Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8541

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(1), 113-117

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Development and Performance Evaluation of Hand Operated Maize Sheller

H. D. Nahate[1*], V. G. Kothalkar[2] and Hage V. J.[3]

[1,2,3]Assistant Professor, Department of Farm Power and Machinery,
College of Agril. Engg. and Technology, Jalgaon Jamod

*Corresponding Author E-mail: harishnahate@gmail.com

Received: 10.12.2020 | Revised: 17.01.2021 | Accepted: 23.01.2021

ABSTRACT

Shelling is one of the important post harvest technology operation where the kernels are to be separated from the cobs to use as seed, fodder, and oil extraction and to prepare the value added products and also to maintain the quality of end product. The maize shellers which are manually or power operated, are used to remove the corn pearls from the cobs. But traditional maize shelling equipments are not fully effective. Also labours are not available in peak season. High wages of labour, changing environment affects the quality of maize kernels. The factors affecting maize shelling efficiency are level of moisture content in the crop, size and quality of cobs, rate of supply of cobs and the extent of the dehusking of the machine. In view of this, it is highly essential to develop a continuous hand maize sheller for enhanced capacity with low grain broken percentage and a modified tubular hand maize sheller for the benefit of small and marginal farmers, especially for seed purposes. A more efficient shelling is achieved when the grain has been suitably dried to 13 percent to 14 percent moisture content. The physical properties of maize at moisture contents were recorded like grain mean diameter, cob mean diameter, cob length, cob width, grain cob mean weight and shelled cob mean weight. Broken seed was 1.96 per cent.

1. *Spread seed was 2.23 per cent.*
2. *Unshelled seed was 4.25 per cent.*
3. *Input and Output capacity was 21.35 kg/h and 14.34 kg/h respectively.*

Keywords: *Sheller, Traditional method, Broken seed, Shelling efficiency etc.*

INTRODUCTION

Maize (*Zee mays* L.) is also known as corn, is the world's third most important cereal crop after wheat and rice. It has very high yield potential and is commonly known as "Queen of cereals". World produces about 856 million tons of maize, whereas India produces about 25 million tons (2017-18). The important maize grown districts are Karimnagar, Medak, Nizamabad, Warangal and Adilabad, contribute about 80 per cent of maize production in Andha Pradesh.

Cite this article: Nahate, H.D., Kothalkar, V.G., & Hage, V.J. (2021). Development and Performance Evaluation of Hand Operated Maize Sheller, *Ind. J. Pure App. Biosci.* *9*(1), 113-117. doi: http://dx.doi.org/10.18782/2582-2845.8541

It is grown over an area of 8.33 lakh hectares in Andha Pradesh with total production of 36.58 lakh tones (www.indiastat.com). Maize contains about 10 per cent proteins, 4 per cent oil, 70 per cent carbohydrates, 2.3 per cent crude fiber, 10.4 per cent albuminoides and 1.4 per cent ash. Maize has significant quantities of vitamin A, nicotinic acid, riboflavin and vitamin E. Over 85 per cent of maize produced in the country is consumed as human food like chapattis prepared out of maize flour and grain, roasted ears and popcorn. Maize crop furnishes huge quantities of green fodder for cattle. Maize starch is used as chemical for production of plastics, fabrics and adhesives. Several industries like starch, milling etc., are based on maize products and by-products. In addition to big industries, several cottage industries are also flourishing on the by products of maize.

The major steps involved in the processing of maize are harvesting, shelling and milling. Mostly harvesting of maize crop is being done manually with traditional sickle at a moisture content of about 33 per cent and the crop is dried in sunshine to reduce the moisture content to 15-21 per cent d.b.

In the past, various types of design have been developed with different design approaches which have their advantages and disadvantages and also operational limitations. We don't have efficient shellerr for manual maize shelling. Traditional methods of sowing give rise to:

1. Drudgery
2. More time consuming maize shelling techniques
3. Loss of seed due to carelessness of labour
4. Problem of labour in peak season
5. High wages of labour
6. Precise maize shelling is not achieved

There are many drawbacks and limitations for maize shelling, therefore it is necessary to develop equipment to overcome the drawbacks of the traditional methods of maize shelling.

