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DESIGN AND FABRICATION OF RICE PLANTING MACHINE

[1]Sumaiyya Nadaf, [2]Dr.T.Praveen, [3]Syed Arshad
[1]Assistant Professor, [2]Professor, [3]Student, [1,2,3]Department of Mechanical Engineering , Siddhartha Institute of Engineering and Technology, Hyderabad, India

ABSTRACT
The ultimate aim of agriculture or farming in India is not only limited to growing of crops but is also associated with the economic growth of farmers and labours. Rice is one of the staple food crops of our country. Basically in India establishment of 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 80-90 labour days per acre. Timely availability of labour and water for various activities of rice is becoming a problem. Hence to overcome these issues there is a need of mechanization in the field of rice cultivation by using rice transplanter as major tool in this process. There is also need for designing and developing an economical and user friendly rice transplanter for small scale farmers in order to increase the production as well as the quality of rice.In this project manual rice planting machine along with their merits and demerits has been discussed by studying various aspects of transplantation related to rice and its field performance which are beneficial to the society and farmers. A rice transplanter is specialized equipment best fitted to transplant rice seedlings on the wet muddy paddy field. This project is focussed on developing a machine which addresses labour problems faced by small scale farmers. The newly developed rice planting machine, can harvest up to two rows of paddy at a time.
Key words: Rice planting machine, mechanization, Seed Sowing

I.INTRODUCTION
1.1 RICE CULTIVATION
India is one of the world's largest producers of rice, including white rice and brown rice, grown mostly in the eastern and southern parts of the country. The Production increased from 53.6 million tons in FY 1980 to 74.6 million tons in year 1990, a 39 percent increase over the decade. By year 1992, rice production had reached 181.9 kg per person, second in the world only to China with its 182 kg.Since 1950 the increase has been more than 350 percent. Most of this increase was the result of an increase in yields; the number of hectares did not increase during this period. Yields increased from 1,336 kilograms per hectare in FY 1980 to 1,751 kilograms per hectare in FY 1990. The per-hectare yield increased more than 262 percent between 1950 and 1992.
The country's rice production had declined to 89.14 million tonnes in 2009-10 crop years (July–June) from record 99.18 million tonnes in the previous year due to severe drought that affected almost half of the country. India could achieve a record rice production of 100 million tonnes in 2010-11 crop year on the back of better monsoon this year. The India's rice production reached to a record high of 104.32 million tonnes in 2011-2012 crop years (July–June).
Rice is one of the chief grains of India. Moreover, this country has the largest area under rice cultivation, as it is one of the principal food crops. It is in fact the dominant crop of the country. India is one of the leading producers of this crop. Rice is the basic food crop and being a tropical plant, it flourishes comfortably in hot and humid climate. Rice is mainly grown in rain fed areas that receive heavy annual rainfall. That is why it is fundamentally a kharif crop in India. It

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demands temperature of around 25 degree Celsius and above and rainfall of more than 100 cm. Rice is also grown through irrigation in those areas that receives comparatively less rainfall. Rice is the staple food of eastern and southern parts of India. In 2009-10, total rice production in India amounted to 89.13 million tonnes, which was much less than production of previous year, 99.18 million tonnes. Rice can be cultivated by different methods based on the type of region. But in India, the traditional methods are still in use for harvesting rice. The fields are initially ploughed and then fertiliser is applied which typically consists of cow dung and then the field is smoothed. The seeds are transplanted by hand and then through proper irrigation, the seeds are cultivated. Rice grows on a variety of soils like silts, loams and gravels. It can also tolerate alkaline as well as acid soils. However, clayey loam is well suited to the raising of this crop. Actually the clayey soil can be easily converted into mud in which rice seedlings can be transplanted easily. Proper care has to be taken as this crop thrives if the soil remains wet and is under water during its growing years. Rice fields should be level and should have low mud walls for retaining water. In the plain areas, excess rainwater is allowed to inundate the rice fields and flow slowly. Rice raised in the well watered lowland areas is known as lowland or wet rice. In the hilly areas, slopes are cut into terraces for the cultivation of rice. Thus, the rice grown in the hilly areas is known as dry or upland rice. The yield of upland rice per hectare is comparatively less than that of the wet rice.

