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Evaluation of Effective Agricultural Vehicle

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ABSTRACT -Agriculture being one of the major occupations in India. It is the source of our food supply and plays a vital role in Indian economy. Over 70 percent of the rural households depend on agriculture. In agriculture field, though lot of work has been done. The purpose of this work farmer needed some tools and mechanical machines. Nowadays agricultural machines are high cost and is complicated for rural people.Evaluation of effective agricultural vehicle is basic and major equipment involved in agriculture for maximum yielding with low cost some modifications were done which includes fabricating a compact vehicle which can be moved easily in the fields.

Evaluation of effective agricultural vehicle is specially designed for small scale farmers to make agricultural operations in technical manner.The need for improvisation in agriculture is very much essential, it is important to fill the gap between farmers and technology implementation. The improvement and sustainability of the crops mainly depends on the technology. Evaluation of effective agricultural vehicle will gives that technicality to improving the yield.

KEYWORDS – Agricultural machine, crop cutter, pesticides sprayer, plough, iron legs.

I. INTRODUCTION

We all know that agriculture is the backbone of the Indian economy. Agriculture is the branch of science and art of farming which includes cultivating the soil, production of crops and raising the economy. It is the most important sector in the world. Indian farmers cannot use modern agriculture techniques and equipment because these are too expensive and and difficult to purches by including scientific farming methods, we can get maximum yield and we can increase the quality of the crops which can a save a farmers life,but the majority of the farmers are still using ancient methods due to lack of knowledge or lack of expenditure for utilizing modern tools.

Design of evaluation of effective agricultural vehicle.We are introduce ironlegs concept instead of bicycle wheel. And then apply some agricultural tools and equipment. The focus of this article is to design and develop agricultural equipment to form cutting, pesticides spraying, ploughing and leveling of soil operations. The first among the above mentioned operations is mechanical driven which consist of an intermittent metering mechanism to serve a primary purpose of cut the different crops. The secondary operations are spraying. During initial days there was only hand spraying people use to do. Then slowly there has been development of various methods to spray out chemicals and dusts. The application of pesticide is one of most frequently used methods to protect crops and trees against diseases and insects in agriculture. In the modern agriculture the usage of pesticides is still increasing, moreover the 90% of these pesticides are being applied in the form liquid spray. The other to operations are achieved by a using vehicle movement by the attachment of frame. The model is designed to be eco-friendly and less maintainance, operating cost.

DIFFERENT OPERATIONS

- Cutting

Cutting operation is used to cut the small size plans, grass and other crops. Cutting tool is connected to in front of the front wheel. It is made up of aluminum oxide and silicon nitride.

- Spraying

Designing of spraying mechanism which is driven by the chain and sprocket by the front wheel of the unit.

- Ploughing and leveling of soil

Ploughing is used to turn over the upper most soil, bringing fresh nutrients to the surface while burging weeds and crop remains to decay. The

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ploughing and leveling tools is connected to the frame of the vehicle.

Objectives

The following are the objectives of this project work:

- It is the best and economic to farmers in today's world without any huge investments and it can be worked without any external source like (electrical, solar energy) and we can contribute today's world without air pollution and water pollution.
- And it can be accessed by any kind of farmer at low cost.
- To improve the soil conditions by reducing evaporation from the soil, improve infiltration of rain or surface water.

CONCEPT DEVELOPMENT

A Introduction

The different kinds of problems faced in traditional method of using individual equipments for agriculture field are mentioned below. We are using two concepts and are developed for multipurpose agriculture equipment and the best concept is selected using bicycle.

A. Need Analysis

1.Gathering raw data from the customers.

2.Interpreting the raw data in terms of customer needs.

3.Organizing the needs into primary,secondary and tertiary needs.

4.Establishing relative importance of needs.

B. Design and Concept Generation

Concept 1: The first concept developed for evaluation of effective agriculture vehicle is shon in figure 1, the frame is rectangular shape and the attachment like cutter, sprayer , plough placed at different sides .The front wheel having snipers which helps in easy flow in wet land ,and there are iron legs which is supported to the rectangular ,cutter can also be adjusted by the handle provide to it ,the sprayer is driven by the front wheel drive.

fig.1: schematic of bicycle With iron legs concept.

