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Technological Interventions in Jowar Harvesting Processes

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Abstract: India is an agriculture based country which takes various types of crops. Similarly, in Maharashtra Millet, Jowar, wheat, paddy and maize are the main crops. Nowadays various agricultural machines are available which are very costly. Due to this it is not suitable for poor farmers. And all farmers remove crops by hands which require much efforts and its time consuming process. Sometimes, while cutting or removing crops by hands results into damage due to blisters and crops on hands. Because of this labors are not available for work, in order to overcome this situation we introduced a new simple, but more efficient machine for farmers. Currently there are some jowar cutting machines are available in Market. Those machines works on the principle of cutting the jowar near the base. But due to this sucrose content in the jowar reduces. It also effects on grain weight. So to overcome all these problems we are designing new harvesting technique. This new technique is focused on uprooting and handling jowar crops by using uprooter and conveyor mechanism. It uproots jowar crop and transfers the crop by conveyor mechanism for further stacking process.

I. INTRODUCTION

The history of agriculture in India takes us back up to Indus Valley Civilization Era and even before some parts of Southern India. Agriculture is a branch of applied science and it is an art of farming which includes cultivation of the soil, producing crops and raising livestock. So by taking into consideration that food is at the top of the list of needs so the most important sector in the world is farming or food producing enterprise. Over all these years, agricultural or farming have been carried out by small-holders produces on land between 2 to 3 hectare, using labor or human power and traditional tools. Today India ranks Second worldwide in Agricultural Outputs. The GDP (Gross Domestic Product) of India is covered by Agriculture and allied sectors like forestry and fisheries in 2013, about 50% of workforce. The economical contribution of agriculture is declining day by day steadily with country‘s board based economic growth. India exported $38 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and 6th largest net exporter.

Modem agricultural techniques and equipment are not used by small land holders because this equipment is too expensive and difficult to acquire. Still at the present day the method of using hand tools and traditional methods are dominant in because tractors require resources that many Indian farmers do not have easy access to. There is huge gap in technology adoption and Implement used with small and marginal farmers as they are not that much useful for small farm holders and non-profitable also. There are resources available and they exist, but the communication between farmers and agricultural R&D is not that effective and the thorough information and overall performance of the equipment is lacking. Evolution of high yielding crop varieties, use of chemical fertilizers, development of irrigation facilities and plant protection measures also does major improvement and made things possible.

Also there is labour unavailability due to lots of human effort and fatigue. And Jowar is the crop which is uprooted traditionally by hand from root to retain glucose from roots of the crop which increase the weight of the grains and which prevents the fodder from getting affected by the fungus which is harmful for the health of the animals which consume it. That‘s why cutting it from the land level is prohibited or avoided in India. And by this increases glucose content in the grain improves the taste of the grain also.
Thus, there is requirement of a compact and efficient combine harvester which would be more efficient as per the small farm requirements and also cheaper which can be afforded by the small scale farmers. The mission of this project is to generate a solution in jowar harvesting process which is a portable, uproots the crop to maintain sugar levels in crop,

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user-friendly and of low cost. The idea is to generate or create a solution to the harvesting processes which is cheap and will reduce the labor required to harvest crops. This solution should have the capability and the economic value for fulfilling the needs of farmers having small land holdings.

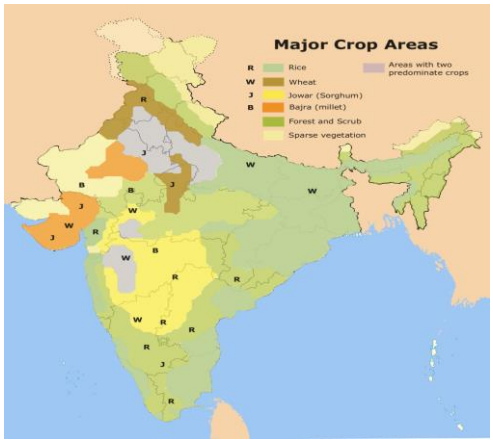

Fig.1.1. Major Crop areas in India

II. LITERATURE SURVEY

Špokas L., Adamčuk V., Bulgakov V., Nozdrovický L.
The paper presents results of the experimental research of a middle-size combine harvester when used for harvest of winter wheat and spring barley in heavy harvest conditions. Based on the results obtained, it was possible to determine the effect of field conditions on the crop mass flow in combine harvester, grain losses, fuel consumption, and combine harvester field performance. It was found that grain moisture content and conditions of the crop stand have a significant effect on the work indicators of the combine harvester when compared with its technological parameters and crop mass flow. [1]