1.2 RICE PLANTING MACHINE

India is known to be an agricultural country. About 70% of the population of India is dependent on farming directly or indirectly. The farmers are using the same methods and equipment since ages. The time is changing and things need to change as well in order to develop the methods and equipment. So, that productivity increases. Agriculture also plays a vital role in the Indian economy. Its contribution in the GDP is now reached one sixth of the total. The Government of India has also started taking steps in the form many initiatives in which the farmers are made aware about the technologies they can use in farming.

There are basically five steps that a farmer needs to do properly to get increased productivity. These five steps namely are: Ploughing, Seed Sowing, Irrigation Process, Harvesting and Threshing. As we know that the rice is one of the staple foods of the India. A large scale of farmers is involved in the cultivating and production of rice. Introducing the technology to the rice farming will result in many advantages such as: Better production , Good quality, Less labour required , Saves time and Low cost Today, India is facing a big problem of child labour along with the farming. The highlighted point is that child labour and farming are interrelated to a great extent. If the technology in farming increases, the requirement of labour will decrease. This will help the nation to get rid of two major problems. The highest number of labour required in rice planting is for transplanting i.e. seed sowing. Many new equipment are invented and modified in order to rescue the effort and get more result in this process. To plant the rice seedlings a rice transplanter is being developed and in many countries like china, japan, korea, etc it is already brought in use. But here in India the rice transplanter is not affordable to the farmers. The rice transplanter in foreign country is runned on diesel engine and the current situation of the Indian farmers is not well enough to buy the transplanters to use it. So, a manual rice transplanter is being developed in India so that the cost of transplanter decreases. In manual transplanting practice, 8-12 labourers are required to transplant one acre. However, if a self-propelled rice transplanter is used, three people can transplant up to four acres in a day.

1.3 TYPES OF RICE PLANTING METHODS

Rice crops can be either direct seeded or transplanted. In direct seeding, seeds are sown directly in the field. While in transplanting, seedlings are first raised in seedbeds before they are planted in the field. When choosing the suitable planting method, the locality, type of soil, rice ecosystem, and availability of inputs and labor, should be considered.

Choosing when to plant is crucial to establishing the crop in the field. Timely planting into a well prepared seedbed will help produce a fast growing, uniform crop that will have higher yields and better competition against weeds and other pests. The best time to plant depends on locality, variety, weather, water availability, and the best harvest time. Planting at the same time (or within a 2 week

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window) as the neighboring fields can help to minimize insect, disease, bird, and rat pressure on individual fields.

1.3.1 TRADITIONAL RICE PLANTING

Manual transplanting does not require costly machines and is most suited for labor-surplus areas and for small rice fields. Manual transplanting can be done in fields with less than optimal levelling and with varying water levels. Seedlings are raised in a wet, dry, or modified mat nursery. Proper nursery management will produce healthy and vigorous seedlings.

Transplanting ensures a uniform plant stand and gives the rice crop a head start over emerging weeds. Further, seedlings are established even if the field is not levelled adequately and has variable water levels. Transplanting may also allow crop intensification as the crop is in the main field for less time.

Fig 1.1: Planting Rice Seedlings in Traditional Way

1.3.2 MACHANIZED RICE PLANTING

Machine transplanting involves planting young rice seedlings into puddle soil by a machine. Machine transplanting requires considerably less time and labor than manual transplanting (1–2 ha/person/day versus 0.07 ha/person/day).

Fig 1.2: Mechanized Rice Planting

II.LITERATURE REVIEW

The forces acting on a fixed fork type transplanting finger during separation of rice seedlings, a laboratory model transplanter was developed. It was equipped with transducers to measure the forces and to measure the speed of rotation of the crank that give motion to the finger. The nursery seed rate was varied from 0.35 to 1.15 kg/m^2. Planting velocity varied from 0.29 to 0.55 m/s. [1]

Rice is one of the staple food crop of our country. Basically in India establishment of rice depends on the availability of moisture, climatic condition, age of the variety, availability of inputs & human labour. Amongst these dependencies availability of inputs & human labour play a huge role on deciding the method of establishment of rice. Shortage of labour and labour costing is one of the major issues of concern now days as it leads to failure of scheduled transplanting of rice. [2]

The transplanting method, seedlings are first raised in a seedbed in the nursery and uprooted for transplanting either manually or mechanically. The transplanters are classified on the basis of nursery used i.e. Machine using wash root seedling and machine using mat type seedlings. Mat type seedlings are raised on a polythene sheet with the help of frames. [3]