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Concept 2 : In this concept

Concept 2: In this concept as shown in figure 2 , a single frame is used to mount all the equipments like cutter,chemical sprayer at the front side of the wheel and the cylinder to maintain the chemical in liquid form at the middle of the frame. Intercultivation is placed at the rear side of the frame base. Using single frame and single attachment of bicycle results in reduction in space, cost and maintainance.

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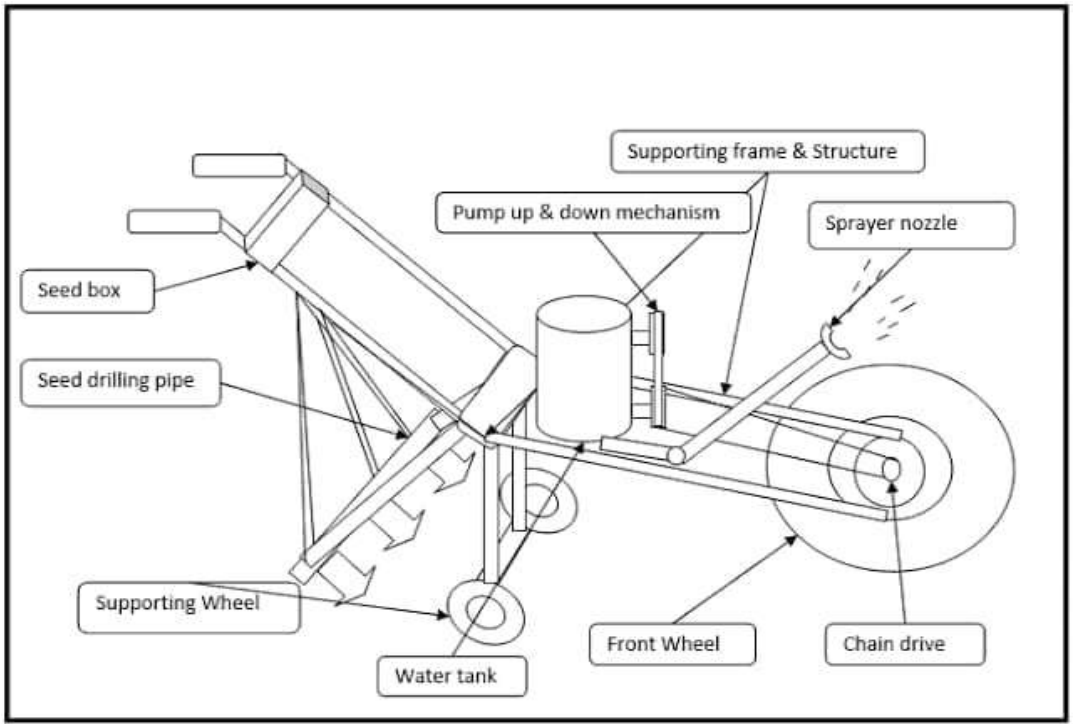

Fig 2: Schematic of multipurpose agricultural equipment

D. Concept selection

TABLE 1 - PUGH MATRIX SELECTION CRITERIA FOR THE MULTIPURPOSE FARM EQUIPMENT

KEY CRITERIA	CONCEPT 1	CONCEPT 2	CONCEPT 3
EASE OF DESIGN	-	+	0
SAFETY	+	+	0
EASE OF FUNCTION	+	0	0
EASE OF MANUFACTURE	-	-	+
EASE OF USE	-	+	+
SUM OF POSITIVES(+'S)	2	3	2
SUM OF ZEROS(0'S)	0	1	3
SUM OF NEGATIVES(-'S)	3	1	0
NET SCORE	-1	3	5
RANK	3	2	1

Concept 1: Gear mechanism results in difficulties in fabrication.
Concept 2: Chain and sprocket arrangement increases the complexity of manufacturing.
Concept 3: Due to design simplicity and cost effectiveness, this concept is selected.

