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A REVIEW PAPER ON DESIGH AND DEVELOPMENT OF LOW COST HARVESTER

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ABSTRACT

The present paper is aimed at to design and development of low cost harvester. In today's competitive world there is a need for faster rate of production of agricultural products. Agriculture is the backbone of India. In India almost all farmers facing problems of labor shortage. Day by day labor wages are increasing and in the same way demand of agriculture products. This review paper is a small work towards analyzing Jowar and Bajra harvester machine aspects for economical harvesting which will help to minimize the working fatigue and to reduce labor cost.

KEYWORDS: Harvesting, harvesting aspects, harvesting methods and machines.

INTRODUCTION

In India agriculture has facing serious challenges like scarcity of agricultural labor, not only in peak working seasons but also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labor force to cities and low status of agricultural labors in the society. Maharashtra state is 2nd rank in Jowar production and 3rd rank in Bajra production. Maharashtra occupied the highest position in production of Jowar with 3.90 million tones of production (51.11%). Thus it is mostly needed to be focused on it.

Harvesting is a process of cutting and gathering of mature crop from the field. Harvester is a machine is used for harvesting. As per farmer requirement, these field crops are cut and collected in bunches. These crops are used for cattle feed for whole year so combine harvester does not implement for this field which done harvesting and threshing at a time.

METHOD OF HARVESTING

Traditional/Manual harvesting:-

The crop should be harvested immediately after maturity. There is no need to wait for stalks and leaves to dry as the plants of hybrid sorghum appear green even after the crop maturity. The right time for harvest is when grains become hard and contain less than 25% moisture. Generally 2 methods of harvesting i.e. stalk cut and cutting of earheads by sickles are adopted. However, in foreign countries, sorghum harvesters are used. In case of stalk cut method, the plants are cut from near the ground level. The stalks are tied into bundles of convenient sizes and stacked on the threshing floor. After 2-3 days, the earheads are removed from the plants. In other method, earheads only are removed from the standing crop and collected at the threshing floor for threshing after 3-4 days of sun-drying.

Threshing of earheads is done either by beating them with sticks or by trampling under bullock feet. The later method is quicker and adopted by majority of farmers. Threshing is also done with the help of threshers. The threshed grain should be cleaned and dried in sun for 6-7 days to reduce the moisture content down to 13-15% for safe storage.

Jowar and Bajra are harvested by hand and mechanically.

Disadvantages of manual harvesting are:

- Harvesting time will be more
- Efficient work is not done
- The cost will be more
- Shortage of labor

Traditional/manual harvesting method

Collection of bunches in stacks

Combine harvester:-

In market various combine harvester are available having 2-5m cutter in length. However, there is need of small combine harvester specially for small and medium farmers. A combine harvester is used to cut, thresh, sort and clean grain/seed. The main units of harvester are header unit, threshing unit, separation unit, cleaning unit and grain collection unit. The header cuts the crops and collect them for threshing The crops get threshed between cylinder and concave. The cleaning mechanism consists of two sieves and a fan. The grain is conveyed with a conveyor and collected in a grain tank. And sorting is done to provide final grains.

Disadvantages of combine harvesting are:

- High initial cost
- Applied only in large farms

- It does both harvesting and threshing at time

Combine harvester

OBJECTIVE OF LOW COST HARVESTER

- It should be available in low cost.
- It should be proper designed by considering small farm area.
- It can be operated by semiskilled worker.
- Initial cost should be minimum while considering small farmer.

LITERATURE SURVEY

This paper deals with designing and development of low cost harvester. Cutter is most important for the harvester. Designing of cutter is done by using properties of plant. From literature, we have found physical properties and behavior of crops after maturity stage. As the plant age increases the moisture content decreases sharply beyond the physiological maturity stage. The shear strength increased at the rate of 3.89 % and 3.63 % for Jowar and Bajra respectively when the moisture content decreased from 80 to 20 %. [1]

From another we came to know minimum energy required for cutting is 9.5 and 6.0 Nm and also relation between the velocity and maximum efficiency. Maximum cutting efficiency of 100% was obtained for cutting at the base, corresponding to knife speeds between 5.2 and 7.3 m/s. [2]