MATERIALS AND METHODS

1. It should be portable.
2. The machine has to be affordable.
3. Machine should be easily operated by labour.
4. Material should easily available.
5. It should be simple for easy maintenance when necessary

Following are some consideration for development of hand operated maize sheller: The materials used for the work were sourced locally. Maize used to evaluate the performance was bringing from local farms.

The functional parts of machine include:

1. Frame
2. Hopper
3. Handle
4. Shelling blade
5. Pressing unit

4.1 Specification of machine component

S.N	Name of Component	Specification(cm)	Material
1	Frame	Length=90 Width=21 Height(46+100)	MS angle
2	Hopper	Length=36 Width(broad=19 Narrow=11)	Aluminium sheet
3	Handle	Length=90 Diameter=6	Steel rod
4	Shelling blade	Length=10 Diameter=4	Iron rod
5	Pressing unit(bowl×rod)	Length=55 Diameter=6	Steel rod

Frame:

The frame as shown in plate 4.1 is fabricated by using MS angle. It is use for supporting the structure. Frame is look like inverted V shape. It holds all pressure acted on machine. Overall dimension of frame are 90 cm length, 21 cm width and 140 cm height.

Hopper

The hopper as shown plate 4.2 is fabricated by using Aluminium sheet. It is used to collect the shelled grains. This unit is at top of the frame. Length of hopper is 36 cm, inner width is 19 and outer is 11.

Handle

The straight handle as shown in plate 4.3 is made up of steel rod, which is attached to the frame with movable arrangement. It consists of rubber cover at the end. Handle is 90 cm long and diameter of 6 cm.

Sheller blade

The sheller blade as shown in plate 4.4 is made up of iron rod have vanes at inner side or tooth at the edges of the blade. It is used for removal of maize with the help of sharpened blades. Sheller blade is 10 cm long, with diameter 4 cm. It has 9 numbers of sharp edges.

Pressing unit

Pressing unit as shown in plate 4.5 is made up of steel rod with bowl like component at bottom. Rod is 55 cm long and bowl have diameter 6 cm. It has arrangement to move up and down with the help of handle.

Assembly of machine

The arrangement of various component of hand operated maize sheller being done as follows:

The foundation frame is being selected which carry the entire load of the machine. Sheller blade and hopper are mounted on the frame. Handle attached to the frame with movable arrangement. Pressing unit is mounted on handle. Handle and the pressing unit are the only movable parts of the machine. These are joined by nut and bolds.

Approximate cost of the maize sheller is calculated as given below:

Material use for fabrication of machine is MS angle, steel rod, aluminium sheet and iron rod. The total fabrication cost of machine is Rs.1500. Details are given in the Table 4.2

S.N	Material	Quantity	Rate(Rs.)	Total cost(Rs.)
1	MS angle	6.0kg	35	210
2	Aluminium sheet	1	180	180
3	Iron rod	1.0kg	200	200
4	Steel rod	0.5kg	100	50
5	Miscellaneous: Nut and bolt	6	-	30
6	Labour charges	-	-	700
Total cost of machine				1470 Say 1500

RESULTS

Performance evaluation of hand operated maize sheller:

Working Principle:

Hand operated maize sheller is operated on the rubbing action and pressing action. The maize comes in a contact with two members, one is pressing unit and another is shelling unit. The shelling unit is stationary member while the pressing unit is movable member. Due to the rubbing action the maize get shelled and divided into two parts i.e. in the kernels and cob. Maize is placed on the shelling unit and get pressed by pressing unit. The diameter of shelling unit is according to the maize. After the shelling of maize the cob is fall on the ground while kernels are collected into hopper. Pressing unit is operated by handle. Hopper is placed at inclination and collected into gunny bag.

Physical Characteristics of Hand Operated Maize Sheller

S.N	Diameter of cob (with grains) (cm)	Diameter of cob (without grains) (cm)
1	5.0	3.0
2	4.3	3.4
3	4.0	2.7
4	4.5	2.8
5	5.1	3.4
6	4.8	3.0
7	4.5	2.8
8	3.2	2.3
9	4.5	3.3
10	4.9	3.5
11	5.5	3.9
12	5.0	3.1
Avg.	4.2	3.1

Performance Evaluation of Hand Operated Maize Sheller

The average number of grains per cob is 376. Maize has moisture contain at the time of shelling is generally noted as 14 per cent. Machine was tested and results obtained are presented and discussed as below.