DESIGN AND DEVOLOPMENT

A. Plan-layout of the model

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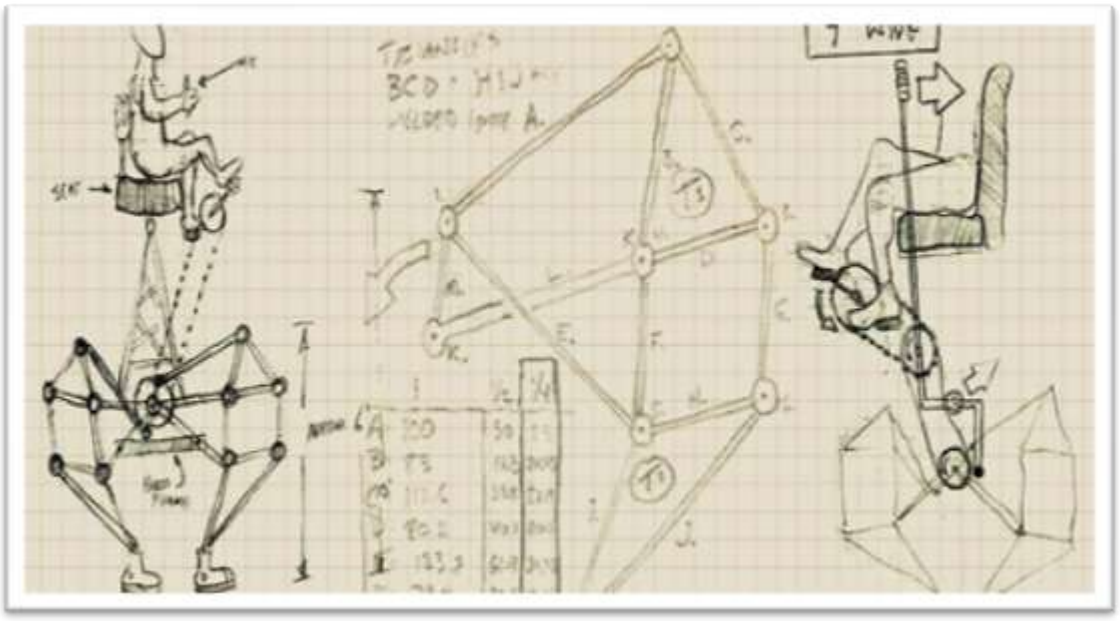

Fig 3: Schematic of Bicycle mechanism

The attachments like inter cultivation chemical sprayer, cutting and ploughing can be replaced on final assembly for specific functions. Any one of the attachments must be fixed on the bicycle assembly of multipurpose agricultural equipment.

