International Conference on Innovative Research in Engineering, Management and Sciences
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2019 IJSRCSEIT | Volume 4 | Issue 9 | ISSN : 2456-3307

Design and Development of Universal Seeding, Weeding and Spraying Equipment

Vinay D R[1], Vijay Kumar S L[2], Sandeep K[3]
[1]Assistant Professor, Department of Mechanical Engineering, New Horizon College of Engineering, Bangalore, India
[2]Assistant Professor, Department of Mechanical Engineering, Presidency University, Bangalore, India
[3]Assistant Professor, Department of Mechanical Engineering, National Institute of Engineering, Mysuru, India

ABSTRACT
This work is based on weed control which is the most important problem faced by the farmers in developing countries. Considerable efforts have been invested in developing alternatives to traditional smallholder weeding technologies and replace the conventional methods of weeding in order to reduce work load, labor and human effort, save time, improve yield of crop, enhance proper weed control and finally reduce the cost involved in farming. Designed Prototype of Farm equipment which would be an easiest way to perform weeding, spraying chemical and seeding, altogether consisting of three functions in one design and making the design a universal fit has been Analyzed, Fabricated, Tested and Evaluated based on the considered design criteria's. The weeder is driven by petrol engine to move in forward direction and the blade is attached at rear end is placed at the roots of weeds, once the engine get started then the blade start cutting the weeds and using cam system the seeding operation can be done, chemical spraying can be done .It is faster than the traditional method of removing weed, seeding and spraying.

Keywords : Weeding, Petrol Engine, Cam System

I. INTRODUCTION

India is agriculture based country. Near about 60% people of our country are farmers. Our economy also depends on agricultural products. Nowadays tremendous changes have occurred in conventional methods of agriculture like seed plantation, irrigation system, pesticides and spray used. For developing our Economic condition, it is necessary to increase our agricultural productivity and quality also agriculture is the backbone of Indian economy. India being developing nation agriculture and industries based on agriculture products has prime importance in the national economy. Majority of the Indian population depends on agriculture and agro-based industries and businesses.

Figure 1. Weed Removing Process

The weed should be controlled and eliminated at their early stage. Depending upon the weed density, 20 to 30 percent loss in grain yield is quite usual which might increase up to 80 per cent if adequate crop management is not practiced.

Every year in INDIA, an average of 1980Cr of rupees is wasted due to weeds. Our country faces the total loss of 33% of its economy from Weeds. The Losses are due to some of the following reasons; total loss of 26% from Crop Diseases, total loss of 20% from Insects and Worms, total loss of 6% from Rats has been surveyed.

Manual weeding requires huge labour force and accounts for about 25 per cent of the total labour requirement. In India this operation is mostly performed manually with khurpi or trench hoe that requires higher labour input and also very tedious and time-consuming process. Moreover, the labour requirement for weeding depends on weed flora, weed intensity, time of weeding and soil moisture at the time of weeding and efficiency of worker.

Weeds can be removed by manual or mechanical weeding .Manual weeding is the use of hands or handheld tools to remove weeds .Mechanical weeding is the use of powered tools and machinery to eliminate weeds.

II. METHODOLOGY

Successful model designing begins with a logical and systematic plan. Model design is a five step problem solving process. The following is a detailed analysis of each step.

Step 1: Problem Analysis

To initiate the design process, we clearly state the problem to be solved. State the requirements as broadly as possible, but specifically enough to define the scope of the design project.

Step 2: Gather and Analyze Information

Collect all the relevant data regarding problem and assemble for evaluation. The main sources of information are weeding, seeding and chemical spraying activity. Design considerations need to be taken into account.

Step 3: Designing Concepts

A brainstorming session should be conducted to come up with several good design alternatives.

Step 4: Concepts Evaluation and Selection

The fourth phase of the design process is analysis of different options using evaluation matrix.

Step 5: Fabrication

This phase of the design process consists of turning the chosen design approach into reality. The model is then fabricated as per specifications and checked if all the mechanisms work efficiently.

Step 6: Testing and Implementation

The equipment is tested to check if it meets all the objectives. Finally the equipment is checked again if there are improvements or alterations to be made. After testing the model completely it is then implemented.

Step 7: Result and Final report

The output calculated during testing the equipment on the field are tabulated .Then submission of final report.

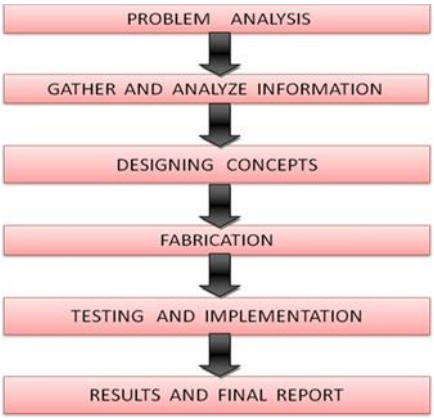

Fig 2: Flow Chart of Methodology

III. DESIGN & FABRICATION OF THE PHYSICAL MODEL

A. Bevel Gear

Bevel gears are gears where the axes of the two shaft intersect and the tooth bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.

