Design and Fabrication of Multipurpose Agriculture Equipment

Mr. Thange R.B[1], Mr. Ugale A.G[2], Mr. Zatale S. V[3], Ms. Thorve N.N[4], Prof. Dhavane S.P[5]
[1, 2, 3, 4, 5] Department of Mechanical Engineering
[1, 2, 3, 4, 5] Sinhgad Institute of Technology, Lonavala, Maharashtra-410401, India.

Abstract-*India is an agricultural country cultivating more number of ground nuts, corns, cereals etc., in the village sides of the country. The available automatic machines are imported from foreign countries. The imported machines are not only bulk in size but also costing around rupees one Lakh. In this project an attempt has been made for the design and fabrication of maintenance free multipurpose agricultural equipment exclusively for small farmers at cost not exceeding rupees 20000 per unit. The different components of above multipurpose machine are modelled using one of the parametric modelling software Creo parametric 1.0. The modelled components are fabricated and assembled together to form a complete machine. A study has been carried out to develop multipurpose agriculture equipment for performing major agricultural operations like goods carrying, spraying pesticides, sowing, seeding, weeding and cutting operations to increase the efficiency and reduce land preparation and handling cost.*

Keywords-Automatic Sowing, Multipurpose, Machinery, Cutter, Hopper, Seed metering mechanism.

I. INTRODUCTION

The agricultural has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for produce grows as well. Hence, there is a greater need for multiple cropping in the farms and this in turn requires efficient and time saving machines. Here we discuss multipurpose agricultural equipment which will be helpful for the agriculture industry to move towards mechanization. Traditional Sowing Methods: Traditional methods include manually operations, opening furrows by a country plough and dropping seeds by hand and dropping seeds in the furrow through a bamboo/metal funnel attached to a country plough. For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand, is practiced. Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers. In manual seeding, it is not possible to achieve uniformity in distribution of seeds. A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field. Traditional sowing methods have following problems:

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The production and productivity of ground nuts, corns, etc., were quite low, when India became independent in 1947. The production was not sufficient to feed the Indian population. The country used to import them in large quantities for fulfilling the needs of our people from many countries. The reasons of low production and productivity were unavailability of machines in the cultivation field. In India most of the farming work is done manually when compared with foreign countries. There were no machines for sowing the seeds like groundnuts, corns then and it is done by man power only. The cost spent for man power was more and the speed of the operation was very less. When small farmers with minimal physical resources or financial assets attempt to improve their productivity, they have a limited choice. The only resource they can maximize is knowledge in which they are not poor. The government of India appointed a commission to assess the feasibility of increasing the crop productivity under prevailing Indian ecological conditions. In order to develop the standard of living of small farmers we should make the machines with low cost. Then only small farmers can implement the recent modern machines for farming purposes. Our proposed multipurpose sowing machine is used to sowing different types of seed like groundnuts, corns, etc. So in this work an attempt has been made to provide the multipurpose machine at low cost.

Like traditional sowing equipment, equipments like spraying, weeding, grass cutting etc. also having drawbacks. we going to produce such type of equipment having neglected those. Also it will useful for small scale farmers with efficient cost.

Developed agriculture needs to find new ways to improve efficiency. One approach is to utilize available information technologies in the form of more intelligent machines to reduce and target energy inputs in more effective ways than in the past. Precision farming has shown benefits of this main approach but we can now move towards a new

generation of equipment. The advent of autonomous system architectures gives us the opportunity to develop a complete new range of agricultural equipment based on small smart machines that can do the right thing, in the right place, at the right time in the right way. The main aim of the project is as follows :

The first step is to go to the farmers and find the problems faced by them.
The second step is to choose a problem.
The third step is to Design & Analyze the problem.
The last step is to find a solution and develop a model.

Problem Statement

The present agricultural equipments are of high cost. The rent of the machines is also considerably high. The machine is not easy to handle. The machine required a skill labour. The present machine having single purpose use. In early days to perform any task of farming we require separate equipment for every different task. Here we are trying to make such a equipment that will perform number of operations like sowing, weeding, grass cutting, tillage, spraying etc. with engine operated three wheeler.