MR. Pavanraj s. Khade, DR. V. N. Bhaiswar
A review paper on design and development of low cost harvester, IJESRT) 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. [2]

M.D. Nikam, S.H. Thakare, V.P. Khambalkar and S.S. Karhale
Average time required per hectare in mechanical harvesting 3.4 hr where as in manual harvesting it was 7.5 hrs with net saving of 54.67 per cent. Total cost of operation for harvesting by tractor operated sorghum harvester was found to be Rs. 3318.12/ha. In manual harvesting it was found to be Rs. 5000/ha. The net saving in the cost of operation per hectare was found to 33.64 per cent over manual harvesting. Thus it is feasible to reduce the harvesting cost of sorghum by using mechanical harvesting method and it is more convenient that harvesting of sorghum by sorghum harvester is much more easy and quicker than manual harvesting by sickle. Thus sorghum harvester is more suitable for farmer for harvesting sorghum. [3]

Aman Pande, Ankit Jain, Moinak Banerjee, Sangeeth Purushothaman
Designing of a hand-held Combined Harvester for Indian Farming Markets, International Journal of Modern Engg. Research). The paper concludes based on the analysis that the design of the chassis for our harvester is safe and since the harvesting mechanism is a variation of already threshing mechanism in place, the harvester will work while the cost of manufacturing and thus cost of working as well as cost to customer is reduced significantly. The whole harvester will be of much less cost to the customer than the current price for combined harvesters in Indian market. [4]

Abhishek Pratap Singh, Anuj Kumar Jain, Mohit Vij, Siddharth Sood, Varun Gulia, Yatharth Gupta
Design and fabrication of low cost crop cutting machine, IJARI vol 4, issue 4.). The main focus of this project was to design and fabricate a crop cutting machine under certain constraints such as compact size, easy to operate, low cost etc.

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A model has been created within prescribed boundaries to meet the demands of the farmer and to make harvesting more flexible operation. [5]

Dinesh B. Shinde, Ritesh D. Lidbe

Designed and fabricated mini harvester. The project work will focus on ease of harvesting operation to the small scale farmers for harvesting varieties of grains in less time and low cost. The power unit used for this machine is petrol engine of 14.2 HP. The chain and sprocket mechanism is used to transmit power inall operating components. The manufactured model was tested on field for its efficiency and capability.

The result got was as per our expectations from machine. It is also concluded that machine was easy to control on the field this harvester is made to work at any condition where mega harvester cannot be reached and it meet to work. In any condition withproper transportation facility to compact size. This harvester might be best solution for the problems faced for small scale farmers relating with availability of labor and cost of harvesting. [6]

III. METHODOLOGY

While designing the complete new harvester we have to design up rooter first. The up rooter assembly is attached to the upper frame of the conveyor. The collecting mechanism and conveyor will start the collection before uprooting action. Then the grouping is done. The up rooter blades are smooth blades, serrated blade. These blades are selected according to the quality required.

Studying the present:

This is the first stage of any project or case study in which we have study about the current scenario of the topic. In this we studied current availability of technology; the reach of the technology to small scale farmers, effective handling of crops which gives higher production rate with lowest grain loss rate by both manual and modern harvesting techniques. By the overall study of the current condition of jowar and harvesting techniques, the problems at various stages noted down. This will help to define statement of the problems which will then decides objective and project goals.

IV. DESIGN

We designed many options for this machine. We analyzed each of them and found out problems regarding to them. To solve those problems, we come with new solutions every time and then we modified design every single time. These designs are shown below as step by step iterations.

