



DESIGN & FABRICATION OF PADDY PLANTING AND PLOUGHING MACHINE

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Abstract: In India farming is done by traditional ways besides that there has been large development of industrial and service sector as compared to that of agriculture sector. In the Agriculture sector there will be a lot of field work such as weeding, reaping, sowing, spraying, and planting etc., Apart from these operations plantings plays a vital role in the agriculture process by the farmers to reduce the labour cost, time consumptions space by using this paddy planting machine. Manual method of seed planting results in low seed placement, spacing efficiencies, and serious backpain for the farmers, which confines the size of field that can be planted. The cost of imported planters has gone beyond the purchasing power of most of our farmers. To get the best performance from paddy planter, the above limits are to be enhanced by proper design and selection of the components essential on the machine to suit the need of corps. The people who use this type of machine are farmers and they are economically poor. The equipment is easy to use and operate. This equipment makes use of both renewable energy and mechanisms.

Index Terms - Mechanism, Devices, Design, Modeling, Analysis.

I. 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. 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 farmhands. It takes 2 weeks for 40 people to plant 35 acres of land with a workhour of 7.5 hr /day. To compound to the long hours, employees work in a slouching position in the fields. Rice is a very famous food. It is the most consumed food in the world. Developing improved techniques for planting and harvesting rice would help rice farming in third world countries and within the region to improve their production of rice to keep and maintain the demand of the market. The repeated strain from this process leads to physical ailments like back pain, neck pain, musculoskeletal disorder (MSD) etc. Motivated to address this durdgerly, 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. Looking into the current situation in AIHasa farms, the rice planting process is generally manual which involves number of labours. It is not so efficient compared to the rice-transplanting machine. The machine requires less time and labours than manual transplanting. With this machine, the rice transplanting will become more efficient and more productive for a small scale of farms. Rice planting machine has a reciprocating motion and mechanism driven by the power from the axle.

II. LITERATURE SURVEY.

Pradhanand S et al, investigate the conventional transplantation by involving 16 labours in varies age group. By considering varies parameter they have analysed two rows, 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 the manual of the paddy 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. Height at which the force applied is thr important parameter which affect the output of the process. Vineet Sharma and Shashank Singh Rakesh Kumar developed a mat type of 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 whereas 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. During the 1990s, Brazil, Indonesia, Saudi Arabia, and Iraq were the major destinations in the rice market. In the last few years, however, Saudi Arabia production to rice becomes very moderate and only available on farming area like AlHasa. Hasawi rice is seeded and planted in eastern province farms but go into hard manual transplanting process. M. Kamaraj and Akshay kumar conducted that Rice farming and cultivation undergo many stages starting from land preparation, seeding, planting, transplanting and harvesting. Successful rice farming no longer depends on heavy rainfall season, but the most critical stage is when moving the rice seeding from the seeding area to the planting area. M Darmawan conducted an Analysis of Legowo Row Planting System and system Of Rice Intensification (Sri) Of Paddy Field in that make her own farming. Many technologies are available in the market to perform the rice planting process in easy and accurate manner. The cost of the machine is vary depending upon the functions and features available in the machine. Some machines can place the rice in one row while some can perform double or triple rows. Other rice-transplanting machines are manually operated while some are motor or engine driven. Girish and Srihari were observed the concept of rice planting stage is the same no matter what the medium or the mechanism are. All rice planting machine consider to be expensive for a light and moderate scale of rice farming. We as a team of the senior project, found that there are some challenges. The first challenge is that there was no initial design or previous work to start with considering proper selection of the material in order to reduce the cost of the machine. This issue makes the team to start from the beginning to have initial design of the machine. The objective to have a cost-effective machine starting with 3D printing components. However, due to the cost the option of 3D printing will not meet the objective of the design. The second challenge to find alternative material, which will allow us to reduce the cost of the machine during the manufacturing phase. For initializing this project, we searched different types of information regarding of transplanting field with literature review of different research paper. Our literature review is divided into different field of analysis like Ergo-Economical analysis of different paddy transplanting operation, performance of self-propelled rice transplanter and its effect on crop yield, theoretical development of rice transplanting machine. These studies were conducted which gives the parameters, specification, problems arising in already exists transplanter and development & design methodology of transplanter. Rice trans planter is a specialized machine used to transplant rice seedlings in the field. The unavailability of the rice transplanter in western 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 makes the handy use. The research and literature on the design analysis of hand cranked and self-propelled with the camfollower mechanism. M.v.Achuta and Chandra conduct an regarding to the Machine transplanting using rice trans planters requires considerably less time and labor than manual transplanting . It increases the approximate area that a person can plant from 700 to 10,000 m²/day. Transplanting of paddy seedlings can be categorized into three groups as follows: • By band (manual) • Manually operated machines (work by manpower) • Mechanically operated machines (work by engine power)

