DESIGN OF A LOW COST MULTIPURPOSE AGRICULTURE

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Abstract — Agro-Technology is the application of the innovative technology and applying it in to the field of agriculture sector which improves the efficiency of the crop produced and also mechanical machine is needed to help the farmer in the agriculture field which reduces the cost and working time spent on one crop. Hence in this paper designing a better mechanical machine which is available to the farmers at a cheaper rate and also which can sow and seed the crop at the same time. And also the machine design focused specifically for rice, wheat crops etc. 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 the past. Precision farming has shown benefits of this 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.

Keywords— mechanical machine, agriculture, crop, cheaper rate, efficiency

I. INTRODUCTION

An innovative technology designed to render agricultural production more efficient and profitable. These devices can make the work easy but at the same time they are
expensive. Now-a-days a middle class farmer was not in a stage to buy this equipment and also it takes time to learn it’s working. Agricultural mechanization refers to interjection of improved tools, implements and machines between farm workers and materials handled by them. Independent India ushered in a process of agricultural mechanization and revival of rural agro processing which got acceleration during post-Green Revolution period. Seed and seed-cum fertilizer drills, planters, mechanical rice transplanters, vertical conveyor reapers, and combines soon followed. In the recent past, Zero-till Drill and Raise Bed Planters have found good acceptance from the farmers.

II. LITERATURE REVIEW

ALISON MCLAUGHLINA, PIERRE MINEAU [1] Agricultural activities such as tillage, drainage, intercropping, rotation, grazing and extensive usage of pesticides and fertilizers have significant implications for wild species of flora and fauna. Species capable of adapting to the agricultural landscape may be limited directly by the disturbance regimes of grazing, planting and harvesting, and indirectly by the abundance of plant and insect foods available. Some management techniques, such as drainage, create such fundamental habitat changes that there are significant shifts in species composition. This paper considers the relative merits of conventional tillage versus reduced, or no-till farming, and reviews the benefits of rest-rotation grazing, crop rotation and intercropping in terms of maintaining wild species populations.

CHUANQIONG SUN’, et.al., [2] The methods from the GB / T 11355 and GB / T 13575 cannot calculate precisely the driving capability of the V-belt which had requirement of reliability. A new formula which can figure out the life of the V-belt with different reliability is presented, and a calculating example by the new method has been provided.

LAWRENCE BUSCH, DIANA STUART [3] The agricultural sciences include the plant, animal, and food sciences; soil science; agricultural engineering and entomology; as well as related fields such as agricultural economics, rural sociology, nutrition, forestry, fisheries, and home economics. Historians, economists, sociologists, and philosophers have all studied agricultural sciences and technology, although there are few links among these four approaches. Current studies include those of biotechnologies, nanotechnologies, relations between science and colonialism, returns to agricultural research, and the relations between public and private research in agriculture.

PETER R.N. CHILDS [5] Belt and chain drives are used to transmit power from one rotational drive to another. A belt is a flexible power transmission element that runs tightly on
a set of pulleys. A chain drive consists of a series of pin-connected links that run on a set of sprockets. This chapter introduces various types of belt and chain drives and presents selection procedures for wedge, synchronous, and flat belts and also for roller chains.

RICKY SMITH, R. KEITH MOBLEY [6] Chain drives are an important part of a conveyor system. They are used to transmit needed power from the drive unit to a portion of the conveyor system. From the above study, the various types of chains that are used to transmit power in a conveyor system and the advantages and disadvantages of using chain drives. It also explains the correct installation procedure for chain drives, how to maintain chain drives, and how to calculate speeds and ratios that will enable one to make corrections or adjustments to conveyor speeds. It shows how to determine chain length and sprocket sizes when making speed adjustments. Chain drives are used to transmit power between a drive unit and a driven unit. Chain drives can consist of one or multiple strand chains, depending on the load that the unit must transmit. The chains need to be matched with the sprocket type, and they must be tight enough to prevent slippage.

