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Evolution in the Technique of Rice Transplantation

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Abstract: Agriculture plays a vital role in the Indian economy. Over 70% of the rural people depend upon the agriculture. A major population is engaged in agriculture and they used ancient technique for the transplanting, in which the highest percentage was in paddy sector. Much of the population of our country depends on rice. In transplanting of paddy crop we need huge labor effort and man power which increases the cost and time of transplantation. To reduce the work effort, cost and time several techniques have developed. Significant technological development in transplantation of paddy seedlings has taken place in past few years, in which mechanization play very crucial role. In the beginning, by transplanting with hand, we are now doing transplantation with the manual operated machine and mechanically operated machine. It increases the approximate area that a person can plant from 700 to 10,000m²/day. Releasing of work force to sector other than agriculture is important to develop our society as well as our country. This mechanism leads high productivity with reducing human effort. It is helpful for small scale farmer as well as large scale farmer for transplanting of paddy.

Key Word: Planting arm, wheel, Spur gear, Engine.

I. INTRODUCTION

The major sector in India is agriculture sector. The agriculture and allied sector shares 17.3% of gross value added during 2016-17 and agriculture export constitute 10% of country export. India GDP is expected to grow at 7.1% in 2016-17 lead by growth in private consumption, while agriculture GDP is expected to grow above trend at 4.1% to Rs 1.11 trillion (US \$ 1640billion). The production of rice is 105 Metric tons (MT) from 44 million hectare. In India milled rice domestic consumption by year 1000 MT.

The method of establishment of rice depends upon (i) Age of variety (ii) Availability of moisture (iii) Climate condition (iv) Availability of input and labor.

Above these availability of input and labor plays vital role in establishment of rice.

II. METHODS OF ESTABLISHMENT

There are two methods practices in establishment of paddy in India. Those are Direct sowing / seeding and transplanting. Direct sowing seeding There are two types

A. Wet seeding

Pre germinated seeds are broadcasted into puddle and leveled fields which are free from standing water. At the time of puddling basal fertilizer should be mixed. When seedlings are of about 5cm tall irrigation must be done. The stand establishment by this method varies with the quality of land preparation, weed competition, water management and rain fall during the initial period after sowing.

B. Dry seeding

Un germinated dry seeds generally sown in dry soil either in random or in rows. Seed rate generally vary with the harsh condition of environment and physical damage of seeds.

Direct sowing can be done in two ways manually and mechanically. It is subdivided in two categories:

Random seeding: In this method seedings is done randomly with non uniform spacing between them. It is also known as broadcasting

Row seeding: In this method there is uniform spacing between plants. For uniform spacing between them planting guide is require.

C. Transplanting

In this method first seed are sown and when seedlings are grown at desired height they are transplanted in another field. This is done for higher yield endless weeding. Manual transplanting requires numbers of labor and requires 250-350 man hours per hectare.

Poor traction, sink age and steer ability types of problem mainly occur during paddy transplanting. For efficient working of self-propelled rice trans planter a suitable puddle soil condition, degree of puddling, optimum depth of puddling and soil strength of puddle wheel. The spacing of transplanted paddy varies with the age of the variety. For long age varieties (4-4 ½ months) and short age varieties (3-3½ months) best spacing are 20x20 cm² and 20x15 cm², respectively. A hill should be planted with 2-4 healthy

seedlings. For random transplanting, hill density of about 25 cm² for 4-4 ½ months varieties and 30-35 cm² for months varieties is optimum. For transplanting minimum age of seedlings would be about 12-14 days. Age of seedling should not increase beyond 15 days for a three month age crop while 21 days for a 4 month crop.