B. Spraying

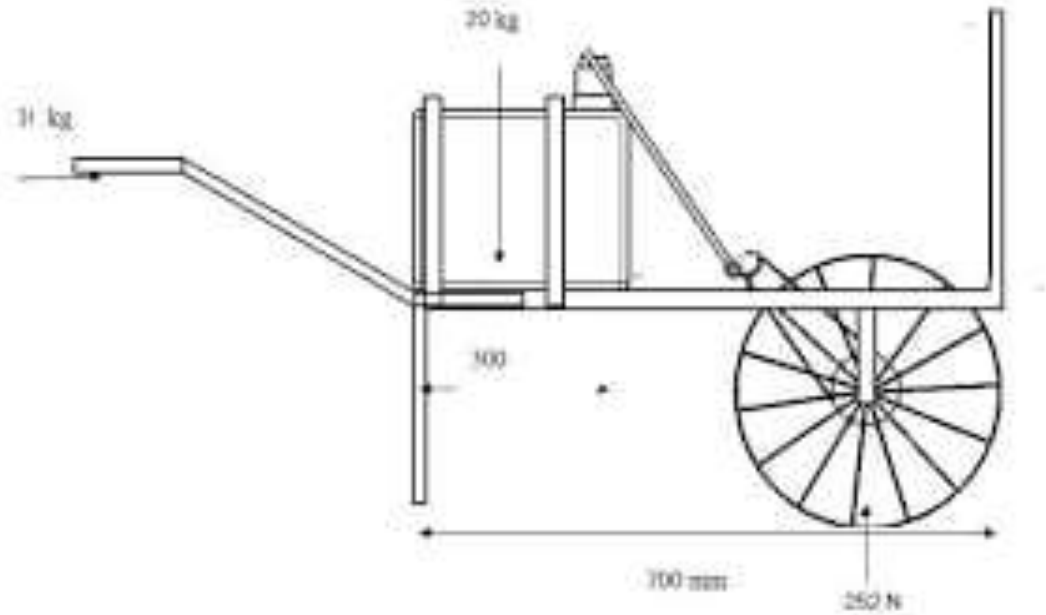

Fig 4: chemical sprayer having front wheel has its driver with sprocket and kinematic links

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C. Cutting

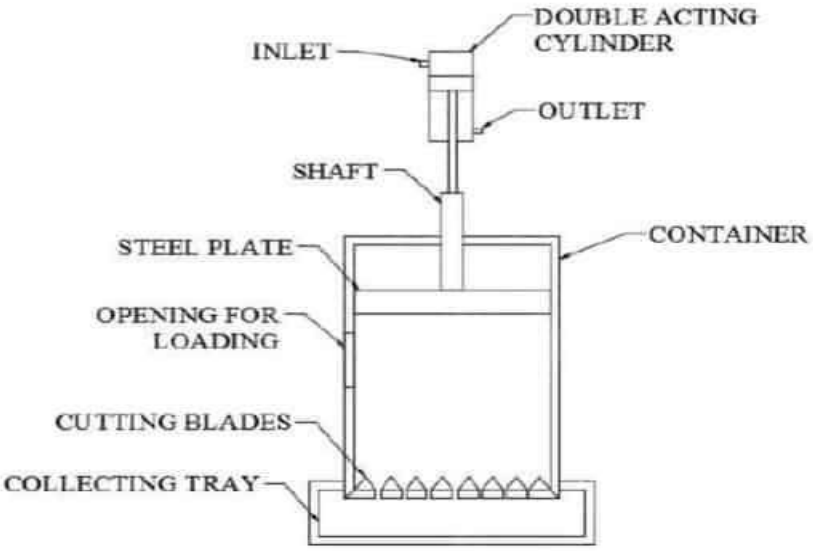

Fig 5: Cutting operation

D. Ploughing

Fig 6: Ploughing and inter cultivation

E.Design of various parts

1)Rear wheel axle shaft Design

For a main shaft which is a power generator, power is given as,

P=FxV---------- (1)

Our whole assembly will have weight approximately equal to 60kilograms.Thus total force acting will be on 5 wheels.

Out of those 4 wheels we have maximum load acting on rear wheels mounted on shaft. This shaft is subjected to approximately 50 kilograms of load. So force acting on shaft is given by,

F=mxg---------- (2)

Putting m= 50 kgs

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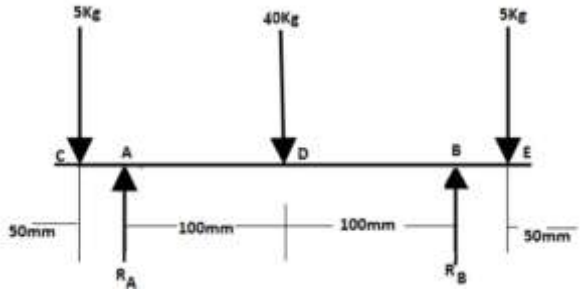

Fig7 : free body diagram

g = 9.81 m/s2
Thus
F = 50 × 9.81 = 490.5 N
Velocity is found out to be 10 cm/s i.e. V = 0.10 m/s
Thus
Power, P = 490.5x0.10 = 40.05 watts
We know that torque is given as, T = Px60/ (2πn)
Assuming No. of Revolution, n=50rpm
Thus, we have Torque, T = 49.05x60/ (2πx25)

