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Design and Development of Rice Transplanting Machine

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Abstract - *In old day's rice transplantation process is generally done manually. All the processes from the sowing rice seeds to rice transplanting from one place to another to the cultivation of rice, to the harvesting of rice and lastly to the collection of rice was done manually. These are all done with the help of labour which increases the cost of production which is not economical for the small scale farmer(for 1 hectare).Rice is one of the Staple food crop of our country. Rice depends on the availability of moisture, climatic condition, age of the variety, availability of inputs & human labour. Mechanization in agricultural sector is advancing in developing countries like India. Rice is a labour-intensive crop and requires about 10-12 labour per acre for transplanting. Timely availability of labour and water for various requirement of rice is becoming a problem. Hence to overcome these issues there is a need of machine in the field of rice cultivation. By using rice transplanting machine we can overcome to some extent. There is also need for designing and developing an economical and user friendly rice Transplanting machine for small scale farmers in order to increase the production as well as the quality of rice. The purpose of paper is to design the rice transplanting machine which will help the small scale farmer(for 1hectare) to reduce their production cost so that they can get maximum profit on the production.*

Key Words: Rice transplanter, Small Scale Farmers, Cost minimization

1. INTRODUCTION

India is an agrarian country, about 70-75% of Indians are dependent on agriculture. India is one of the world's largest producers of rice, accounting for 20-25% of all world rice production. Rice being the important food crop covers about one fourth of the total cropped area and cater food to half of the Indian population. In India, average rice production per hectare is 1.6 tonne. Rice is the main food of more than half of the world. It constitutes 20% of the total daily nutrition need of an average person. More than 3.5 billion people depend on rice for their daily demands.

Rice is usually grown by planting rice paddy in the fields manually with hands. With this method of planting rice paddy, labour cost increases and it is a very time consuming process. These problems can be solved with the help of rice planting machine. This machine reduces labour cost and time to plant rice paddy. This machine has a simple mechanism and it is eco-friendly and easy to operate. This machine requires only two persons for its operation. This machine can bring increase in rice production. So, the main aim of this is to design and develop a rice planting machine which will help the small scale farmers to make the rice planting process mechanical, resulting in reduction of labour cost, time. It increases profit and does not required skilled labour.

A Rice Transplanter is an agricultural machine used for transplanting saplings to the field .This is very important as it reduces the time taken to transplant saplings (when compared to manual transplanting), thus allowing more time for harvesting. Hence, paddy transplanter is one type of transplanter which plants paddy saplings to the field. Farmers are aware of the advantages associated with transplanting of paddy over the scattering. But they are unable to practice it for high shortage of labour. Still the transplanting machines available for the country are imported. The engine driven transplanter are available in market, the limitation of Engine driven transplanter are high in cost and required skilled operator for operating. Existing manually operated transplanters are quite unfriendly . The main reason for the poor acceptance was the low capacity of the machine.

2. LITERATURE REVIEW

For initializing this project, we searched different types of information regarding of transplanting field with literature review of different research paper . The unavailability of the rice transplanter in east Maharashtra zone gave the reason to find proper research in this zone and designing transplanter The unawareness of use of this transplanter in the farmers which leads to make the use of traditional farming.

[1]In this paper they used 4 row, 3 row and 2 row rice transplanter on the basis of their study of various parameters they concluded that the 3 row rice transplanter was the best among all transplanting methods. Therefore ,Due to higher costing for 3 row rice transplanter, we are manufacturing 2 row rice transplanter.
[2]From this paper we found that, the cost is cheap than motor and hand cranked mechanical rice transplanter. The four bar mechanism gives the each operating and maintenance with less parts which reduces the weight. Therefore we are using four bar mechanism for giving a simple and easy operation of rice transplanter machine.

[3]In this paper they studied ergonomic and working environment of worker from that they conclude that the height at which push-pull forces were applied was the most important variable in affecting the force output. They concluded that the foot placement, handle height and body postures all affected the push-pull strength. Further reported that the posture of workers while performing some tasks is another factor that can influence energy requirements. Transplanting in bending posture requires the highest energy than any other posture. The body posture during the push and pull force is important factor while transplanting, sowe provide the adjustable handle.