III. RESEARCH METHODOLOGY

Most farmers practice the nursery bed method. Nursery beds are made occupying about 1/20th of the total field area. The paddy seeds are sown in the bed. They are ready within 25 days of sowing in low land areas while in higher altitudes they take about 55 days to become ready for transplantation. There are four different practices of cultivation of rice, viz. transplantation method, drilling method, broadcast method and Japanese method.

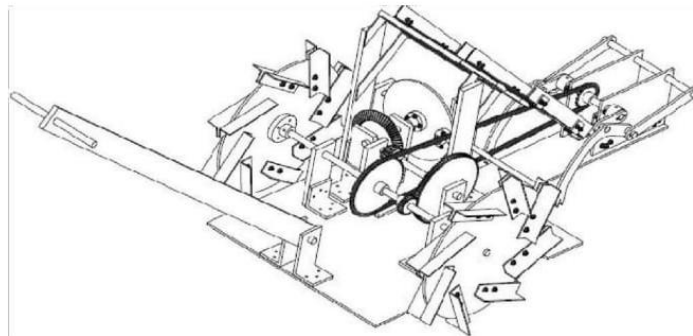


Fig (1) Planting machine

- Transplantation is the most used method wherein seeds are first sown in nursery and the seedlings are transplanted to the main field once they show 3-4 leaves. Although this is the best yielding method, it requires heavy labor.
- Drilling method is exclusive to India. In this method, one person ploughs a hole in the land and the other person sows the seed. Ox is the most used 'person' to plough the land.
- Broadcast method generally involves scattering of the seeds manually over a large area or in the entire field. Labor involved is very less and so is the precision. This method produces very less yield as compared to others.
- Japanese method has been adopted for the high yielding variety of rice and those that need a high number of fertilizers. Seeds are sown in nursery beds and then transplanted to the main field. It has shown tremendous success for the high yielding varieties. Another newly found technique is SRI method of rice cultivation. This is a high yielding method with less water but this method is

4.1 Land preparation for paddy cultivation: -

Rice is cultivated in different methods depending on the water availability and weather. In areas where the rainfall is abundant clubbed with abundant water supply, wet system of cultivation is followed. On the other hand, in areas where irrigation facilities are unavailable, and water is scarce, dry cultivation system is followed. Rice fields with sandy-to-sandy loam soil are ploughed in summer and again ploughed once or twice after letting in water to get the requisite puddle. Heavy soils of clayey nature are not generally opened in summer. These soils are usually ploughed a few days before transplanting. Optimum depth of puddling is found to be 10 cm in clay to clay-loam types of soil. Land preparation is important in that it helps in killing of weeds, improves soil aeration, destroys different stages of crop pest such as egg, larval, pupae or adults by burying them or exposing them to predators, encourages penetration of plant roots and water infiltration into the soil, makes subsequent operations possible and in some cases manure and other organic matter can be incorporated into the soil during this process. The first steps prior to planting is ensuring fields have a fine tilth achieved by primary, secondary tillage and minimum tillage operations. Primary cultivation is achieved through; Mechanical cultivation that break hardpan for preparation of a deep and large seedbed and disc ploughing suitable for rocky and hardy areas and in which the depth of ploughing is determined by the type of crop to be grown, the type of soil and implements available for such

Secondary cultivation helps break large clods to reasonable tilth for ease in planting, levels the fields in order to achieve a uniform depth at planting, kills weeds and as well help in mixing up of organic matter in the soil to improve soil aeration. Sometimes repeat secondary cultivation is done depending on the condition of the soil, size of planting material, slope of the land and the moisture content of the soil. The aim is to achieve a fine tilth.

