

# Design and Synthesis of Crop Cutting Machine

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**Abstract—** This Nowadays, agriculture especially in Maharashtra soybean crops has some problem such as how to increase the productivity and profit, how to reduce the cost and how to solve the problem come from foreign workers. Harvesting of soybean crops is also done by huge harvester machine but, it also has some limitations like high cost, applicable for large farm-fields. On the basis of these constraints for crop cutting a new engine driven crop cutter is designed. It works on shearing cutting principle. It composed of fixed blade disposed on the lower portion of a frame; movable blade guided through bushes reciprocates over it. A crank and slotted lever assembly driven by engine through gearbox which imparts cutting force. The reciprocating blades consist of double edge sharpened knives to cut crops during both forward and return stroke. The belt conveyor mechanism is provided to guide and transfer the crops accumulated on the reciprocating blade assembly to the collecting tank. As the engine driven crop cutting machine is designed for soybean which is strongest crop in all crops and the blades are designed with the side clearance for variety of crops diameter the machine can be conveniently used for multiple crop cutting. As in given crop cutter the machine is designed for crop cutting only with some further modification in design thresher mechanism can also be incorporated for direct seeds extraction.

**Keywords—**Shearing cutting, reciprocating blade crop cutter.

## I. INTRODUCTION

Crop cutting is major operation in harvesting. Till date crop cutting is done manually or by using big harvester machine. There are several social and economical problems with the existing methods of crop cutting. With a view to eliminate all these limitation of crop cutting a new crop cutting machine is designed and developed to meet the requirement of crop cutting. In this machine shearing cutting principle of reciprocating blades is used. A specially designed flat belt conveyor guides the cut crop to collecting tank. A light petrol engine is used as a source of power for driving the mechanism. The collecting tank is provided to collect the cut crops.

### A Present Methods of Crop Cutting

In present crop cutting is done by manually or by means of big harvester machine. Manual method of crop cutting include cutting of crops by using conventional hand tool like sickles. Manual methods have some limitations like high demand of wages, labour intensive ,unavailability of labours other than this human being have some limitations like fatigue. The harvester machine also has some limitations

like applicability for big farms, high operating cost, spilling of crop residue on farm-field and high initial cost. Also to fulfil the requirement of high foodstuff the mechanization of agricultural operation is necessary. The present crop cutting methods shown in Fig. (a) and Fig (b). If we channelize this system in proper manner we can overcome the problems which we presently faced.



Fig. (a), Fig (b) Present method of crop cutting

### B Modified Methods of Tackling Problems

To minimize the dependency of farmers on foreign workers for cutting crops current crop cutting machine is designed. The crop cutting machine is designed to cut the crops accumulated in the cutting blades. It is designed in

order to avoid spilling of crop residue on farm-field which can be used as food for cattle. It is simple mechanism involving use of manual force propels the machine. The machine designed for the soybean crop which having the highest shear strength value among all the crops. The machine mainly target on the areas like proper cutting of crops, machine economy, and suitability for different varieties of crops and applicability for small farms.

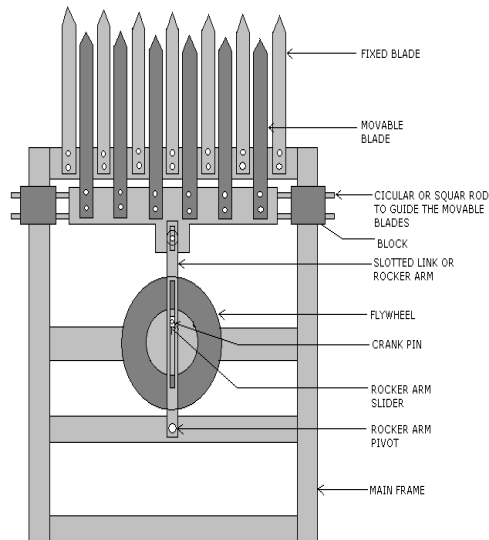


Fig.(c) Schematic of Proposed Crop Cutting Machine

## II. NOVELTY OF APPROACH

This Proposed Crop cutting machine is better than that of present crop cutting methods because of following Reasons–

- It prevents dependency of farmers on foreign workers for cutting crops..
- As it is compact its handling is easy.
- Reduce the cost crop cutting.
- Proper storage of crops in collecting tank.
- Prevent spilling of crops on farms.
- Require less time compared with other method for cutting.
- Variety of crops can be cut.

## III. PROBLEM IDENTIFICATION

- 1) Labor intensive
- 2) High wages of foreign worker.
- 3) High cost
- 4) The spilling of crops residue on farm field which create difficulty in cultivation of farm.
- 5) Limitations of human capability.
- 6) Applicability to large farms.