3. COMPONENT & IT'S WORKING

Ground wheel: Ground wheel which is in contact with ground. It is mounted on driver shaft it's motion gives quick return mechanism through the chain drive. On the periphery of this wheel blade is mounted to achieve proper grip in mud.

Sprocket: The main function of sprocket is to transmit torque through the chain. There are two sprocket one driver and other driven mounted on respective shaft.

Chain: Function of chain is to transmit torque from driver to driven shaft.

Tray : This is used to store the rice plant from where planting Mechanism pick the plant and sow in the ground. This tray has two vertical guide slots.

Planting Mechanism: The planting Mechanism is the main element which is responsible for the plantation of paddy. It has the specific shape which picks the paddy and plant in the mud. It oscillates at certain angel and it is called as fixed fork mechanism.

Pulling Arm: It is adjustable arm provided to pull whole Machine.

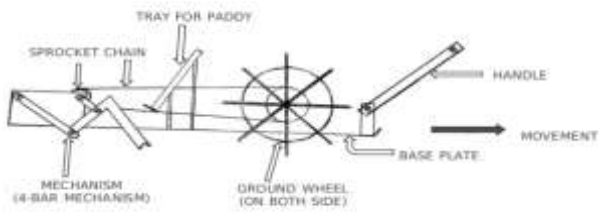

Fig -1: Design of Rice Transplanting Machine

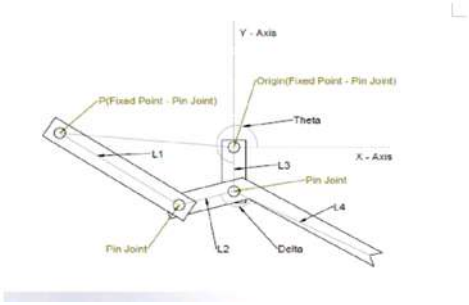

Fig -2: Planting Mechanism

Sr. No.	Links	Dimension
1	L1	150mm
2	L2	160mm
3	L3	50mm
4	L4	160mm
5	Delta	101

Table -1: Dimension of Mechanism

4. WORKING METHODOLOGY:

After 15-20 days when the paddy is ready for transplanting which we are doing with the help of rice transplanting machine. The paddy that grows in other place for 15-20 days are collected with the help of labour. Than paddy is placed on the rice transplanting machine. labour pulls the transplanter with a handle provided on the machine, the effort of labour will result in motion of wheel. Wheel is mounted on driver shaft with help of wheel hub. The driver and driven shaft is connected with the help of sprocket and chain drive. The rotation of driver shaft will rotate the sprocket on the shaft which gives the motion to the chain which directly moves sprocket on driven shaft which gives motion to the mechanism. In the rice transplanter, the planter or finger is moved in such a way that it passes through the slot in the tray containing paddy saplings. During this motion, the finger traces circular path and picks the saplings. During return, the finger executes elliptical path in order to avoid hitting the seedling tray. For this a four bar linkage mechanism is used to accomplish this event. As the labour pull machine the paddy is planted one by one in a specific consecutive distance.

5. VALIDATION

Plantation of rice requires number of labours to work in farm and it is economical for large scale farmer (i.e more than 2-3 hectare) and is easy to find labour, but for the small scale farmer it is quite difficult to find number of labour for

transplantation. Even if they find, it's not economical for small scale farmer. Time taken for plantation of paddy by labour is about 30 men per day per hectare which is reduced by rice transplanter machine by 3-4 hours. It is light in weight ,Compact in size and is easy to handle .This reduce man power by 50% and require less skilled operator. It is affordable for small scale farmer.
It is only used for rice transplanting and useful for only 2-3 acres .So one cannot use for large scale rice transplantation.

6. CONCLUSIONS

In this study it was concluded that high labour demand during the peak periods adversely affects the timeliness of operation, thereby reducing the crop yield. To offset these problems, mechanical transplanting is the solution. Hence, there is a need of mechanization in rice cultivation sector. In market rice transplanter are available, the only problem with the existing rice transplanter is that, these transplanter are very expensive and they possess very complex mechanism which could not be repaired or serviced easily at any ordinary workshop. Hence there is need for designing and developing a rice transplanter for the small scale farmers who are mostly affected by the unwanted situations or condition. Transplanter helps to acquire lesser cost of production with higher yield and production moreover the quality of produced rice is also good.

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