing. For a long time now, shelling maize to remove the grain from the cob has been a time consuming, tedious and a mind cracking process especially to the many small scale farmers in the country that basically practice subsistence maize farming. Small scale equipments like hand operated maize shellers were developed and economically feasible for small farmers. The aim of this investigation is to performance evaluation of hand operated maize sheller which was fabricated by FIM scheme, Rajendranagar. The machine was tested on three local varieties of maize DHM117; DHM115 and 900M Gold procured from different parts of Telangana (Rangareddy, Medak, Khammam) with moisture content level below 12% (w.b.). The shelling capacity of hand operated maize sheller on maize varieties DHM 117; DHM 115 and 900M Gold was found as 39.75kg/h; 39.89kg/h and 40.22kg/h with an average shelling efficiency of 97.49%; 98.134 and 98.394% respectively. The shelling efficiency and shelling capacity is not varying with variety of maize.

Keywords- Hand operated maize sheller, Machine capacity, Shelling efficiency, maize thresher.

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Introduction

Maize is one of the most important cereal crops, largely cultivating in this world after wheat and rice. The world's production of maize is about 856 million tons, whereas in India it is 21.81 million tons (2016-17) [1]. The important maize grown districts are Karimnagar, Nizamabad, Warangal and Adilabad, contribute about 80% of maize production in Telangana and Andhra Pradesh. In Telangana State the maize crop is grown in 6.91 lakh hectares. It is third growing crop after cotton and paddy in Telangana State [2]. It is basically the removal of the maize kernels from the cob. This separation, done by hand or machine, is obtained by threshing, by friction or by shaking the products; the difficulty of the process depends on the varieties grown, and on the moisture content as well as the degree of maturity of the grain. The main purpose of the study is performance evaluation of hand operated maize sheller which is typically a thresher for the small farmers who tend to maize farms less than two acres.

Materials and methods

Raw Materials

Three varieties of maize cobs namely DHM 117, DHMM 115 and 900M GOLD were selected and procured from different parts of Telangana (Rangareddy, Medak, Khammam) for carry out this research. The selected cobs should have moisture content less than 14% (w.b.) to get more shelling efficiency (Naveenkumar, D.B. and Rajshekarappa, K.S. 2012) This study was carried out on hand operated maize sheller as shown in [Fig-1] which was fabricated by FIM Scheme, Rajendranagar [3].



Fig-1 Hand operated maize sheller

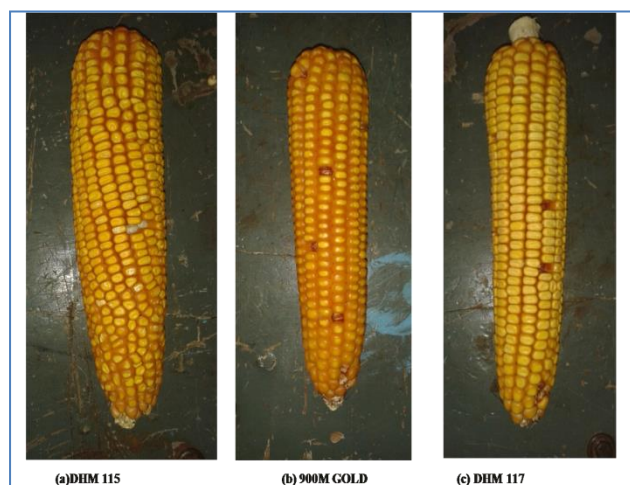


Fig-2 photo view of different maize varieties

Performance Evaluation

The operators were given the tips, information and working of the machine for 20 min before starting the actual trials. In each trial machine was operated for 30 min to shell the maize cobs. Three trials of the machine were conducted on DHM 117 variety maize cobs with moisture content of 11.80% (w.b); DHM 115 variety maize cobs with moisture content of 11.10% (w.b) and 900M GOLD variety maize cobs with moisture content of 10.60% (w.b). The definitions and calculations of these parameters are as under

Determination of moisture content:

The moisture content of wet basis of dried grains were determined by hot air oven method for all the varieties done by putting 10-15 grams of grains at 130°C for 1h. The average moisture content of the two samples was calculated to obtain the moisture content of the samples using the relationship below:

$$MC (w.b) \% = \frac{W_w - W_d}{W_w} \times 100$$

Where,

W_w = Weight of wet grains, g

W_d = Weight of dried sample, g

Shelling capacity: The weight of maize cobs was shelled in unit time is calculates as shelling capacity of the machine

Shelling efficiency: Shelling efficiency can be calculated as percentage of weight of shelled grains from outlets with respect to total weight of input grains

$$\text{Shelling efficiency (\%)} = \frac{(\text{quantity of shelled grain obtained from all outlets in kg})}{\text{Total grain input in kg}} \times 100$$