Objectives

Multipurpose agriculture equipment can perform number of functions like Sowing, Weeding, Tillage, Grass Cutting, and Spraying. This equipment can be run on engine. It will have minimum cost and easy handling. Also there will have minimum weight and compact in size.

II.CONSTRUCTION

Initially we have prepared model of equipment on creo parametric. Study of each model is as follows:

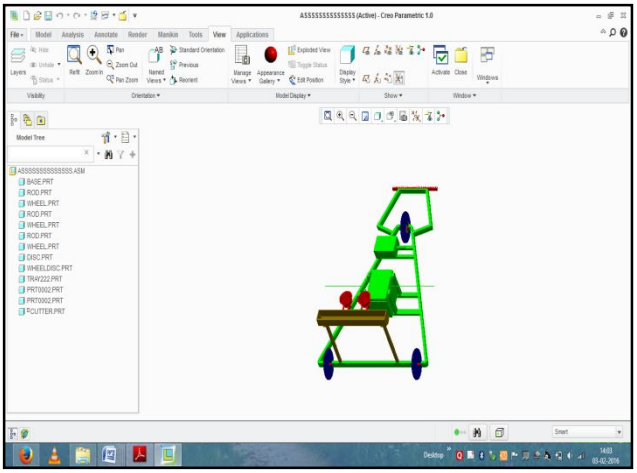

Fig.no.1 Whole assembly of project

The equipment consists of following parts:

i) Chassis:

Chassis provides support for each part. Wheels are attached to the chassis. It is made up of C section so as to having more strength with minimum weight. It is made up of mild steel.

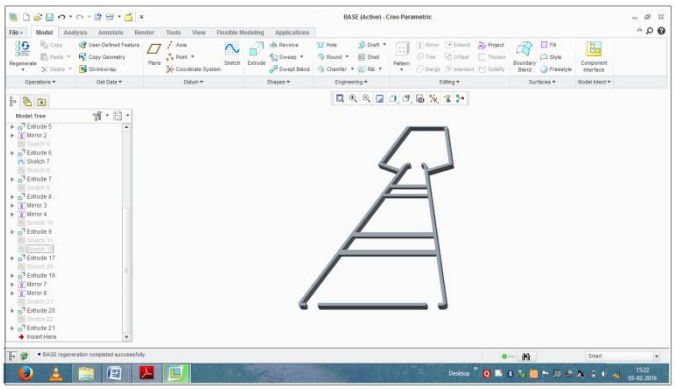

Fig.no.2 Chassis

ii) Sowing parts

Mainly it consists of hopper, tray, pipes, sowing feed mechanism and supporting structure. There is provision of hopper for storing seeds. This equipment will work automatically by using power of engine. This equipment will be attached at lower side to final equipment.

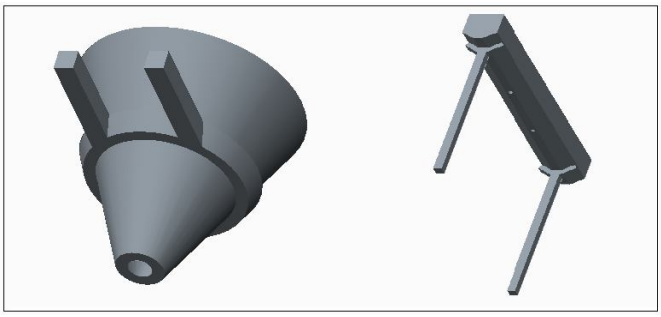

Fig.no.3 Hopper and tray

iii) Sprayer:

It consists of centrifugal compressor which works on engine power. The liquid pesticide which comes from tank is mixed with compressed air and goes to nozzle. There will be provision of long pipe for supplying pesticides far away. So we can spray when our equipment is in state of rest. It will situate at the top of setup. Sprayer drum will be made up of plastic material. It will have capacity of 15 litres.