III. MAIN COMPONENTS

Engineers generally talk about “simple machines” in six different categories: inclined planes, levers, screws, wedges, wheel and axels, and pulleys. All are made of basic, everyday components and all make humans’ work simpler in one way or another. Pulleys are usually most concerned with lifting and moving large objects. In its most basic form, this tool consists of little more than a wheel with a groove. A rope, belt, or cable runs inside the groove. That mechanism can be used alone or connected with others in a pulley system. The greater the number of pulleys in the system, the less force it will take to lift the object. There are three basic types of system: (1) fixed, with a fixed axle; (2) movable, with a free axle; and (3) compound, with a combination of fixed and movable axles Movable and compound axles, by multiplying the force, tend to be more efficient than fixed systems. Wheel-and-rope tools can also be used in combination with other tools for more specific purposes. The so-called “belt and pulley system” is one example. These tend to be “closed” systems in which several grooved wheels are connected by one circular, connected belt, and are designed for the transmission and amplification of energy rather than straight lifting power. The major components of the multipurpose of agricultural machinery equipment are, (i) Pulley to make lifting heavy objects easier and to more efficiently channel energy. (ii) Bearing for constrains relative motion and reduces friction between moving parts to only the desired motion. (iii)
Chain drives to provide a positive form of power transmission. The links of the chain mesh with the teeth of the sprockets and this action maintains a positive speed ratio between the driver and driven sprockets (iv) Sprocket to engage with something that will be pulled over the wheel as the wheel rotates. The sprocket looks like a gear but differs in three important ways, Sprockets have many engaging teeth; gears usually have only one or two. The teeth of a gear touch and slip against each other; there is basically no slippage in a sprocket and The shape of the teeth is different in gears and sprockets (V) Bevel gear to translate one direction of force into another with the power of two axles meeting. The axles usually meet at an angle of 90 degrees, although they can work at other angles. (vi) Supporting frame (vii) Single phase induction motor to drive the roller shaft which fixed on the end of the frame structure. The free end of the shaft in the motor a large pulley is found around which the belt runs. (viii) Belt drive used for transmits the power from the motor shaft to the brush shaft. The greater the shaft center distance, the more practical the use of chain and belt, rather than gears.

IV. AGRICULTURE & EQUIPMENTS

Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. For the growth of Indian economy, mechanization is necessary.

Agriculture can be divided

a) According to its dependence on water:
   i) Dry Land Farming
   ii) Irrigation Farming

b) According to the scale of production and its relation to the market
   i) Subsistence
   ii) Industrial Agriculture
   iii) Intensive Agriculture
   iv) Extensive Agriculture

c) According to the method and objectives
   i) Traditional Agriculture
   ii) Industrial Agriculture
   iii) Organic Farming And Organic Farming

Farm equipment is a group of devices designed to open furrows in the ground, shredding, spraying and fertilizing the soil.
a) PLOUGH

Agricultural equipment is designed to open furrows in the earth consists of a blade, fence, plough, bead, bed, wheel and handlebar, which serve to cut and level the land, hold parts of the plough, set shot and to serve as handle. The ploughing machine, also known as plough or plow, is a tool used in farming for initial cultivation of soil in preparation for sowing seed or planting. The ploughing machine also aerates the soil, and allows it to hold moisture better. In modern use, a ploughed field is typically left to dry out, and is then harrowed before planting.

![Fig. 1 Operation of Plough](image)

b) SEED CONTAINER

This setup consists of seed container with the door arrangement which is placed over the wheel shaft. The hollow cylindrical shaped container consists of two sides enclosed by mild steel plates. The material of the seed container is made of mild steel. The middle of the container is opened to pour the seeds in it. It consists of a Door made by thin sheet metal, Seed exit holes with four holes which have enough and equal diameters to exit the seeds and Plates with internal threaded.

c) FERTILIZER CONTAINER

Fertilizer container is made of mild steel. Bottom of the hollow rectangular shaped container is enclosed with plate and the top of the container is opened to pour the fertilizer in it. It is mounted in the frame. Two valves are mounted on the side of the fertilizer container. It is used to exit the fertilizer. The valve can be adjusted such that to exit the required fertilizer.
d) SEED SOWING