Broken seed, Spread seed and unshelled seed

The percentage of broken seed, spread seed and unshelled seed were observed and tabulated in Table 5.2

S.N	Parameter	R1	R2	R3	R4	R5	R6	Avg.
1	Broken Seed (%)	1.96	2.29	1.63	1.96	2.62	1.31	1.96
2	Spread Seed (%)	2.29	2.29	1.96	2.29	2.95	1.63	2.23
3	Unshelled Seed (%)	5.24	2.62	3.27	5.57	5.24	3.60	4.25

From Table 5.2 it was observed that the average broken seed were 1.96 per cent. The average spread seed and unshelled seed were 2.23 per cent and 4.25 per cent respectively.

Input and Output Capacities

The two values of Input and Output capacities were observed and tabulated in Table 5.3

From Table 5.3 it was observed that the average input capacities were 21.35 kg/h and average output capacities (considering clean seed as output) were 14.34 kg/h. The average input and output capacities were depends on moisture contain of the maize.

S.N	Capacities (kg/h)	R1	R2	R3	R4	R5	R6	Avg.
1	Input	22.00	21.66	18.83	23.90	25.32	16.42	21.35
2	Output	13.70	15.21	13.01	15.40	16.70	11.90	14.34

Shelling efficiency

The shelling efficiency of hand operated maize sheller was calculated and found to be 94.76 per cent.

REFERENCES

Abdulkadir, B. H. (2009). Design and Construction of Maize Threshing Machine *AU J.T. 12*(3), 199 -206.

Barnwal, P., Kadam, D. M., & Singh, K. K. (2012). Influence of moisture content on physical properties of maize. *Institute of Agrophysics, Polish Academy of Sciences*. *26*, 331-334 assan.

Chowdhury, M. H., & Buchele, W. F. (1978). The nature of corn kernels Damage inflected in the shelling crescent of grain combines. *Trans. the ASAE*, *21*(4), 610 – 614.

Hussain, S. Z., Nain, H. R., Rather, A. H., & Khan, J. (2009). Comparative evaluation of horizontal maize cob sheller with traditional methods of maize shelling. *Research on Crops 10*(1), pp. 168-170. 0972-3226.

Lee, S., & Mafu, L. (2009). Transactions of mechanical damage of the maize seed germination [Papers] - *Agricultural Mechanization Research* (*03*).

Mady, M. A. (2004). Development and evaluation of a power operated corn sheller. *Soil and Water Dept, Fac. of Agric*., Suez Canal University, Ismaielia, Egypt.

Ng, H. F., Wilcke, W. F., Morey, R. V., & Lang, J. P. (1998). Machine vision evaluation of corn kernel mechanical and mold damage. *Trans. of the ASAE 41*(2), 415 – 420.

Olaoye, J. O., & Oni, K. C. (2001). Some Physical and Mechanical Properties of Selected Grain Crops. Proceedings of the 2nd International Conference & 23rd Annual General Meeting of the Nigerian *Institution of Agricultural Engineers (A sdivision of NSE); 23*, 315-329.

Pathak, S. (2008). Design, development and evaluation of a power operated maize sheller (Spiked Disk Type) College of Agricultural Engineering and Technology Dr. B.S.K.K.V., Dapoli, Ratnagiri (m.s.) *India Internat. J. Agric. Sci*. *4*(1), 215-219.

Solanki, N., Ramteker, T., & Gitel, P. (2006). Evaluation of Hand Operated Maize Shellers. *J. Agril Engg. 43*(4), 125-128.

Tiwari, P. S., Pandey, M. M., Gity, L. P., & Shrivastava, A. K. (2010). Effect of operating speed and cob size on performance of a rotary maize sheller. *Journal of Agricultural Engineering*. *47*(2), 1-8.

Victor, I. O., Ndirika, & Buys, A. J. (2006). Intermediate Agricultural Processing Technologies for Cereal Crops in South Africa. *Agric Mech Asia Afr Lat Am 37*(2), 24-28 Japan.