Fabrication of Paddy Transplanter Machine

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Abstract. Wheat and Paddy are the new focuses in farming where still, relatively few scientists and makers take an interest. This field faces a few issues, for example, how to boost the benefit, how to build efficiency and how to diminish the expense. In India, two sorts of horticultural gear are utilized, manual strategy (ordinary technique) and motorized sort. Automation includes the utilization of a gadget between the work and power source. Transplantation is the on the extensive labor processes in agriculture, where in cultivation field the workers need to work in stooping position which creates the physical ailments to labors. In this work, to eliminate the difficulties in rice cultivation design of semi-automatic rice transplanting machine by cost effective method was discussed. This machine helps the farmer to improve the productivity and efficiency. Machine was designed and fabricated by using the available materials. Compare to the commercial machines the project has more economic. Investigation of the machine performance indicate that it significantly reduces the effort of labors and translation time.

Keywords: transplanting machine, cultivation, agricultural, farmers, plantation

1. Introduction

Rice cultivation is one of the commercial food crops and a staple diet for around half the world’s population. India is among the top producers of rice and contributes about 20% of world production. Agriculture is the backbone of India’s economy and over 58% of the rural sector still depends on agriculture as their major source of livelihood [1]. Annual yield worldwide is approximately 535 million tons. However, a recent survey has shown a significant decline in the production of paddy in rural areas because of the cost of cultivation and labour problems. To compound the problem, most of the farmers in rural areas still follow traditional methods of planting and harvesting which leads to several postural issues for the farm-hands. It takes 2 weeks for 40 people to plant 35 acres of land with a work-hour of 7.5 hr/day. To compound to the long hours, employees work in a slouching position in the fields [2].
The repeated strain from this process leads to physical ailments like back pain, neck pain, musculoskeletal disorder (MSD) etc. Motivated to address this durgery, we have designed a low cost machine with a planting mechanism to make an affordable prototype for common farmers that helps reduce the labour effort, and increases productivity by adhering to the Legowo row rice planting system.

2. Literature Survey

Pradhanand S etal, investigate the conventional transplantation by involving 16 labours in varies age group. By considering varies parameter they have analysed two row, three row and four row transplanter methods. The investigation results hows that two row rice plantation is the excellent method for rice cultivation.

G.Singh et al. conducted experimentation on manual rice transplantation at the International Rice Research Institute farm. The results states that at this field the transplanter complete the process with capacity of 3.4 ha/h in different water depth. Rajvir Yadav et al investigate the performance of manual rice transplanter and found the pulling force required for the transplanter. Heightnt at which the force applied is thr important parameter which affect the output of the process.

Sharma and Singh developed a mat type nursery-raising device for rice planter. They reported that 72.02 and 33.33% saves the time and labour respectively, over the manual method of raising type nursery. The cost of raising mat type nursery for 1 ha was Rs. 299.50 with the developed device where as it was Rs. 1608.75 with manual method. Sivaswami and Anie John found that nearly 85% of labour cost was reduced by the introduction of paddy transplanters compared to manual transplanting.

3. Preparation Process

3.1 Land preparation process.

The process of rice cultivation includes several steps beginning with land preparation in which the land is prepared by tilling with a tractor in order to make it soft. Then the field is filled with water and again using a tractor with a cage well, the land is ploughed. A leveller is used to level the ground.
3.2 Seedling preparation process:
In seed preparation the seeds are scattered in the nursery. After the seedlings mature they are transplanted. During transplantation, seedlings from the nursery are taken after 24 days and planted again with proper spacing in between them for better yield. Organic insecticides are also sprayed to prevent insects. After 140 days of growth, the crops are ready to get harvested. The harvesting process could be manual. Sometimes the farmers also use machines to reduce the effort and time involved in the process.

3.3 Traditional / hand transplanting:
Hand transplanting is mostly practiced in India. For manual transplanting a person has to stand in puddled field and bend for long time for putting rice seedlings into soil. This process is highly labor intensive, tedious and tiresome. For manual transplanting (nursery raising, uprooting of the seedling and transplanting) nearly 250-300 man-hours are required for 1 hectare. The transplanting operation involves the uprooting of 20 to 25 days old seedlings and transplanting them (2-3 seedlings per hill) in well puddled and leveled field. For manual transplanting the workers change their posture very frequently. This may cause suffering from musculoskeletal disorder.

3.4 Mechanized method:
Looking towards the labor shortage in the farm operations, government promotes mechanization in all the possible way to make the farming profitable. The farmers have come forward to adopt transplanting with the help of self-propelled rice transplanter. Due to small land holding and weak economic position, farmers are not in a position to purchase the machine individually, but on hiring basis the technology should be adopted.

4. Transplantation Methods and Types
4.1 Legowo method:
Legowo system is a way of planting rice, if there are several lines and then interspersed with 1 blank line. But at the very edge of the row, 2x seeds are planted more than the middle row. For this way of planting, usually in the agricultural world it is called legowo (2: 1), (3: 1), (4: 1), (5: 1), (6: 1) and so on.

Figure 3. Legowo method
4.2 System of Rice Intensification (SRI):
System of Rice Intensification is not a secure technological method. Different set of methodologies are used to increase productivity by changing the seeds, nutrients, water, land, and human labour.

5. Design Process
Paddy seedling, planting unit, power transmission and attachments are the vital mechanisms of Rice Transplanting machines.
Planting Unit:
In mechanism design the following parameters are plays the vital role.

Depth of planting -. Planting depth is the important parameter in root growth. In this machine the depth was set 50 millimeter below the ground level.
Plant catching mechanism - Four-bar linkage mechanism adapted to obtain the required motion. While designing the mechanism there are several parameters were considered (location of catching, distance, No. of plants, angle of the tray).

Moving pathway- The required pathway was obtained by four bar mechanism

Designing of Tray: Speed of tray movement, width and length are the varies factors considered in designing of tray mechanism. To make constant feeding of the seed mat to the planting arm it should come down to the end of the try by gravity.

6. Fabrication Work

There are different types of rice transplanting machine that are fabricated based on the sand. Here we have a rice transplanting machine that can be affordable by all farmers. We have designed and fabricated a special type of wheel that could be able to move in wet land. The wheels are attached to the shaft which makes the wheel to rotate in same direction. The shaft is attached to the base plate through the shaft support plate.

The driver sprocket is fixed at the center of the shaft. The tray is fabricated in such a way that, in which the four bar mechanism pick and place the rice in the wet mud. The tray is attached to plate through the tray support. The tray support is welded to the base plate. The tray is kept in 60-degree angle.

We have designed a special planting arm and the planting arm are connected by the shaft. The driven sprocket is fixed at the center of the sprocket. The chain is used to connect both the sprocket. When the wheel rotates the power transferred from driver sprocket to driven sprocket. The driven sprocket makes the planting to pick the rice and place it in wet mud.
7. Conclusion
In paddy field to improve the effectiveness and efficiency of rice cultivation there is huge demand for automation. Cost and complex design of the mechanism are the major drawback of existing transplanter. It was difficult to do the service and other maintenance in the conventional shop. It leads to develop the rice transplanter for the farmers who are affected with health related issues. Mechanized rice transplanter helpful to the farmer possess land of small size which reduce the involvement of labour in transplantation.

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