## IV. PROPOSED CONSTRUCTION

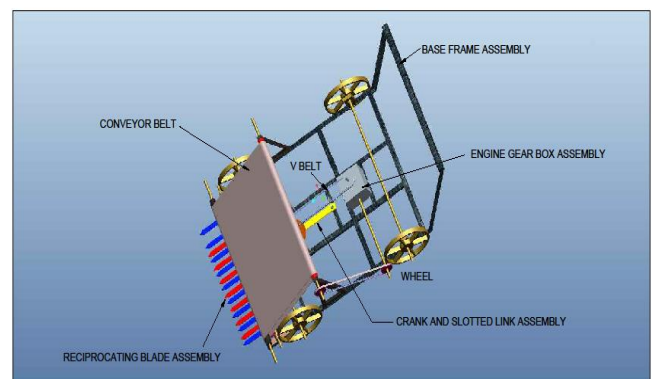


Fig.(1) CAD Design of CROP Cutting Machine

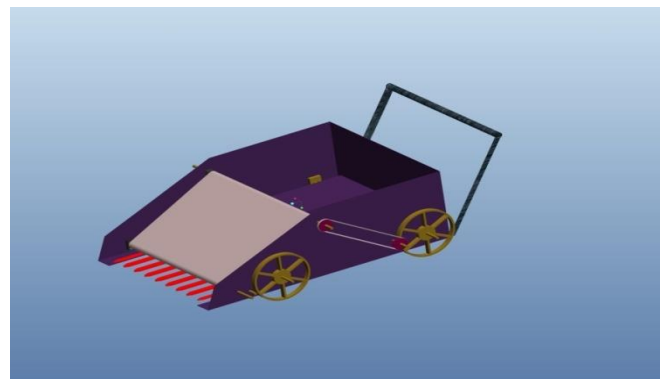


Fig. (2) Actual CAD Model of Crop Cutting Machine

The basic construction of crop cutting machine includes main frame (1) which act as main supporting frame for holding the different mechanism of machine ,fixed blade (2) which is bolted to the main frame ,movable blade (3) which is guided through the guiding bush (4) , Slotted link (5) which is a part of crank and slotted link mechanism which convert the rotary motion of bull wheel (6) into a curvilinear motion , bush pin (7)which is a connecting link in between slotted link and reciprocating blade .It also consist of crank pin (8) which act as a coupler in between slotted link and bull wheel.

The conveyor system consists of a bearing holder (9) which holds the rotating shaft in bearing. The driven drum (10) is an assembly of bearing and free shaft of conveyor. The driver drum (11) is rigid shaft mounted drum that receives power from the engine through gearbox via v-belt and pulley arrangement. The flat belt (12) is a polyester fabric belt which

forms a means for carrying the crops accumulated over the reciprocating blade to the collecting tank (13).

#### V. WORKING OF MACHINE

A crop cutting machine is propelled by human power, as the machine is propelled forward the crops get trapped in between the reciprocating blade. The reciprocating blade is driven by crank and slotted link mechanism through bull wheel and crank pin. As the engine get started the power is transferred through v-belt arrangement to gearbox. The gearbox consist of two output and one input shaft .The input shaft receives power from engine , one output shaft of gearbox is connected to crank and slotted link mechanism while other is connected to the conveyor belt mechanism. The crops which are trapped in reciprocating blade mechanism is get cutted by shearing action of cutting imparted by cutting blade. The cutted crops which are accumulated over the reciprocating blade is guided by side frame over the conveyor belt .The conveyor belt is high speed friction belt which conveyed the crops accumulated toward the collecting tank. The collecting tank is a detachable tray, which can be removed easily and can dump the crops collected in it.

#### VI. CONCLUSION

Based on study of previous crop cutting methods, following conclusions can be drawn-

- With the reference of field testing of machine the crops are effectively cut by machine that reduces dependency of farmers on foreign workers.
- The machine is simple, compact and it is very easy to handle.
- It avoids the spilling of cut crops on the farm field.
- As the machine is having simple design and construction it leads to easy maintenance.
- The operating cost of machine is very low.
- The cost of machine is very less by which it is affordable to small farmers.

- Different variety of crops can be efficiently cut.

#### REFERENCES

- [1] Li Liang , Janardhanan and Yuming Guo, “*Relationship between stalk shear strength and morphological traits of stalk crop*”, Department of Mechanical and electrical engineering, Luoyang institute of science and technology ,Luoyang ,Henan province , China , Vol. 1-2, pp 288-290, April 2011.
- [2] Konakala Nagan Shri Athan,Vaitla Rakesh & Pothamesetty Kasi Viswesrao “Design and selecting the proper conveyor belt”, Mechanical Engineering KLU Guntur, Vol. IV, pp. pp. 43-49, June 2013.
- [3] Souravik Dutta , Tarun Khanti Naksar, “Synthesis of adjustable offset slider crank mechanism for simultaneous generation of function and path using Variable length- Link” , Department of Mechanical Engineering, Jadavpur university, Kolkata India, Vol. 1, pp . 465-471, December HIH Sarvanamutto, H. Cogen, GFC Rogers, “Gas Turbine Theory”, Pearson publication, fifth edition 2012, ISBN: 978-81-7758-902-3
- [4] Asif Elliston, Charles E. Kalomeris “Double Sided Reciprocating Saw Blade and Related Method”, U.S. Patent, Appl. No. 216007, pp. 43-49, June 2013.
- [5] Mark Vitantaneo “Dual Blade Reciprocating Saw”, U.S. Patent, Appl. no. EP20120706430, March 2011.
- [6] Bibitex, “Multifunctional cutting crop machine”, China Patent, Appl. No. CN 201220457334, Sept 2012.
- [7] Bibitex“Method for preparing ultra-sharp steel alloy cutting tool” China Patent, Appl. No CN 200810031123, April 2008.
- [8] Poettinger Ohg Alois “Cutting equipment for leaf or stalk material - has cutting blades with ends which engage in sloping openings” China Patent, Appl. No, DE19792909412, April 2008
- [9] Wolfgang Holzer, Thomas Freichel “Chipping machine with cutting blades and method for fabricating the cutting blades” China Patent, Appl. No CA 2533776, Jan 2005.
- [10] V.B Bhandari,” Design of Machine Elements”, Tata-McGraw Hill-2009.