The feasibility study of any machine is the process by which its design is initiated, carried to the point of creating a number of possible solutions of manual reaper, and narrowed down to a single best concept, we call this Conceptual design phase. Dieter, G.E., (1991) had given the definition of conceptual design as follow as: –It is the phase that

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requires the greatest creativity, involves the most uncertainty, and requires coordination among many functions in the business organization. The goal in this phaseis to validate the need, produce a number of possible solutions, and evaluate the solutionson the basis of physical reliability, economic worthwhileness, and financial feasibility.

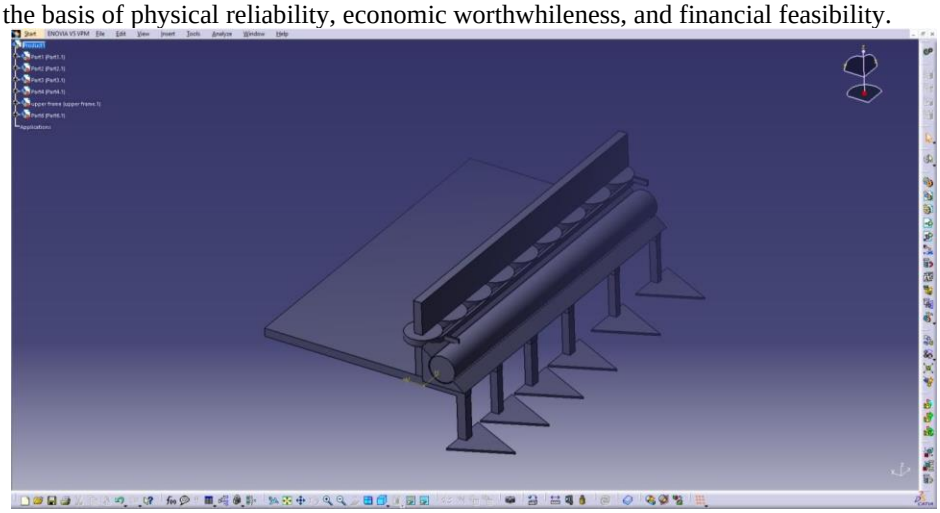


Fig. Design Iteration 1

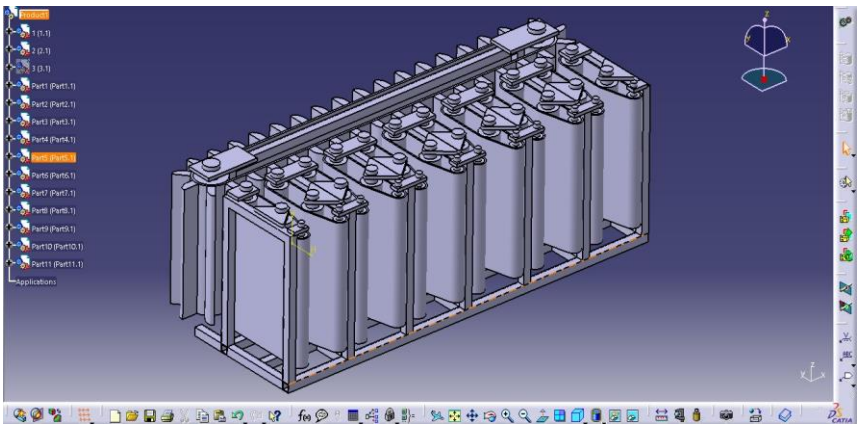
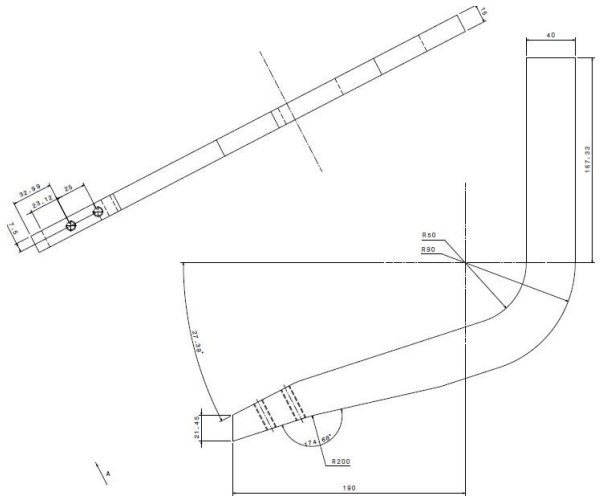


