International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN:2147-6799 www.ijisae.org Original Research Paper

Construction and Design of a Multi-Crop Threshing Device

D. Remalya[1], K. Ravi Kmar[2], Dr. Ch. Vijaya Kumar[3], N. Sandeep[4]

Submitted: 15/08/2023 **Revised:** 08/10/2023 **Accepted:** 17/10/2023

Abstract: The majority of villages in rural India currently experience intermittent electricity supply, with nearly 10 hours of load shedding. Consequently, many agricultural activities must be performed manually. We have developed a multi-crop thresher for crops such as wheat, jowar, bajra, barley, and particularly corn, which will be operated using a bicycle. Additionally, we have included an automated screening system, enabling the threshed food to be screened and cleaned mechanically, therefore providing farmers with grains that are suitable for packaging, thereby save significant human effort, time, and costs. This study addresses the issue encountered by farmers in the separation of seeds from sunflowers. Farmers use manual techniques owing to the lack of appropriate technology for sunflower threshing. The most time-intensive and laborious task in manual sunflower production is threshing, which involves striking the sunflower heads with a stick, rubbing them against a coarse metal surface, or using a motorized tiller. The objective of the project is to construct a machine that will segregate the seeds from the sunflower. The primary components need for the machine's fabrication are blades, shaft, pulley, disk plates, blower, hopper, tray, sieves, motor, V-belt, and pillow block bearings.

Keywords*: Design and Fabrication, Sunflower, Seed Extractor, sunflower, heads, thresher, teeth, performance*

Introduction

In the modern agricultural systems of a number of countries, farm equipment is an important and indispensable component for the development of agriculture and the production of crops. Farmers are able to accomplish agricultural activities in a much shorter amount of time because to technological advancements in farming. On a constant basis, the wealth of a country and its economic status are evaluated based on compositions (steel) under proper conditions, in addition to other considerations. India has a population that is quite large. Nevertheless, countries such as Japan, Germany, and the United States of America remain at the forefront of steel manufacturing. Trade and commerce were two areas in which India flourished throughout its history. Nevertheless, the entry of the East India Company brought about a complete change in the circumstances. For the first time, the British started to utilize the riches of the Indians. India became the location where they built their market for finished items. As a consequence, the Industrial Revolution took place, which ultimately resulted in the revival of several industries. The year 1992 saw the passage of laws that made it possible for multinational corporations to create their own industries. This led to a paradigm shift that prioritized quality and accuracy above quantity. As a consequence of this, the SPM became necessary since the GPM was unable to live up to the expectations of the customers. In the field of engineering, there are several processes that are required, and various steps are required for different components. However, the properties of materials and other factors are also important.

Processes undergo transformations. A project entails the endeavor of developing something novel, namely the production of an inventive product. The essential prerequisites for an efficient project organization are:

1) Flexibility

2) Autonomy

3) Group functional integration

4) Small group size

5) Common work location for all project members

6) Team spirit among group members.

Methods and Material

DESIGN METHODOLOGY

Market Analysis The process for this project starts with understanding the farmer's needs for the threshing machine in question. This included a comprehensive assessment of the several types of individual threshing machines and a detailed analysis of the Indian market landscape. In our endeavor to create a specialized machine, we have used a meticulous method, dividing the overall design process into two primary components;

System Architecture System design primarily addresses numerous physical restrictions and ergonomics, spatial needs, the arrangement of components on the machine's primary frame, the positioning of controls, maintenance

[1,3,4]Assistant professor, Department Of Agricultural Engineering, International School Of Technology And Sciences For Women, A.P, India.
[2]Associate professor, Department Of Agricultural Engineering, International School Of Technology And Sciences For Women, A.P, India.

accessibility, potential for future enhancements, and the machine's weight relative to the ground.

System selection based on physical constraints :- Market Analysis The process for this project starts with understanding the farmer's needs for the threshing machine in question. This included a comprehensive assessment of the several types of individual threshing machines and a detailed analysis of the Indian market landscape. In our endeavor to create a specialized machine, we have used a meticulous method, dividing the overall design process into two primary components. System Architecture System design primarily addresses numerous physical restrictions and ergonomics, spatial needs, the arrangement of components on the machine's primary frame, the positioning of controls, maintenance accessibility, potential for future enhancements, and the machine's weight relative to the ground.