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Transplanting of paddy is very tedious job mostly done by female workers during kharif season and by 2020 there would be 50 % women against 42 % at present. Manual hand transplanting consumes a lot of energy and time and full of fatigue, but the poor socio-economic condition of the farmers does not allow them to adopt power operated transplanter. Transplanting operation by different research centers have been developed as 2 row, 3 row, 4 row rice transplanter. [4]

SRI practices have been developed in order to increase production and quality of rice. Based on SRI practices the rice seedlings are transplanted at the young ages, fifteen days old with just 2 leaves and carefully planting of just one seedling per hill and space the hill optimally widely in a square pattern of 25x25 cm for better usages of water, sunlight, minerals, space, nutrient, weeding and pest management within in the moist soil condition. [5]

Mechanized Transplanting of Rice in Non puddled and No-Till Conditions in the Rice-Wheat Cropping System in Haryana , India ” from this paper we understood that the common practice of establishing rice in the rice-wheat system in India is manual transplanting of seedlings in the puddled soil . Besides being costly, cumbersome, and time consuming, puddling results in degradation of soil and the formation of a hard pan, which impedes root growth of subsequent upland crops. In addition, decreased availability and increasing cost of labour have increased the cost of rice cultivation through conventional methods. Because of these concerns, there is a need for mechanized transplanting of rice which is less labourintensive and can ensure optimum plant population under non puddle and/or no-till conditions. [6]

III.DESIGN OF RICE PLANTING MACHINE

The design of the rice transplanting machine completed in CATIA V5 R19 software. By using these software’s we design several parts of this machine and finally assembled these parts.Draw the different parts by using different commands in CATIA software after design the every part to combine each and every part by using assembly commands with nuts and bolt. After completion of assembly project the views in sheet.

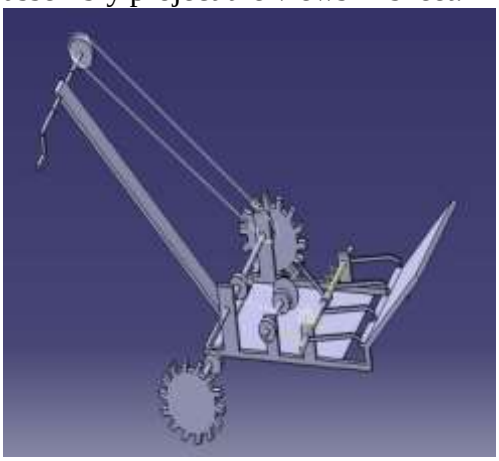

Fig 3.1: Design of rice planting type machine in CATIA

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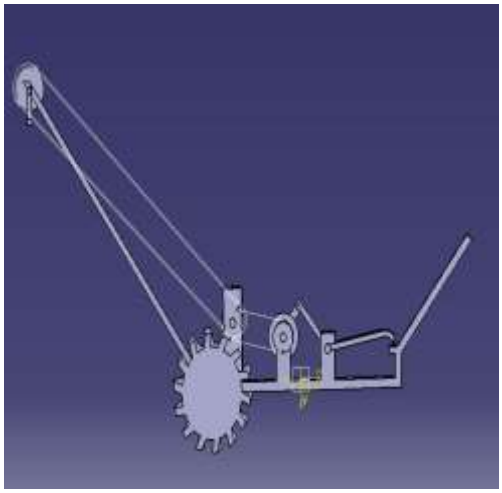

Fig 3.2 Side view of rice planting machine in CATIA

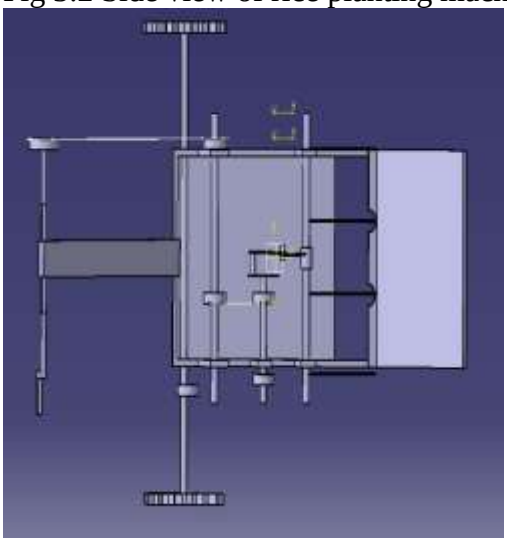

Fig 3.3: Top view of rice planting machine in CATIA

IV.FABRICATION OF RICE PLANTING MACHINE

The fabrication of Rice Transplanting Machine is fabricated by using different fabrication techniques i.e., cutting process, welding, grinding and drilling etc. Thistransplanted machine consists of several parts are as follows.