$= 9.36 \times 10^3$ N-mm

For a given shaft we have from diagram,
Vertical reactions at wheels i.e. fixed supports,
$R_A = R_B = (5+40+5) / 2$
= 25 kg
= 25x9.81 = 245.25 N

From bending moment diagram, maximum bending moment is found to be M = 1750 Kg-mm = 17.167×10^3 N-mm

The resultant moment on a given shaft is given as

$$M_R = (M + T)^{1/2}$$

$$= ((17.167 \times 10^3)^2 + (9.36 \times 10^3)^2)^{1/2}$$

$= 19.552 \times 10^3$ N-mm
Also we know that shaft diameter is given as,

$$d = [(M_R x16)/ (\pi x \tau)]^{1/3}$$

SHEAR STRESS VALUES

Service Condition	τ, (MPa)
Heavily loaded short shafts carrying no axial load	48-106
Multiple bearing long shafts carrying no axial load	13-22
Axially loaded shafts (bevel gear drive or helical gear drive)	8-10
Shafts working under heavy overloads (stone crushers, etc.)	4.5-5.3

Consider shear stress, τ = 50Mpa
d = [((19.552x103) x16)/ (πx50)]1/3
d = 12.581 mm
This is ideal diameter of shaft which is needed. Since a shaft may be subjected to extra load as it has to work in rough conditions and from availability point of view, we chose a safe diameter from DDHB (Table 3.5a) of standard shaft
diameter of 15 mm.
Thus diameter of shaft, d = 15 mm

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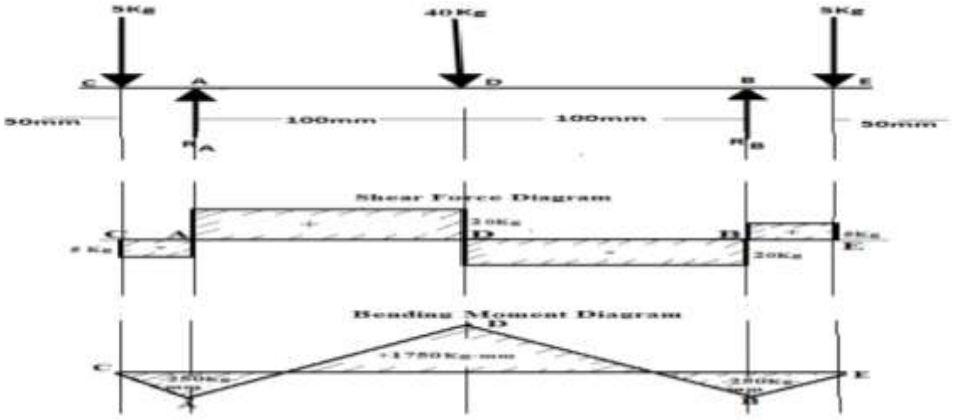

Fig8 :Bending moment and shear force diagram

COST ESTIMATION

Table: Cost estimation table

COMPONENT	COST (RS)
BICYCLE	3000
INTER CULTIVATING AND PLOUGH ATTACHMENT	6000
CHEMICAL SPRAYER	2900
SEED SOWING EQUIPMENT AND ATTACHMENTS	7200
TOTAL COST	**19100**

Fabrication and labor cost = Rs 5,000
Total cost = Component cost + Fabrication and Labor Cost
= 19,100 + 5,000
= Rs 24,000/-

II. CONCLUSION

- The various components required for building the multipurpose agricultural equipment has been designed as planned.
- Evaluation of effective agricultural vehicle single system which can perform multi operations like cutting, spraying, ploughing and soil leveling and cultivation.
- The equipment can do the work of 6 labors a day which reduces the labor cost of the farmer.
- Agriculture sector wanted new technical operating machines, our evaluation of effective agricultural vehicle will gives that technicality. A single machine can do lot of agricultural operations.

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