Author Anderson de Toledo discuss about the various cutter geometry and quality of cut. As we know the physical property and shear strength of Jowar and Bajra stalk at time of harvesting so the rotary blades are more suitable for harvester. He also discuss about cutting height and damage to stalks caused by different blade and disc combinations of the base cutter mechanism were used as indicators of quality. And Damage levels were lowest when using tilted cutting blades. With regard to cutting height, the treatment with serrated blades and normal discs (FSDN) yielded the best result. [3]

Author Nieuwenh of Philippe discuss about the context of the development and testing of a prototype non-row sensitive corn header for a pull-type forage harvester, models to predict the specific energy requirements were developed through the analysis of field data, laboratory experiments and theoretical developments. The model development required particular machine plant interaction properties to be measured, such as cutting energy and crushing resistance. [4]

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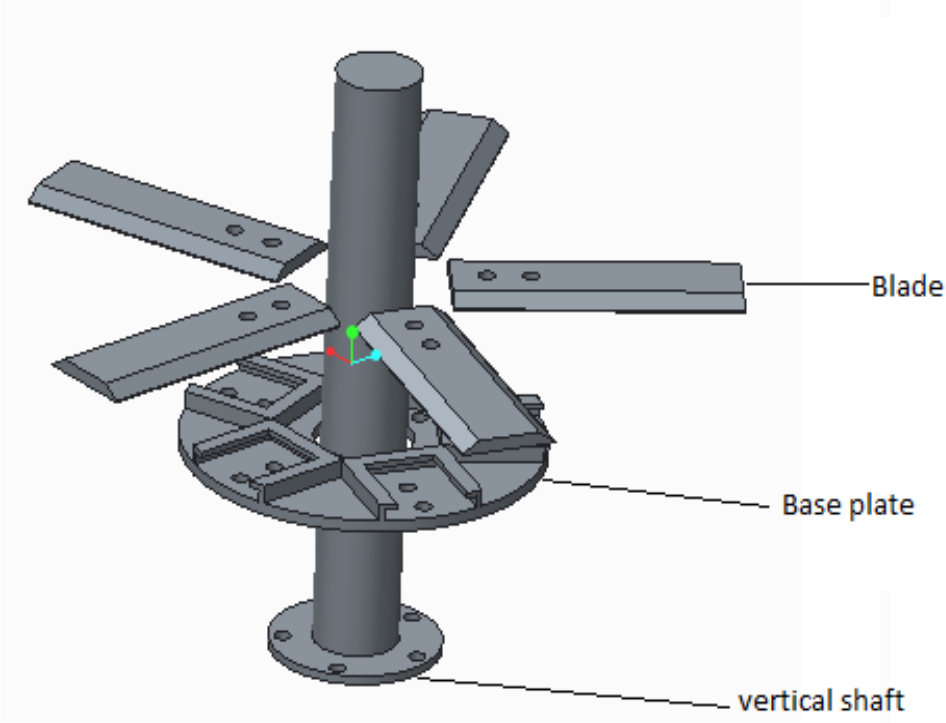
METHODOLOGY

While designing the complete new harvester we have to design cutter first. The cutter assembly consists of cutter disk which carry the cutters, vertical shaft and cutting blades. The cutter blades are smooth blades, seratted blade and fast exchange blade. These blades are selected according to the quality required. [3]

The cutter blade should have rotating opposite direction with same velocity.
Dia of disk- 150mm
Length of blade- 100mm
Total dia of blade- 250mm
Total cutting length- 1000mm
No of blade required- 4 (2 pairs)

Exploded view of cutter assembly (Creo model):-



Assembly of cutter:- (Creo model)

