

A REVIEW ON DESIGN AND DEVELOPMENT OF PEDAL OPERATED MAIZE SHELLER

¹Dushant U. Meshram, ²Dr. C. C. Handa, ³Mr. A. S. Hande

¹M-tech Student, Department of Mechanical Engineering, K.D.K. College of Engineering, Nagpur, India

²Professor and Head, Department of Mechanical Engineering, K.D.K. College of Engineering, Nagpur, India

³Assistant Professor, Department of Mechanical Engineering, K.D.K. College of Engineering, Nagpur, India

Abstract - Corn is most common cereal grain in the world. In India after the rice and wheat, maize is the third most important crop. In India many farmers grow maize but could not afford the cost of acquiring some of the imported threshing machines because of their cost. The maize is shelled traditionally by hands. This is done in such a way that maize is rubbed against another until the grains are removed from the cob. This method is time consuming with low productivity. Maize Sheller machine is constructed to shell maize and separate the cob from the grains. It was constructed from locally available materials and its cost is low and affordable. Design of various parts of maize sheller machine using different methodology. Design of the machine could be operated continuously for a comparatively long time with high shelling rate without causing damage to kernels. Four shelling units can be provided for shelling of maize cobs and operated with the chain and sprocket arrangement. The results revealed that the machine was easy to operate with an average kernel shelling rate when operated by persons with no any kernel damage.

shell corn by mainly three methods namely shelling cob grain by hand; hand operated corn Sheller and beating by stick method were carried for removing corn kernel from the cob. The Corn shelling was designed and built to improve the standards of living of people living in villages of developing countries. The power operated maize Sheller machine requires electrical energy for its working and its capital investment is also high compared to the conventional methods of shelling but in rural areas supply of electricity is not good at all times. So in order to suit the prevailing condition and reduce the capital investment and operating costs, pedal operated maize Sheller needs to be developed.



Fig. Maize/corn

1. INTRODUCTION

Maize, the American Indian word for corn, means literally that which sustains life. It is, after wheat and rice, the most important cereal grain in the world, providing nutrients for humans and animals and serving as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and, more recently, fuel. In Africa, maize has become a staple food crop that is known to the poorest family. There have been large variations in the production of maize in India since independence. The different methods of maize shelling can be categorized based on various mechanization technology used. These includes: hand-tool-technology, animal technology, and engine power technology. Hand technology involves the use of hand tools in shelling, while as animals technology were used in threshing on the field by marching on the maize. The easiest traditional system for shelling maize is to press the thumbs on the grains in order to detach them from the ears. Another simple and common shelling method is to rub two ears of maize against each other. These methods however require a lot of labour. It is calculated that a worker can hand-shell only a few kilograms an hour.

In India, Maize is emerging as the third most important crop after rice and wheat. In our country, most of the farmers

2. REVIEW OF DIFFERENT TYPE OF MAIZE SHELLER

[A] Sharma(2007) studied to developed such a machine and suggest the farmers to adopt suitable values of crop and machine operational parameters for the optimum threshing. The studies were carried out in three different phases. In the first phase, physical properties of maize kernel and maize cob that have bearing on dehusking and shelling performance of maize thresher were determined. These include length, breadth, thickness, bulk density, sphericity and terminal velocity for maize kernel; and cob size and grain-to-non grain ratio for maize cob. In addition, an effort was also made to determine the force required to detach husk and a single kernel from maize cobs using a pendulum device which was specially developed for this purpose. Results indicated that the size of the maize kernel ranged from 6.91 - 7.93 mm and grain-to-non grain ratio from 2.64 - 4.34. The force required to detach husk and a single kernel from maize cob ranged from 5.83-23.26 N and 3.89-17.33 N respectively.

[B] Chand et al. (2013) developed Pedal Operated Integrated Potato Peeler and Slicer. For the processing of potatoes, removal of the peel is an important unit operation. The main parts of the integrated machine were peeling drum, water spraying unit, slicing unit, a piston to transfer the peeled potato from peeler to slicer and a power transmission system. The peeling drum, with protrusion on the inside surface, rotated and detached the peel from the potatoes by abrasion. The water spraying unit washed the potatoes and, simultaneously, the peel was removed from the drum through the peripheral clearance of the drum along with the flow of water. The miter gears, transmission shafts and chain drives were significant parts of the machine. The machine worked at 45 r.p.m with a 65 kg/capacity.

[C] Tambari (2015) designed and fabricated of a pedal powered hacksaw cutting machine. The aim of this work is to develop a modernized and less stressful operation for cutting wood, metals and plastic materials. It is very useful for cutting PVC materials (pipes) and can be used widely in lather and in furniture making industries. This work can also serve as an exercising machine for fitness while cutting; it uses the principle of a slider crank mechanism which converts the rotary motion of the flywheel to the reciprocating motion of the hacksaw during pedaling. The machine was tested and continued to be very efficient with an ideal mechanical Advantage of 0.5 (less than 1), velocity ratio of 0.65 (less than 1), a power output of 5.72 KW and an efficiency of 76.9%, which makes it very adequate and capable for cutting.