Arrangement of various component :- Given the space limitations, the components must be organized to enable easy removal and maintenance. Moreover, each component must be clearly visible, with none concealed, and all available space should be used efficiently in the layout.

Components of system :- The system must be compact enough to occupy a corner of a room. All mobile elements must be tightly contained and small. A streamlined method improves visual appeal and orderliness.

Man –m/c Interaction :- The user-friendliness of the machine/controller in operation is a crucial design factor. It pertains to the application of anatomy. Below are few examples of this section: - Design of machine elevation - Energy consumption in manual operation Illumination status of the machine.

Chances of failure :- The losses sustained by the owner due to component failure are critical design considerations. The factor of safety in mechanical design is maintained at a high level to minimize the likelihood of failure, while frequent maintenance is necessary to ensure the machinery operates without issues.

Servicing facility :- The arrangement of components must facilitate simple service, particularly for those that need regular maintenance and may be readily dismantled.

Scope of future improvement: - Provisions should be made to broaden the area of work in the future, such as converting the motor-operated machinery, which can be easily adapted to meet the necessary requirements.

Height of m/c from ground: - To ensure the operator's convenience and comfort, the machine's height should be appropriately determined to prevent fatigue during operation. The machine should be positioned slightly higher than the level, with sufficient clearance from the ground to facilitate cleaning.

Weight of machine: - The overall weight of the machine is contingent upon the choice of material components and the dimensions of those components. A heavier weighted machine is difficult to carry, and in the event of a significant malfunction, repair becomes problematic.

Mechanical Design The mechanical design step is crucial from the designer's perspective. The overall success of the project hinges on the accurate design analysis of the challenge. Numerous initial options are discarded at this stage. The designer must possess sufficient understanding of the physical characteristics of materials, including load stresses, deformation, and failure. Theories and wear analysis need the identification of external and internal forces operating on machine components.

These forces may be classified as ; a) Static load forces. b) Forces of friction. c) Inertial forces. d) Centrifugal forces. e) Forces exerted during electricity transmission, among other factors. The designer must precisely estimate these forces using design equations. If he lacks enough knowledge to estimate them, he should formulate realistic assumptions based on analogous circumstances that would nearly fulfill the functional requirements. Assumptions should always prioritize caution. The selection of safety variables to determine operating or design stress is a crucial stage in the design of machine element dimensions. The adjustments to the theoretical stress values must be made based on the kind of loads, the geometry of components, and service needs. The selection of materials must be based on the loading circumstances, product shapes, environmental factors, and the desired material attributes. Measures should be implemented to reduce the improper use of lubricating techniques. In mechanical design, components are cataloged and stored based on their procurement in two categories. For design parts, a comprehensive design is executed, and the resulting designations are compared to the next highest dimensions readily accessible in the market. This simplifies the assembly and post-production servicing operations. The specific tolerances for the task are delineated. The process charts are created and sent to the designated work area. The components for direct purchase are chosen from multiple catalogs and specifications, enabling anybody to get them from retail stores according to the provided requirements.