Number of teeth: 16

Figure 3. Bevel Gear

B. Main Wheel

Diameter: 30cm
Material: Rubber

Fig 4: Main Wheel

C. Base Frame

Length: 60 cm
Breadth: 50 cm

D. Ball Bearings

Spherical roller bearings have an outer ring with an internal spherical shape. Spherical roller bearings can thus accommodate both static and dynamic misalignment. The bearings have higher friction than an ideal cylindrical or tapered roller bearing since there will be a certain amount of sliding between rolling elements and rings. Number of bearings used is about 6.

Inner Diameter : 2cm
Outer Diameter: 4cm

E. Seed Container

Length: 20 Cm
Breadth: 20 Cm
Height: 20 Cm

F. Engine

Engine type: single cylinder , 2 stroke Fuel: petrol Fuel tank capacity: 0.5L Weight: approximately 10.5 kg

G. Chain and Sprocket

This is a standard sprocket which is made of C30 steel with the outer diameter as 185mm with inner diameter as 44mm with 44 number of teeth which is matching to the chain and used in this work.

Fig 7: Chain and Sprocket

H. Lead Battery

Cycle Use : 14.4-15.0 V

Stand By Use : 13.5 13.8 V Initial Current is less than 2.25 A

I. Other Specifications

Sprayer Tank Capacity : 3

Litres Nozzle Diameter: 1mm

Grass Cutter Dia : 12 Cm

Circular Plate Dia : 17 Cm

V. TESTING

A. Testing of Weeding Operation

The weeding unit was first subjected to testing, where in order to measure the weeding efficiency an area with weeds was analysed and an area of 1 square feet was marked so that the number of weeds before and after the operation could be noted. The above field testing figures shows the

number of weeds before the operation and after the operation.

Before After

Fig 8: Testing of Weeding Operation

B. Testing of Seeding Operation

With the use bevel gear, seeding is done at a uniform distance with a help of cam system .

Fig 8: Testing of Seeding Operation

C. Testing of Spraying Unit

Fig 8: Testing of Spraying Unit

V. CALCULATION

A. Gear Ratio

As we need drive sprocket to be bigger than driven sprocket,

- No. teeth in drive sprocket (bigger) = 44 teeth
- No. teeth in driven sprocket (smaller) = 14
- Therefore gear ratio of these two sprocket= 44/14
- Gear ratio = 3.143

B. Blade Angle

The blade angle of the Spreader bar plough which is also the angle of attack is decided as about 15deg which will produce good Removal of weeds.

C. Weeder Efficiency

We = {(N 1 - N2)/N 1} * 100

={(10-1)/10}x100 =90%

Where N1 and N2 are the number of weeds before and after weeding operation

D. Field Efficiency

Fe = (Te/Tt) *100 =

(72sec/80sec)x100 Fe =90%

where Te and Tt are useful and total time respectively.

VI. RESULTS AND DISCUSSIONS

Table I. Time Comparison Between Manual Method And Using Machine

Parameter	Manual Method	Through this Machine	Percentage Time Saved
Time taken for weed removal per person	20 hours	3 hours	70.86%
Time taken for fertilizer distribution per person	1 hour	----------	100%

Table II. Result of Fertilizer Feeding

Parameter	Standard	Manual	Using Machine	Difference
Amount of fertilizer fed per crop	3 grams	Uneven distribution	3.28 grams	0.28 grams

In traditional method of weed removal process for a person per acre it takes around 20 hours and for fertilization it takes another 1 hour. In our machine it takes around 3 hours to complete the weeding of an acre land and it completely saves time for fertilizer spreading. This machine ensures the uniform feeding of fertilizers to the each crop that is 3grams to each crop and it can be adjustable as for our requirement. It is time saving and economical machine as it performs two tasks at same time.

IV. CONCLUSION

As study says that in our country about 70% of population lives in villages & their mainly income depend on the agricultural source. Hence the prominent aim of this project is to complete the weed removing and fertilizer spreading in same time.

The above topic shows the details of agricultural technology, this machine can be used to reduce labour cost and time of a middle class and small sector farmers. This is the little effort to make comfort to farmers also this machine is manufactured in less cost as compared to other machines. The result from this project outcomes are assurance of much efficiency, less time consuming, worker friendly machine respective to the conventional method of weeding. It assures the maximum work done with minimum work effort. It has solved the problem of traditional way of Fertilization.

