DESIGN AND DEVELOPMENT OF SEMI AUTOMATED MULTIPURPOSE AGRICULTURE WHEEL HOE

PROJECT REFERENCE NO: 38S0026

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Introduction / background: A Wheel hoe is a mechanical device used by farmers for ploughing, weeding and cultivating. It was invented by a horse farm tools manufacturer Planet.Jr in the year 1890, Up to 1920 they used wheel hoe using animals like horses, ox, etc. In 1920 Allen and company invented manual driven wheel hoes. They started with single wheel hoe and double wheel hoe, later wheel hoe was modified for various agricultural operations using different tools. The aim of our project is to design and development of semi automated multipurpose agricultural wheel hoe to use of various agricultural operations in single equipment. In India agriculture is practised mostly when compared to other countries in the World. Everyone knows that the farmers in India still follow the conventional methods such as hand weeding, ploughing and cultivating using animals and some farmers also uses recent technology and modern equipments. The main disadvantages of this modern equipment are high cost and also facing the problem in usage of these equipments. Very few Indian farmers have Tractors but all the farmers cannot afford tractor. There is an alternative for tractor that is power tillers which is also expensive. There exists another alternative called wheel hoe. It is manual driven equipment used for agricultural operations. The main objective of this project is to design and development of semi automated multipurpose agricultural wheel hoe to use of various agricultural operations in single equipment.
Objectives: The main objective of our project is to design and development of semi automated multipurpose agricultural wheel hoe to use of weeding, ploughing and cultivating in single equipment. Our aim is to reduce the man power required for the operation of the wheel hoe. The only way is to automate it but we cannot fully automate it due to few constraints such as it will require electricity which will not be mostly available in villages, we will be requiring Microprocessor and sensors which will again increase the cost and might require skill to use it. We thought of solution being that instead of automating it fully we planned to semi automate it using engine, motors and power transmission equipments. This might help us reaching our goal by reducing the man power as well as cost. In this work we are planning to design, fabricate and testing of semi automated multipurpose agricultural wheel hoe to use of various agricultural operations.

Methodology:
The methodology of the project work consists of following stages

1. Literature survey
2. Design of wheel hoe
3. Fabrication
4. Result and discussion
5. Testing
6. Conclusion

➢ Designing of the Equipment: The first stage of our project is to plan and prepare the design of the equipment as per approximate suitable dimensions (Reference from the manual wheel hoe).
Component Details:

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COMPONENTS</th>
<th>MATERIAL USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Base Frame (chassis)</td>
<td>Galvanized iron</td>
</tr>
<tr>
<td>02</td>
<td>Handle</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>03</td>
<td>Clamps, Mesh and Covering frame</td>
<td>Mild Steel</td>
</tr>
<tr>
<td>04</td>
<td>Pneumatic Wheels</td>
<td>----</td>
</tr>
<tr>
<td>05</td>
<td>Two stroke Petrol Engine</td>
<td>----</td>
</tr>
<tr>
<td>06</td>
<td>Covering Plates</td>
<td>ACP</td>
</tr>
<tr>
<td>07</td>
<td>Oil and Petrol tank</td>
<td>----</td>
</tr>
<tr>
<td>08</td>
<td>Brake and Acceleration</td>
<td>----</td>
</tr>
<tr>
<td>09</td>
<td>Chain and Sprockets</td>
<td>Mild Steel</td>
</tr>
<tr>
<td>10</td>
<td>Self Start Motor kicked</td>
<td>----</td>
</tr>
<tr>
<td>11</td>
<td>Locking Mechanism</td>
<td>----</td>
</tr>
<tr>
<td>12</td>
<td>Bulb</td>
<td>----</td>
</tr>
</tbody>
</table>

Table 1: Components Details

Fabrication of the working model: Once design is over we are planning to prepare working model of the equipment.

- **Turning**: It is a basically Metal Removal process where the shaft was reduced to suitable diameter.
- **Welding**: Different components were joined by metal arc welding process.
- **Assembly**: Once all the above components were ready with the help of welding technology and using fasteneners components were assembled to final model.
Results: Once testing is over results are compared with manual wheel hoe and this helps to give conclusion of our project work.

<table>
<thead>
<tr>
<th>Equipments</th>
<th>Fuel Consumed (Per Acre)</th>
<th>Cost Per Acre (Rs)</th>
<th>Time Taken In (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi Automated Wheel Hoe</td>
<td>2 liter</td>
<td>250</td>
<td>02</td>
</tr>
<tr>
<td>Manual Wheel Hoe (Four Wheel )</td>
<td>----</td>
<td>200</td>
<td>08</td>
</tr>
<tr>
<td>Power Tillers</td>
<td>2 liter</td>
<td>350</td>
<td>01</td>
</tr>
<tr>
<td>Tractors</td>
<td>2 liter</td>
<td>450</td>
<td>1/2</td>
</tr>
</tbody>
</table>

Table 2: Cost and Time Estimation per Acre

Conclusions:-

- Wheel hoe is designed and made semi-automated operative with the use of 2 stroke petrol engines to assist human to perform various agricultural operations like cultivating, ploughing, weeding and also other operations by attaching and detaching different tools for different agricultural operations.
- Semi-automated wheel hoe was tested to perform operations like cultivating and ploughing by attaching respective tools and the results were found appreciable.
Four pneumatic wheels used to support the set-up and tools were found best suited to grip over ground. We noticed that Engine power and efficiency were almost Upto the desired level of performance.

We were tested the model for cultivating operation and noticed that the semi automated wheel hoe gives the better performance compare to manual and power tiller.

**Scope for future work:-**

- Semi-automated wheel hoe can be made into fully automated with the use of sensors which can detect obstacles, crops and weeds.
- It can also be made to operate under remote control. Few more operations like grass cutting with the addition of rotating cutting blades, pesticide sprayers with the attachment of sprayer, seed sowing with the respective attachments to the equipment, can also be performed.
- The size of the model can be suitably reduced to the optimum size which can be used for the weeding in between the crops like ground nut, Jower, sun flower and other vegetable cultivation.
- Advancement in wheel hoe which can be made to perform various operations to multi-rows at the same time in order to save time.

**REFERENCE:-**

1. M Pandey Indian Agriculture – An Introduction Fourth Session of the Technical Committee of APCAEM 10-12 February 2009, Chiang Rai, Thailand