Working Mode Of The Machine

The threshing of wheat, paddy, amaranth, and millet crops was accomplished with the help of a multi-crop thresher that was designed. The threshing, separation, and cleaning units are the primary components that have been included into the machine. The threshing of different types of crops needs different principles to be used. Patty requires pounding action, millet requires impact and abrasion, and amaranth requires abrasion. Wheat requires cutting and impact, while paddy requires grinding. There is a significant amount of electricity required for the threshing of the wheat harvest. The threshing of wheat earheads, on the other hand, will need less force per instant. There are three components that make up the threshing drum: a spike tooth that has a blade for threshing wheat, a wire loop for threshing paddy, and a rasp-bar that has a canvas belt for threshing millet and amaranth. The threshing of wheat is achieved by the rotating movement of a cylinder equipped with spike teeth, positioned above a set grid, aiding the extraction of grains from the panicles and their separation from the straw mass. Following the threshing process, the grains are routed via a concave grid and into the cleaning unit, which is equipped with two sieves that operate in a reciprocating manner. During the process of the grains moving through the sieves, a constant flow of air is sent through them, which causes the outflow of particles that are less dense than the grain. A single-phase electric motor with a horsepower rating of one was intended to be used for the operation of the device. The threshing drum shaft receives power from the motor that is providing it. During the process of the crop panicles being delivered into the threshing drum via the hopper, the grains are separated from the straw mass and freed from the panicle. Concave is the name given to a fixed grid that is rotated over by a cylinder that is fitted with beater pegs (for working with wheat). There are bars that run the length of the concave, and the grains are dislodged between these bars and the pegs on the cylinder. The concave is fitted with bars over its whole width. The vast majority of the grain is transported via the concave grid and into the cleaning unit. This unit is equipped with two sieves that move in a back-and-forth motion, and a centrifugal fan is responsible for directing air into the sieves. While the top sieve is responsible for retaining the chaff, the lower sieve, which is referred to as the grain sieve, allows the grains to flow through. The pores in the grain sieve are designed to correspond with the diameter of the grains. The purpose of the grain sieve is to further partition the grain from trash, sand, and grains that have been damaged. The air that is sent through the sieves by the blower avoids the buildup of debris and other objects that are lighter than the grains that are being passed through the sieves as the grain moves through them. Additionally, the alternative pan is responsible for directing the broken grains and smaller components to a separate exit. The grain pans that are located beneath the grain sieve are responsible for transporting the grain that is free of any imperfections to the clean grain outlet for collection. In order to determine whether or not it was capable of threshing, separating, and cleaning the seeds of wheat, rice, amaranth, and millets, one assessed it.

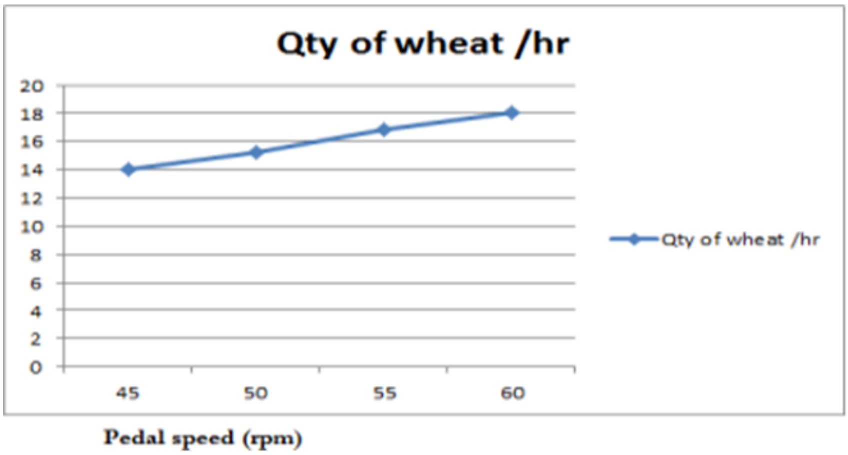
RESULTS AND DISCUSSION

Test and Trial On Agriculture Multi crop Thresher

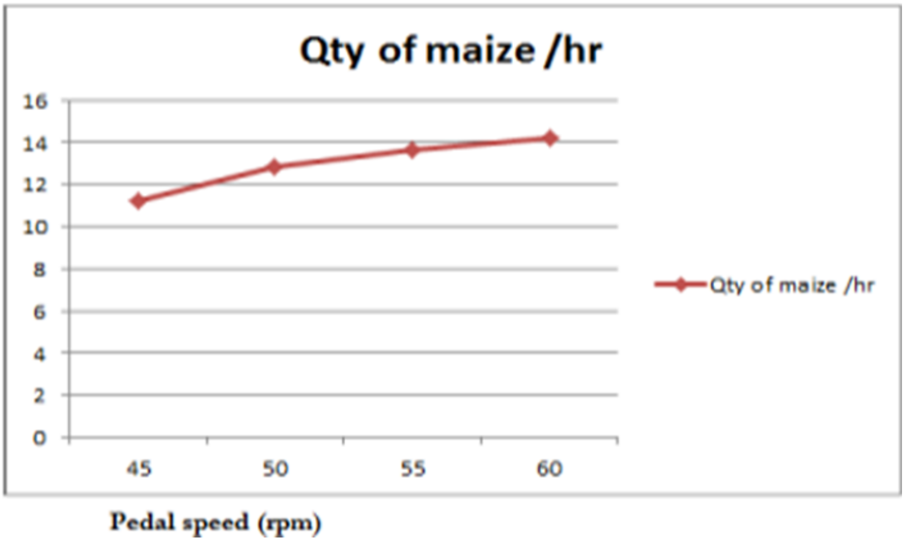
Results for Manual operated mechanism:

Sr. No	Pedal Speed (rpm)	Qty. of Wheat Threshed / hr.	Qty. of Maize Threshed /hr.
01	45	14 kg	11.2
02	50	15.2 kg	12.8
03	55	16.8 kg	13.6
04	60	18 kg	14.2

Graph of Wheat threshed / hr by Thresher Vs Pedal speed.