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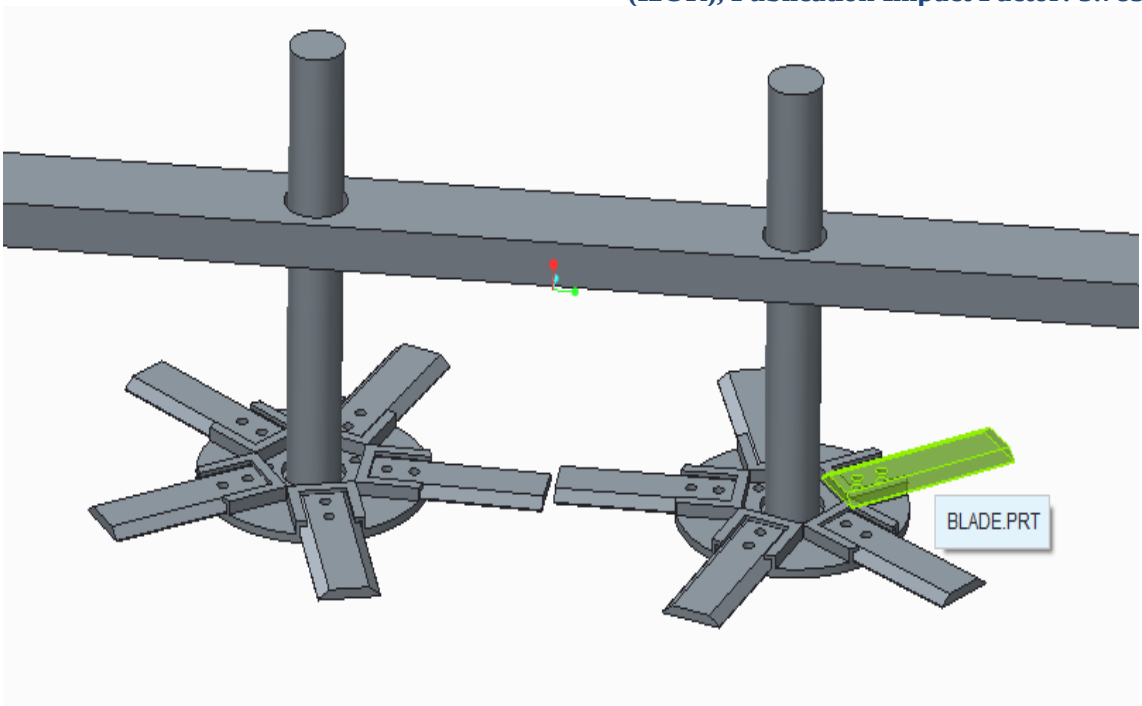

Two opposite rotating blades

Conceptual model:-

CONCLUSION

In this paper we discussed the various harvesting methods currently employed in agricultural field. It is found that there is a possibility to develop low cost harvester as an alternative to the existing harvester. By literature and field observations we expect that our design will minimize manual work ,cost and time. The most important feature required for an harvester is cutter, we designed the cutter by considering strength, physical properties and other factor of crops. And further in the project we will develop and fabricate the whole design**.**

REFERENCES

[1] Jekendra, Y. "Physical and rheological properties of forage crops with reference to cutting." *Archivos de zootecnia* 48.181 (1999): 75-78.
[2] Yiljep, Y. D., and U. S. Mohammed. "Effect of knife velocity on cutting energy and efficiency during impact cutting of sorghum stalk." (2005).\
[3] Toledo, Anderson de, Rouverson Pereira da Silva, and Carlos Eduardo Angeli Furlani. "Quality of cut and basecutter blade configuration for the mechanized harvest of green sugarcane." *Scientia Agricola* 70.6 (2013): 384-389.
[4] Nieuwenhof, Philippe. *Modeling of the energy requirements of a non-row sensitive corn header for a pull-type forage harvester*. Diss. University of Saskatchewan Saskatoon, 2003.
[5] Baruah, D. C., & Bora, G. C. (2008). Energy demand forecast for mechanized agriculture in rural India. Energy Policy, 36(7), 2628-2636.
[6] Katupitiya, J., Eaton, R., & Yaqub, T. (2007, April). Systems engineering approach to agricultural automation: new developments. In Systems Conference, 2007 1st Annual IEEE (pp. 1-7). IEEE.
[7] Zend, J. P., Umrikar, S. H., Yeole, S. N., & Kamble, K. J. (2008). Ergonomic assessment of ear cutter for Jowar harvesting. Asian Journal of Home Science, 3(1), 34-37.
[8] Singh, G. (2006). Agricultural Machinery Industry in India (Manufacturing, marketing and mechanization promotion). Status of Farm Mechanization in India.
[9] Raut, L. P., Dhandare, V., Jain, P., Ghike, V., & Mishra, V. Design, Development and Fabrication of a Compact Harvester.