Fig Design Iteration 2

Sweep Bar:



Sweep bar is connected to the main frame with the help of attachment pads. The sweeps are mounted on the sweep bar with nut and bolt. The sweep bar is designed such that it places the sweep below the roots of the crop and the angle is designed according tothe depth of roots. Material used is Mild Steel.

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V. FABRICATION TECHNIQUES & MANUFACTURING

Any time metal is manipulated from one state into another, it is considered to be ametal fabrication. There are several basic categories of metal fabrication — structural, architectural, ornamental, automotive/recreational, and artistic are just a few. Metal fabrication has many facets that are not commonly known. Knowing whether the metal being fabricated contains iron (ferrous) or contains no iron (non- ferrous) is vital to a project. Welding media must be carefully chosen to correspond to the type of metal beingused. A successful metal fabrication project involves intricate planning of details and can range anywhere from a basic weld to highly specialized structural metal work, rolling andbending metal, bolting pieces together mechanically, even artistic sculpture.

MANUFACTURING & ASSEMBLY:

Fig. C channels assembled on each other on square tubes

The laser cut and bent c channels are assembled over each other by the support of the square tubes and rectangular plates which are welded together by arc welding machine. These supported c channels with more supports to fasten them on the main frame of the machine which have slots in it to adjust the distance between them by sliding theconveyors in them. Following are the images of the C channel assembled on the main frame in various angles.

Fig.7.2 c channel assembled on the main frame

Fig. chain with attachments and support plates for conveyor material or mat

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Fig. testing of conveyor pair

VI. FUTURE SCOPE OF WORK

Man is always trying to develop more and more modified techniques with increasing the apathetically look and economic consideration. Hence there is always more and more scope towards whatever he might have created of course after having the experience of the presently manufacturing things. Being engineers and having the ability to think and plan but, due to some time constraints, we only have thought of drive and put in the report the following future modifications and alternate options for drive:

- Giving the self-propelled drive and more compact gear box by actuallymanufacturing it.
- Taking drive from the tractor shaft to run the conveyors.
- Reduce noise in the chains of the conveyor.
- By providing small engine on the design itself to operate it without tractor by asingle person.
- To reduce weight to power ratio.

VII. CONCLUSION

Applying the innovative ideas & advanced technology to the farms is necessary tomodernize the Indian agriculture there by removing the old manual methods and costly methods also (big expensive harvesters), by using the modern wisdom and integrating mechanical system to the agricultural fields, theses traditional implements needed to be standardized keeping in the mind economy of the rural people by accelerating the farm work and farmer friendly.

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 featurerequired for our harvester is uprooter, we designed the uprooter by considering strength, physical properties and other factor of crops. We have fabricated uprooter and conveyor assembly and further in the project we will develop a permanent drive and fabricate the whole design.**[2]**

This research has clearly demonstrated that it is quite possible to design for manufacture of a harvester aimed at solving farmer‘s problem of harvesting in developingnations. The calculated results obtained showed that the chassis was able to withstand the design load the harvester may be subjected to as long as high strength material is used forthe chassis construction. The result also revealed a deflection of sweeper and frame are 0.29mm and 7.84mm respectively when the chassis is subjected to 500N load, which it was safe to use considering a factor of safety of 3.37 and 1.56 respectively

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incorporated in the design. Finally, the materials that have been carefully selected for the harvester design were those available locally. All these were attempted to ensure the cost ofproduction was significantly reduced and the harvester is readily accessible to small scalefarmers.

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