4.2 Wet Cultivation System: -

The land is thoroughly ploughed and flooded with water up to 5cm in depth. In the case of clayey or loamy soil the depth must be 10 cm. Post puddling the land is levelled so as to ensure uniform water distribution. Seedlings are sown or transplanted after leveling. Rice fields with sandy-to-sandy loam soil are ploughed in summer and again ploughed once or twice after letting in water to get the requisite puddle. Heavy soils of clayey nature are not generally opened in summer. These soils are usually ploughed a few days before transplanting. Optimum depth of puddling is found to be 10 cm in clay to clay-loam types of soil.

4.3 Dry Cultivation System: -

In this rice cultivation process the soil must have a good tilth hence it must be ploughed thoroughly. In addition, farmyard manure must be distributed on the field uniformly at least 4 weeks before sowing. The seeds are then sown with 30 cm space between the plants.

- Mark plots of 2.5m breadth with channels 30cm wide all around the seedbeds.
- Length of the seed bed may vary from 8 to 10m according to soil and slope of the land.
- Collect the puddled soil from the channel and spread on the seedbeds or drag a heavy stone along the channel to lower it, so that the seed bed is at a higher level.
- Level the surface of the seedbed, so that the water drains

IV. Working

A rice transplanter is a specialized transplanter fitted to transplant rice seedlings onto paddy field. Mainly two types of rice transplanter i.e., riding type and walking type. Riding type is power driven and can usually transplant six lines in one pass. On the other hand, walking type is manually driven and can usually transplant four lines in one pass. But both of them little cost so many of them transplant by manually. As the process is manual the worker has to provide the initial motion. When the rice transplanter will move forward the ground wheels will get rotate. The ground wheels are used to maintain constant distance between the two successive plants. Then we have larger sprocket is provided on the same shaft with the ground wheels and hence at the same time sprocket will also rotate. The larger sprocket is in engagement with the smaller sprocket by using the chain drive. As the power will get transmitted to the smaller sprocket, it will rotate. The speed is increased from driver to drive shaft as we used 3:1 speed ratio. On the same shaft planting finger will be fixed through the four-bar linkage so that it will oscillate for certain angle. As the drive is provided by the worker it will not have high speed and hence through this sprocket arrangement, we have increased the planting finger speed. As the planting finger will oscillate, it will pick the rice plant from the tray and plant in mud. The planting finger is designed in such a way that rice plant should be easy to pick during the motion and it should pick during the downward motion only. It works on the basics of movements produced by the manually pulling. When we manually pulling the machine, it automatically rotates the wheel and correspondingly it touches the lever kinematic linked to planter stick. It continuously plants until we stop our pulling.

V. RESULTS AND DISCUSSION

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. The rice transplanter which we designed working is found to be satisfactory. The four-bar mechanism gives each operating and maintenance with less parts which reduces the weight.

After further improvement, this two-row paddy transplanter can be transplanted 0.3 to 0.5 hectare/day while manual hand operated gives 0.1 to 0.15 hectare/day by considering 8 hours per day of working.

By performing the trials of the rice trans planter, we have concluded that this machine is suitable for our Indian climate. It is affordable for small scale farmers as the cost of the machine is less as compared to other rice transplanted. Machine can be developed to transplant several rows simultaneously. The weight of the machine is less to other transplanting machines.

The expert consultation recognized that rice is the staple food of most people in Asia and he food security means rice security. Rice is closely linked with the social harmony and political stability of many countries. It is therefore recommended that the governments should take appropriate action to improve rice farmers' productivity and income while ensuring national food security.

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