The quantity of wheat threshed by the thresher increases with the increase in pedal speed as the blade speed increases.



The quantity of maize threshed by the thresher increases with the increase in pedal speed as the blade speed increases.

Result for motor operated Mechanism

Sr. No	Motor Speed (rpm)	Qty. of Wheat Threshed / hr.	Qty. of Maize Threshed /hr.
1	1460	27	18.7

Result for motor operated Mechanism

Sr. No	Motor Speed (rpm)	Folder cut per hour
1	1460	30 pendi

Conclusion

A multi-crop threshing machine has been successfully built and manufactured by using the several methodologies and formulae that have been discussed before. As a result of the machine's ability to thresh many crops, particularly wheat, rice, millet, and amaranth, while simultaneously separating stalks from grains and avoiding grain breakage, it offers a better way of threshing in comparison to the procedures that were previously used. We have designed a lightweight multi-crop thresher that has capacities of 34 kilograms per hour for wheat, 75 kilograms per hour for rice, 58 kilograms per hour for barnyard millet, 54 kilograms per hour for finger millet, and 30 kilograms per hour for amaranth. After careful analysis, it was established that these crops had a threshing efficiency of at least 98%. In the case of these crops, the cleaning efficiency was more than 95%.

References

[1] Azharuddin Kazi, Mir Safiulla, Narasimhan .M.Manohar & Pavan kumar: "Design and Fabrication of Sunflower Seed Extracting Machin" International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS) Volume V, issue Vi June 2016| ISSN 2278-2540 .

[2] Hamada El-Khateeb, Husain Sorour and M. I. Saad ,"Operating factors affecting using two different threshing machines for threshing sunflower heads. The 15th Annual Conference of the Misr Society of Ag. Eng., 12-13 March, 2008.

[3] Hunt, D.R. (2001). Farm power machinery accumulated R&M costs to be lower than the actual data management. 10th Ed.,Iowa State University for the first period of machine life and also predicts some Press. Ames. IOWA. U.S.A. Design Of Machine Elements :- V B BHAN

[4] Nkama, I. (1992). Local Rice Processing. Paper presented at the monthly Technology Review Meeting for Taraba ADP, Adamawa, Nigeria.

[5] Singh, K. P., Mishra, H. N. and Saha, S. (2010). Optimization of machine parameters of finger millet thresher-cum pearler. *Agricultural Mechanization in Asia, Africa and Latin America,* 41(1): 60-67.

[6] Singh, K. P., Mishra, H. N. and Saha, S. (2010). Moisturedependent properties of barnyard millet grain and kernel. *Journal of Food Engineering*, 96(4): 598-606.

[7] Nasser Mohammednour Ibrahim Ahmed "Evaluation Of The Performance Of A Sunflower

Thresher" International Journal of Technology Enhancements And Emerging Engineering Research, VOL 2, Issue Vi 2014|ISSN 2347-4289.

[8] Somposh Sudajan , Vilas M. Salokhe : "Power Requirement and Performance Factors of a Sunflower Thresher" issue in March 2015.

[9] A.K. Goel, D. Behera, S. Swain and B.K. Behera : "Performance Evaluation Of A Low – Cost Manual Sunflower Thresher" Indian J.Agric. Res, 43(1):37-41, 2009.

[10] Shivanand H. Kakhandaki, M. Anantachar, & M.S. Madhusudhan: "Performance Evaluation Of High Capacity Sunflower Thresher", International Journal of Agricultural engineering |Volume 5|Issue 2|October, 2012|138-141.

[11] Singh, K. P., Mishra, H. N. and Saha, S. (2011). Design, development and evaluation of Barnyard millet dehuller. *Journal of Agricultural Engineering*, 48(3): 17-25.