Also the project learn to fabricate any model according to its requirements. All the manufacturing process are carried out with the great concentration; any wrong calculation may have result in the failure of model. And this equipment saves the fuel for the larger extent because here we don't use any fuel for its working. At the same time environment pollution can also be reduced. Thus aiming to save the revenue of government & also most demanded fossil fuel.

Practically our multipurpose agricultural equipment can be used for tilling, fertilizing, sowing, levelling and also used for weed removal purposes. All the parts are connected in such a way that in every stage of agriculture the equipment can be rearranged or easily assembled with fasteners to required length and specifications of field operation.

Our team has successfully combined many ideas from various fields of mechanical engineering and agricultural knowledge to improve the yield and by reducing the labour effort and expenses. The whole idea of multipurpose equipment is a new concept, patentable and can be successfully implement in real life situations.

REFERENCES

[1] Brian.G.Sims, "Elements of Design and Evaluation of Manual-drawn weeders", International Journal for "Technical centre for agriculture & flU'a1 corporation(CT A)" Wageningen, the Netherlands. PP in Starkey P and Simalenga T (eds), 2000.

[2] Smith D W and Sims B G, Technical evaluation of small fann equipment. Presented at the Eleventh Session of the F AO Panel of Experts on Agricultural Engineering, 28-30 October. FAO (Food and Agriculture Organization of the United Nations), Rome, 1992 Italy. 233p.

[3] Tewari V K, Datta R K and Murthy A S R, Field performance of weeding blades of a manually operated push-pull weeder. Journal of Agricultural Engineering Research 55(2):129-141. PP -1993.

[4] Payne P C J and Tanner D W, "The relationship between rake angle and the perfotmance of simple cultivation implements". Journal of Agricultural Engineering Research 4(4):313-328. PP- 1959.

[5] Dym.C.L. Engineering Design - A Project-Based Introduction, 3rd Ed. Hoboken, NJ, US: John Wiley & Sons, 2009.

[6] L.O. copeland, O.B. he sterman and M.B tesar., "Seeding practices for Michigan crops", International Journal for department of crop

and soil science, Michigan state university, PP-8/5/1914.

[7] S. Shekar, S.Cbandra and D.K. Roy, "Performance evaluation of different weeding tools", Indian Journal of weed science 42(1&2), PP-95-97, 2010.

[8] Sharma VK, Garg IK, Singh S and Sodhi S., "Performance evaluation of weeding equipment on wheat crop". Journal of Agricultural Engineering, 122-126, PP-1987.

[9] Kurstjens K.,"Study of weed management in different tillage system", Agricultural Mechanization in Asia, Africa and Latin America 39 (2): 24-26. PP-2006.

[10] Garg IK and Sharma VK. "Simple wheel hand hoe for interculturing in wheat crop Intelligence", 324-325. PP-I998.

[11] Sowing depth for chickpea, faha hean, lentil and field pea, Department of Agriculture and Food farm note no. 45/97.

[12] Sowing depth for chickpea, faba bean, lentil and field pea, Department of Agriculture and Food fann note no. 45/97, source: www.grdc.com.auldirector/eventslfactsheets.

[13] HSE Research Report 228, "Review of the risks associated with pushing and pulling heavy loads" Bristol university of west of England, Published• Jan 2006.

[14] Mark Hanna, Ag Decision Maker, file A3-24, "Estimating the field efficiency of farm machines", lOW A state university, Published-April 2002.

[15] P. Bala Hussain Reddy, S.Sreenivasulu and C.Manohar RASS - Acharya Ranga Krishi Vigyan Kendra, Tirupati, AP." Direct seeding with Drum seeder", published- 2008.

[16] Mohammad Reza Alizadeh, "Field perfonnance evaluation of mechanical weeders in fields" International Journal for Rice research institute of Iran(RRII), pp- Sept 28, 2011.

[17] Singh G, Sahay KM, Research, Development and technology dissemination. A silver Jubilee Publication, ClAE, Bhopal, India, PP- 2011.

[18] Remesan R, Roopesh MS, Remya N, Preman PS, Wet land weeding- A comprehensive comparative study from south India. The CIGR E- journal. Manuscript, PP-2007.

[19] Parida BC. "Development and evaluation of star-cum conoweeder for rice. Agric. Mechanization in Asia", Afr. Latin Am., 33(3): 21-22. PP- 2002.

[20] Biswas HS., Rajput DS., Devani RS. Animal-drawn weeders for weed control in India. Pub!. ATNESA, Wagenigen The Netherlands. Isbn: 92-9801-136-6.

[21] Tanner D W. Further work on the relationship between rake angle and the perfolDlance of simple cultivation implements. Journal of Agricultural Engineering Research 5(3):307-315. PP- 1960.

[22] Spoor G. Design of soil engaging implements. Parts I and II. Farm Machinery Design Engineering 3:22-25, 28. PP-I969.