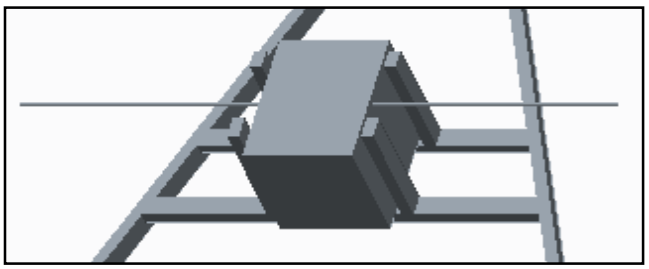

Fig.no.4 Sprayer

iv) Cutter:

This equipment works on principle same as Shaving trimmer. It is used for cutting grass and harvesting the crops. It consist of two blades in which one is fixed another is reciprocating over it. Reciprocating link is attached to the offset plate. It will situate at front of main equipment.

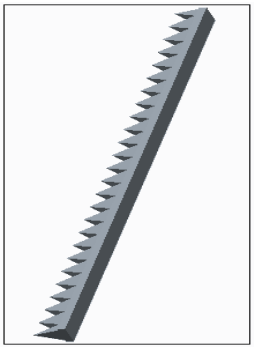

Fig.no.5 Cutter

III.WORKING

In this equipment, engine is connected to the front wheel by using chain drive. So, whenever we start engine whole equipment start to run. Rotary motion of wheel is connected to sprayer pump. So, at running position sprayer will automatically work. Now for sowing operation automatic seed feeder mechanism start their function with rotation of wheel. As wheel rotates seed feed mechanism allows seed to come down in proportion with speed of equipment. for cutting operation power is supplied from engine so as engine start, cutter start their operation. in this equipment we are going to provide disattachment facility for performing function as per requirement. So that we can get only required operations which are needed at farming.

IV. CALCULATIONS

A) To find maximum Tractive Power:-

Given: Total mass of equipment = 125 Kg

μ for soil is 0.4

Maximum velocity of equipment = 20Kmph =5.56m/s

Time for acceleration = 5sec

Total Force = Force of rolling resistance (Fr) + Force of inertia(Fi)+Force of aerodynamics resistance(Fad)

Fr = μ×R =0.4×125 =50Kg ..... (μ for soil is 0.4)

..... (R=Mass of equipment)

Fi = m× (Vfinal -Vinitial)/time

= 125 × 5.56/5

= 139 N

Fad = 100 N

Ftotal = 500 + 139 + 100 = 739 N

Tractive Power = Ftotal × Velocity

= 739 × 5.56

= 4108.84 W = 4.108 KW = 5.5 HP

V. SPECIFICATIONS

Table 1: Technical specification of Engine

Type	2 Stroke
Cooling type	Air cooled
Capacity	80 cc
Max. power	Appx. 5 KW
Max. torque	500 N-M
Ignition type	Spark ignition
Power transmission	Chain drive

Table 2: Material selection

Sr. No.	Part Name	Material Name	Appx. Weight(Kgs)
1	Chassis	Aluminium alloy	30
2	Engine	_	20
3	Sowing Pipe	Plastic	4
4	Tray	Plastic	15*
5	Sprayer Tank	Plastic	20*
6	Cutter	Cast Iron	4
7	Funnel	Plastic	1
8	Small parts (nut, bolts, sprocket chain etc.)	Mild steel	8

* - Including weight of water for spraying and seed for sowing

VI. FUTURE SCOPE

Here we are going to design and Fabricate of multipurpose Agricultural Equipment for small scale farmers with affordable price. But there are chances to produce Equipment with taking other operations for large scale farmers.

VII. CONCLUSION

The multipurpose field equipment is relatively cheap and particularly useful for medium-scale farmers. The cost of the machine was estimated approximately as Rs.20000.
The major advantage of this design is the ability of this equipment to perform several operations, which include automatic sowing, weeding, Spraying, grass cutting and land preparation.

Existing machines had the individual storage place and separate individual mechanism which leads to more cost. The drawbacks in the existing machine are rectified successfully in our machine.

Low cost for maintenance and operations.

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