Fig. 2 Process of Seed Sowing

There are three different types of seed sowing, the first type is broadcasting in which seeds are scattered randomly with the help of hand on the soil. The second type is drill sowing and dribbling in which small holes is put it in the ground for seeds and then covered with the soil it has the added advantages of time and labor power saving and also prevents the damage of seeds by birds. The next type drilling or line sowing in which the dropping of seeds into the soil with the help of implement such as mogha, seed drill, seed-cum-ferti driller or mechanical seed drill and then the seeds are covered by wooden plank or harrow to have contact between seed & soil. Crops like Jowar, wheat Bajara, etc. are sown by this method. And the last type is Transplanting in which the raising of seedlings on nursery beds and transplanting of seedlings in the laid out field. For this, seedlings are allowed to grow on nursery beds for about 3-5 weeks. This method is followed in crops like paddy, fruit, vegetable, crops, tobacco, etc.

e) ROTAVATOR

The rotary tiller performs farming operations such as ploughing, pulverizing and levelling the soil simultaneously, thus saving time and fuel. It can function on both dry and wet land. It mixes residual matter into the soil through uprooting and chopping and enhances its fertility. It is also very useful for interculture,
V. DESIGN OF THE MACHINE

The first stage of calculation is for motor with motor pulley diameter 20mm, shaft pulley diameter 30mm and motor speed 440 rpm. The second stage of calculation is for the belt with shaft pulley diameter 20mm and pulley diameter 250mm. The next Stage is for the each sprocket with 14 numbers of teeth. From the Calculation 960 rpm is obtained as the belt output speed, Shaft pulley speed of 76.8rpm and finally chain drive speed is 76.8rpm.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the parts</th>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wheel</td>
<td>Rubber</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Plough</td>
<td>Mild Steel</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Sprocket</td>
<td>Mild Steel</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Chain</td>
<td>Mild Steel</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Shaft</td>
<td>Mild Steel</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Rotavator</td>
<td>Mild Steel</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Bevel gear</td>
<td>Mild Steel</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Bolt &amp; Nut</td>
<td>Mild Steel</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>Frame</td>
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</tr>
<tr>
<td>10</td>
<td>Bearing</td>
<td>Type 6202</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Pulley</td>
<td>Mild Steel</td>
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<tr>
<td>12</td>
<td>Induction motor</td>
<td>Single phase</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Frame</td>
<td>Mild Steel</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Hopper</td>
<td>Mild Steel</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Seed sowing</td>
<td>Mild Steel</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1. List of materials
An assembly line is a manufacturing process (most of the time called a progressive assembly) in which parts (usually interchangeable parts) are added as the semi-finished assembly moves from work station to work station where the parts are added in sequence until the final assembly is produced. By mechanically moving the parts to the assembly work and moving the semi-finished assembly from work station to work station, a finished product can be assembled much faster and with much less labor than by having workers carry parts to a stationary piece for assembly.

![Fig. 4 Assembly view of the model](image)

The main purpose of mechanization in agriculture is to improve the overall productivity and production. Planting is conventionally done manually which involves both animate (humans and draught animals), this result in higher cost of cultivation and delay in planting. The main purpose of this paper is to compare between conventional sowing method and new proposed machine which can perform number of simultaneous operation. The required row to row spacing, seed rate, seed to seed spacing and fertilizers placement varies from crop to crop can be achieved by the proposed machine. This machine reduces the sowing time, human efforts and labour cost.
The basic function of sowing operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance between the seeds and provide proper compaction over the seed. A sowing machine is a device that plants or sows the crops, it digs a furrow places the seed or seeds into the furrow and covers it. Seed sowing machine ensures uniformity in seed broadcast.

![Multipurpose Agricultural Machine](image)

**Fig. 5 Multipurpose Agricultural Machine**

The multipurpose machine having the advantages like, simple and safety operation, more suitable for small farmers, less maintenance, Skilled operators are not required, Cost of the machine is very less and with the limitations of, manual type mechanism depending upon the seeds, Suits only for small farmers, proper provisions are needed to couple the machine with the tractor.

**VI. CONCLUSIONS**

A mechanical machine for the farmers at a cheaper rate to sow, seed and cut the crop at the same time has been designed to reduce the human efforts in the agricultural field with the basic agricultural operations taken in to consideration. The model is fabricated with the necessary constrains and it has been tested on the field and the results prove to be effective. By applying more techniques, the vehicle can be modified and developed according to the respective application.
REFERENCES