[D] Tiwari et al. (2010) explained operating speed of rotary maize sheller was optimized for its operation at higher operating speeds in pedaling mode, by conducting a simulation study for three sizes of maize cobs at seven operating speeds. The shelling capacity and shelling efficiency of maize sheller for all categories of maize cobs increased curvilinearly with increased in operating speed up to about 70 r.p.m. The shelling capacity at a particular operating speed decreased with increased in the maximum diameter of cobs. Operating torque of rotary maize sheller for a given size of maize cobs decreased with increased in operating speed. On the other hand, the torque decreased with decreased in maximum diameter of maize cobs at a given operating speed. It was concluded that the operating speed of maize sheller should be 70 to 80 r.p.m for higher shelling capacity, shelling efficiency and lower operating torque.

[E] Nwakaire et al. (2011) designed constructed and evaluated a low cost maize sheller for rural farmers in Nigeria. The methods used involved the collection of farmer's opinion on their sheller needs, selecting appropriate materials, and utilization of theories of failure that enable the determination of allowable shear stress on the bearing supports. The communication methods used were interactive sessions with farmers especially the women and children determine their shelling problems. Comparison was made between the human performance index for shelling and the machine performance index. The human mechanical

efficiency, though-put capacity and grain handing capacity are 45%, 26.67kg/h and 21.1kg/h at a biomaterial test weight of 20kg with actual shelled weight of 15.8kg at a shelling time 45 minutes. For machine indices, though-put capacity and the grain handing capacity of the sheller are 86%, 119.76kg/hand 109.99kg/respectively. The price difference shows drastic reduction in the purchase price of maize thresher by N 32,500.00 (216.67), which represents 56.52% price reduction.

[F] Singh(2013)examined that hand operated maize dehusker-sheller was ergonomically evaluated with ten farm women to assess the physiological workload and its performance in standing and sitting postures. Two workers are required during its operation, i.e., one for hand cranking and another for feeding the cob. One by one cob (without removing its outer layer/sheath) was fed in hopper at an interval of about 4 s. Farm women operated the equipment at their rhythmic speed in both postures. The average heart rate of subject was 144 and 142 beats per min in standing and sitting postures, respectively. The overall discomfort rating (ODR) and Body Parts Discomfort Score (BPDS) clearly indicated that the standing posture could be better option for operation of this equipment. This was found to reduce the physiological cost by 38.95% and 21.62% in dehusking & shelling the maize cob with hand, and dehusking by hand & shelling by octagonal maize sheller respectively.

[G] Karikatti et al. (2015) found that dehusking and shelling are important post-harvest activities in maize crop, predominantly done by women. These activities involve a lot of drudgery as these are done manually. The maize shelling with the tool makes women's lives difficult and yields very low level of output. Moreover, dehusking as a separate activity precedes shelling that brings additional burden on farmers. They may employ labourers or use machines. But in villages, there is a shortage of labourers, and their wages are also pretty high. The farmers or field owners find it difficult to afford the machines. In order to make it affordable and more convenient to shell the maize, and as a part of our academic project, we have developed a "Crank Operated Maize Sheller" using ergonomic and mechanical considerations for dehusking and shelling. It consists of feeder from where the maize is inserted. The crank is connected to the blade. When the crank is turned, the blade rotates and shells the maize. The machine is operated by 1 person and requires feeding of cobs one by one.

3. RESEARCH GAP

Pedal operated corn shelling machine, work output will depend on the operator as well as on the machine itself. So there is lots of scope of improvement and future scope to increase the overall machine efficiency using different methodology. This specific design therefore focuses on energy consideration to improve man machine system efficiency. Maize Sheller technology can be more cost effective when use lesser parts so there is a scope of product

development and design. There is a need for an innovative idea or product that is feasible, safe, cost effective and productive for the Indian farmer.

- In local methods hygienic conditions are not maintained.
- These are laborious, time consuming, cost intensive and Involve various processing activity.
- In local methods hygienic conditions are not maintained.
- Sometimes manual maize shelling is harmful to human body.

4. CONCLUSIONS

The maize is shelled traditionally by hands. This is done in such a way that maize is rubbed against another until the grains are removed from the cob, this traditional method of shelling is highly tedious, inefficient and time consuming with low productivity. The power operated maize sheller machine requires electrical energy for its working and its capital investment is also high compared to the conventional methods of shelling but in rural areas supply of electricity is not good at all times. Hence there was a need for an innovative idea or product that is feasible, safe, cost effective and productive for the Indian farmer. Keeping in view the prevailing conditions, a continuous and high capacity pedal operated maize shelling machine was designed, developed and tested by RSM methods. The effect of operational variables was studied on response variables. The main criteria for optimization were capacity of machine, mechanically damaged grain and shelling efficiency. The moisture content had no effect on the capacity of pedal operated maize shelling machine. Increase in speed of operation, capacity of the machine had shown a continuous and sharp increased. Capacity of the machine was maximum when the shelling disc r.p.m was maximum. The moisture content had no effect on the capacity of pedal operated maize shelling machine, with increase in speed of operation, capacity of the machine had shown a continuous and sharp increased. Capacity of the machine was maximum. when the shelling disc r.p.m was maximum and it showed an increasing trend with the increased in speed of operation.

5. CAD MODEL OF MAIZE SHELLER



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