

Solar Energy Based Crop Cutter

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Abstract: In our country energy crashes is the main trouble for the development for the farmers that may be in the terms of petroleum energy conventional energy like coal etc. Looking to the view of present scenario of energy demand and supply such a model is designed which will be useful for farmers in the field of cultivation. There are many different types of Crop Cultivator in the market which are either imported from other countries like China and are very costly and petroleum based. In order to reduce the expenses of farmers these designs facilitate the farmer to reduce the production cost and overcome the dependency of petroleum product. Multi crop cutter using Solar energy design to work is first step towards the use of non- conventional energy which is totally pollution free. These model gives economical, vibration free and rigid and maintenance free design for economically backward class of farmers. Since, there is no diesel/petrol base engine to move the blades which are used for cutting. In these paper different models are compared with our model.

Keyword: Crop cutting, harvesting, reaper, scissoring action, Fabrication

I. INTRODUCTION

In India where the main source of income is agriculture,[1] needs to be concentrated in some accepts like how to increase productivity, profit how to reduce the cost and how to solve the problems of the farmers. In the list of problems of the farmers cutting crops is one of them. In which farmers have to face many of difficulties. In India, two types of agricultural equipment are used, manual method (Conventional method) and mechanised type. In conventional method Crop Cutting is done by hand. In which labour has to work hard for many hours in field and also the farmers has to pay daily wages to the labours. So this will increase expenditure cost of farmers and the physical pain to the labours is one of the problem in this method. For manually harvested crop nearly for cutting and bundling the crop 185 to 340 man-hour/hector is needed in case of wheat crop where as in case of paddy crop it is 170 to 200 man-hour/hector [7] In machanized type method, the cutter is operated by the engine, engine runs on petrol and diesel which create the air pollution. Engine produces the vibration which is harmful for the farmers and also the operating and maintaining cost of recently operated cutter (Mechanized type) is high, which cannot be affordable by the Indian farmers.

Some silent features of petrol based crop cutter are as:

Table 1 Features of the crop paddy cutter

Sr. No	Name of item	Specification
1	Engine	2 stroke petrol (48 CC Max. power)
2	RPM	6800
3	Blade diameter	415 mm
4	Cutting width	255 mm
5	Fuel tank capacity	1.2 Liter
6	Net weight/Gross weight	7.7 to 9.2 Kg.
7	Cost	12000-16000 Rs

For machine harvested field manpower required is a single operator can harvest at a speed of 1.8km/hr. is 43.2m². area and in term of man-hour is 23.20 man-hour/hector. Fuel required is nearly 41 liters for one hector in case of paddy crop. Which in term of cost is Rs.3300/ hector. This ultimately increase the production cost of crop. [7]

So to overcome all this drawbacks new manually operated cutter is fabricated name as Multi function, economical solar power crop cutter, as solar energy plays very important role in agriculture.

II. IMPORTANCE OF SOLAR ENERGY FOR FARMERS

- Solar energy plays an important role in agricultural operation.
- In Indian farms the cutting operation are mainly performed by hand and conventional method.
- In mechanised cutting method the operating and fuel cost of machine exceeds the budget of common farmers.
- Therefore, our objective is to overcome all these drawbacks we can use renewable non – conventional energy source like solar energy as it is easily and free available in nature.

III. PRESENT MULTI CROP CUTTER AVAILABLE IN MARKET

A Crop Cutter machine is an effective agricultural tool used to cut weeds, harvest crops, trim small trees and other Foliage. Crop cutter machine has various types of blades like Tap & Go. Two Point Blade or Circular Teeth Blade that can be attached to the machine for specific purpose. Crop cutter consists of an engine that is held close to the body, and a pole with a drive shaft is provided to transmit the power to a rotary cutting head, which is fixed at opposite end of a pole is shown in fig 1. Other parts of the brush cutter or crop cutter are Cutter Blade, Trimmer Head, Crop Cutter Shaft and Handle. Crop Cutter is very effective to cut through overgrown brush. Congested brush and hard part of trees where larger machines cannot be enter. Crop Cutter has various types of blade attachments that help you to several purpose.