4.1 PARTS OF RICE PLANTER MACHINE

4.1.1 HANDLE

A handle is a part of, or attachment to, an object that can be moved or used by hand. The design of each type of handle involves substantial ergonomic issues, even where these are dealt with intuitively or by following tradition. Handles for tools are an important part of their function, enabling the user to exploit the tools to maximum effect.

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Fig 4.1: Handle

4.1.2 WHEELS

A wheel is a circular object that revolves on an axle and is fixed below a vehicle or other object to enable it to move easily over the ground. In this project we have usedtwo fixed wheels made of iron which are movable in $360^{0.}$

Specifications:

- ✓ Length of the wheels: 36 cm
- ✓ Radius of the wheels: 18 cm
- ✓ Wheel to Wheel distance: 94 cm

Fig 4.2: wheels

4.1.3 BEARINGS

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts.

Fig 4.3: Bearings

4.1.4 PEDAL

A pedal is a lever activated by ones hand, sometimes called as hand pedal.

Fig 4.4: Pedal

4.1.5 CHAIN

A bicycle chain is a roller chain that transfers power from the pedals to the drive-wheel of a bicycle, thus propelling it. Most bicycle chains are made from plain carbon or alloy steel, but some are nickel-plated to prevent rust, or simply for aesthetics.

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Fig 4.5: Chain

4.1.6 SPROCKETS

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs,that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Fig 4.6: Sprocket

4.1.7 TRAY

Tray is used to hold the rice seedlings which are used to plant in the soil. Tray consists of four spacing from that seedlings can plant into the soil in four rows with the help of pulling rods**.**

Specifications:

✓Length of the Tray: 65 cm

✓ Width of the Tray: 105 cm

✓ Thickness of the Tray:2mm

Fig 4.7: Tray

4.1.8 NUTS AND BOLTS

Bolts are used to assemble two unthreaded components along with a nut. A nut is a type of threaded fastener with a hole. Nuts are normally used alongside a bolt to tighten multiple parts together.

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Fig 4.8: Nuts and Bolts

4.1.9 PULLING RODS

The pulling rod is the main element which is responsible for the plantation of the nursery seed. It has the specific shape which picks the nursery seed and plant in mud. It oscillates at certain angle and it is called as fixed fork mechanism.

Specifications:

✓Length of the Pulling rods: 50 cm
✓Width of the Pulling rods: 3 cm
✓ Thickness of the Pulling rods: 1 mm
✓Each Pulling rod occupies: 23 mm

4.2 WORKING OF RICE TRANSPLANTING TYPE MACHINE

Rice planting type machine is a machine that plants rice seedlings into fields. When the rice seedlings are in the tray of rice planter and starts pulling the rice planter these seedlings are plants into the soil due to connecting mechanism of this rice planter.

Fig 3.10: Rice Transplanting Type Machine

5. ADVANTAGES

1. Efficient utilization of resources by saving labour & cost of overall production.
2. Timely transplanting of seedlings of optimal age.
3. Ensures uniform spacing and optimum plant density
4. Higher productivity compared to traditional methods.
5. Less incidence of disease in seedlings due to less root injury generated due to shock while transplanting.
6. Improving soil health through eliminating puddling.
7. Generates an alternate source of income for rural youth through custom services on nursery raising and mechanical transplanting.

6. LIMITATIONS

Expensive with respect to poor socio economic condition of labours in our country. Can't be repaired in any ordinary workshop special workshops are required for their maintenance. Involves complex

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mechanism which is hard to understand and manipulate. Skilled operators are required along with the mat type nursery raised seedling.

CONCLUSION

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.

Mechanization not only changes the structure of labour in agriculture, but also influences the nature of the workload. Hence there is a need of mechanization in rice cultivation sector. In this direction Rice transplanter helps us to see a bright future ahead Existing models of rice transplanters are highly efficient and effective in term of cultivation of rice in paddy field. The only problem with the existing rice transplanter is that, these transplanters are very expensive and moreover 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 prevailing in ourcountry can help them to cultivate rice effectively and efficiently with less health related issues. In India since an average farmer possess land of small size in area thus a mechanized rice transplanter would be highly helpful in the rice transplantation. It would also help in decreasing the over dependence of farmers upon labour for transplantation. 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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