Unshelling efficiency

Unshelled grain from all outlets with respect to total grain input and it is calculated by the following formula.

$$\text{Unshelling efficiency (\%)} = \frac{(\text{quantity of unshelled grain obtained from all outlets in kg})}{\text{Total grain output in kg}} \times 100$$

Visible damage (%):

Visible damage grains from the grain outlet with respect to total grain received at outlet expressed as percentage by weight.

$$\text{Visible damage (\%)} = \frac{(\text{Broken grains from outlet in kg})}{\text{Total grain input in kg}} \times 100$$

Results and discussions

The hand operated maize sheller was tested for three varieties of maize cobs for 30 minutes and five trails for each variety were recorded. The results were analyzed for shelling efficiency, unshelled grain (%), visible damage (%) and capacity (kg/h). The Pedal operated maize Sheller was initially tested on DHM 117 variety maize cobs for 30 minutes and five trails were recorded. The shelling capacity in terms of maize cobs varied from 37.50 kg /hr to 42.50 kg /hr with an average of 39.75 kg/hr as shown in [Table-1] with an shelling efficiency varied from 97.12% to 97.80%.

Table-1 Performance of Pedal operated maize sheller on DHM 117 variety

Replications	Time, min	Weight of cobs, kg	Capacity, kg/h	Shelling Efficiency, %	Unshelled grains, %	Visible damage, %
1	30	21.250	42.50	97.12	2.340	0.705
2	30	20.880	41.76	97.22	2.231	1.370
3	30	19.330	38.66	97.59	1.952	1.240
4	30	19.185	38.37	97.72	1.865	1.146
5	30	18.750	37.50	97.80	1.694	1.380
Average	30	19.875	39.75	97.49	2.016	1.168

The pedal operated maize sheller was tested on DHM 115 maize variety. The shelling capacity in terms of maize cobs varied from 19.07 kg/h to 21.37 kg/h with

an average of 19.95 kg/hr as shown in [Table-2] with an shelling efficiency varied from 97.50% to 98.62%.

Table-2 Performance of Pedal operated maize sheller on DHM 115 variety

Replications	Time, min	Weight of cobs, kg	Capacity, kg/h	Shelling Efficiency, %	Unshelled grains, %	Visible damage, %
1	30	21.37	42.75	97.500	1.953	1.169
2	30	20.52	41.04	98.100	1.291	0.925
3	30	19.46	38.91	98.220	1.111	0.873
4	30	19.33	38.66	98.450	0.883	1.500
5	30	19.07	38.13	98.620	0.686	0.681
Average	30	19.95	39.89	98.134	1.584	1.029

The pedal operated maize sheller was tested on 900M GOLD maize variety. The shelling capacity in terms of maize cobs varied from 37.57 kg/hr to 45.22 kg/hr

with an average of 41.76 kg/hr as shown in [Table-2] with an shelling efficiency varied from 97.90% to 98.94%

Table-3 Performance of Pedal operated maize sheller on 900M GOLD variety

Replications	Time, min	Weight of cobs, kg	Capacity, kg/h	Shelling Efficiency,%	Unshelled grains,%	Visible damage,%
1	30	45.226	90.452	97.900	1.980	0.353
2	30	41.379	82.758	98.300	1.546	0.459
3	30	43.062	86.124	98.380	1.454	0.394
4	30	41.570	83.140	98.430	1.243	0.384
5	30	37.578	75.156	98.940	0.946	0.266
Average	30	41.763	83.526	98.390	1.434	0.371

Conclusion

The hand operated maize sheller was tested on three maize varieties. The shelling capacity of hand operated maize sheller on maize varieties DHM 117; DHM 115 and 900M Gold was found as 39.75kg/h; 39.89kg/h and 40.22kg/h with an average shelling efficiency of 97.49%; 98.134 and 98.394% respectively. The percentage of unshelled grains and visible damage was more in maize variety DHM 117 compare to remaining varieties. The shelling efficiency and shelling capacity is not varying with variety of maize.

Application of research

Hand operated maize sheller is useful for small farmers who cultivate maize in less than two acres to shell and market it.

For farmers who prepare concentrate feed material for their animals at home

Research Category: Maize sheller, Shelling efficiency, maize thresher

Abbreviations:

cm : centimetre
et al : and others
etc. : Etcetera
Fig. : figure
d.b. : Dry basis
m.c. : moisture content
w.b. : Wet basis
h : Hour
Kg : Kilogram

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*Research Guide or Chairperson of research: Dr Rajender G

University: Professor Jayashankar Telangana State Agricultural University Rajendranagar Mandal, Hyderabad, 500030 Telangana

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