There are two stroke, four stroke and shoulder mounted crop cutter and different varieties of blades i.e Heavy Duty TCT Saw Blades, Thick and Slim Blades, TCT and non TCT Saw Blades. Different blades are used for different crops based on the number of teeth on blades. Some are as follows:

1. 120 Teeth Blade which is used for harvesting Wheat, maize etc.
2. 40 Teeth Blade is used for cutting two inch plants.
3. 60 & 80 Teeth Blades are used for feeder.



Fig.1 Crop Cutter with 1.2L petrol tank

Energy generated by solar panels is depends upon the type of mounting structure. The tracking system are mostly used where huge power generation are estimated, but for small power generation like in case of residential and commercial mostly fix type structure are used.

IV. NEED OF CONSTRUCTION OF EQUIPMENT WHICH IS SOLAR BASED

The main goal behind this is to construct the equipment which are useful for the agriculture with the desirable cost which will be affordable for the Indian farmers and also the efficiency of the machine will be high. So that all farmers can go through these equipment rather than going to the mechanized Crop Cutter. When we use mechanized type cutter like diesel, petrol based machine the main problem produce by these machine is pollution and the vibration which is harmful for the environment as well as the farmers. As we know that there are much amount of non- conventional and renewable energy i.e Solar energy available in the environment we can use Solar energy as the main source for fulfilling the different operation and having no harmful effect such as pollution in the environment. Thus by using solar energy making such a crop cutter which will be having low maintenance cost, operating cost, light in weight, easy structure so that it can be affordable by the all Indian farmers.

V. DESIGN OF SOLAR BASED CROP CUTTER

A PV module is an assembly of photo-voltaic cells mounted in a frame work for installation. Photo-voltaic cells use sunlight as a source of energy and generate electricity. A collection of PV modules is called a PV panel, and a system of Panels is an Array. Arrays of photovoltaic system supply solar electricity to electrical equipment's.



Fig.2 Solar Plate with crop cutter

5.1 DC Motor:

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produce by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Ratings of DC Motor:

1. Power- 100 W
2. Voltage- 24 V
3. Current – 0.5-5 A
4. Shaft – 3 inch

5.2 Blade:

Present Crop Cutter has blades which cut the crop in a scissoring type of motion. It runs on petrol or diesel engine. The power from engine is provided through Shaft, Pulley and belt drive, but in solar based cutter the blade is attached to the shaft of DC motor which runs with the help of Solar panel, hence it cut the crops.

VI. POWER CONVERSION EFFICIENCY

The Solar cell Power Conversion Efficiency can be calculated by using the relation,

$$\frac{P_{max}}{P_{min}} = \frac{\text{Out put power}}{\text{Input power}}$$

Where,

P_{min} . = Incident Solar radiation x Area of the Solar Cell in = $I_T \times A$

Ratings of Solar Panel:

- A. Performance data measured at (STC) Standard Test Condition (1000 W/ m²; 1.5Amp; 25⁰C)
- B. Maximum Voltage at Peak Power (Vmp) : 17 V
- C. Maximum Current at Peak Power (Imp) : 5.88 A
- D. Peak Power :100 Wp
- E. Open Circuit Voltage (Voc): 24V
- F. Short Circuit Current (Isc): 6.35 A

The output power (Pmax.) = V x I out Power : 17 x5.88 = 99.96 \cong 100 watt.

It is the power delivered from the motor.

Power deliver to the motor :

The output power (Pmax.) = V x I out Power : 17 x5.88 = 100 watt.

Since this project has not include any battery there will be variation of working hours depending on the intensity of sunlight. Comparing the result on actual basis normal working hours are 7 hours in case of summer and in case of winter it is 5 hours.

VII. FUTURE SCOPE

Present model is portable and is design only for farmers. There are many ways to expand or digitalized the present model for automation. The present model is powered by 100WT, 24V which is a old panel but in market there are many panels available which comes with the rating of 100W- 24V, 100W- 12V etc. The motor with less rpm is used in these model due to economical reason, but in Future Scope the motor can be upgraded with high speed. This model is design to cut the crop due to limitation of resources.

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