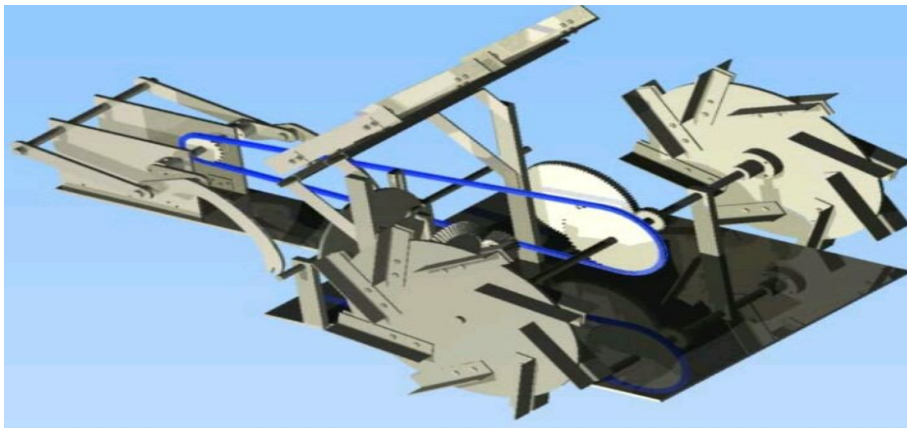


Fig. Manual two row rice transplanter

- 1) *Working*: The system is working on the four bar linkage mechanism. It's most important mechanism are for the following:
- a) *Planting Unit*: The Planting unit is described as the unit which is used to feed the plant into the ground, basically it is depend upon the following aspects were given below:-
 - i. *Motion of planting arm*: 4 bar linkage mechanism were used in this. There is a variable angle which varies from 0° to 360° and the length of each arm is different. Also the variation of speed is simulated and the plant simulation is shown in figure
 - ii. *Speed travelling by man*: The normal speed of man is near 25 m/min
 - iii. *Plant catching mechanism*: Place of catching, number of plant per catch, travelling distance, releasing point and angle of planting. Plant is not damaged during the catching and releasing by arm.

For the proper planting mechanism following factors are governed-

Man walk speed = 25m/min

Radius of wheel = 120mm

$2 * \pi * 120 = 785.39\text{mm}$

Distance of plant = 180mm Number of plant per rotation = $785.39 / 180 = 4.363$

Angle of planting decided by the key feeding point angle and moving direction.

- iv) *Depth of planting*: Depth of the plant is important factor for the growth of the plant and the planting depth is set 51 mm below the ground level according to our design

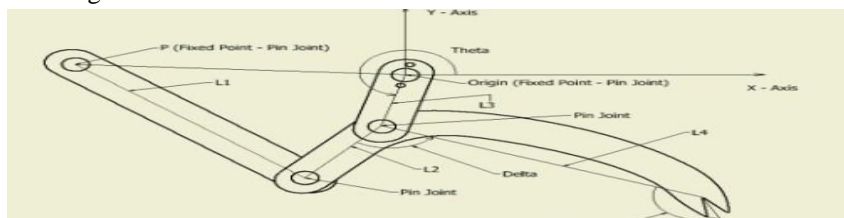


Fig . Planting arm

- b) *Paddy Feeding Tray*: Seed mat is to carry by the tray and to direct the plants to planting arm. Basic factors (width, angle, speed of movement) is considered in designing the tray mechanism. At once two plant rows are planted, two trays are placed side by side for each planting hand. For constant feeding of the seed mat to planting arm it should come down to the end of the tray by gravity. Higher angle reduces energy requirement to feed the seed mat to transplanting arm while too much angle effect on falling down and compaction of nursery at the end of the tray making difficult to take out the plants from the nursery by transplanting arm. The final angle of the tray is 60°.
- c) *Power Transmission System*: All the power generation is achieved by wheel. Chain and sprocket mechanism is used to transmit
 - No. of teeth of sprocket at wheel = 34
 - No. of teeth of sprocket at planting mechanism = 9

No. of plants planted per wheel rotation = $34/9 = 3.8$

Tray has to move very very slowly relative to the wheel. The gear ratio is 9:1

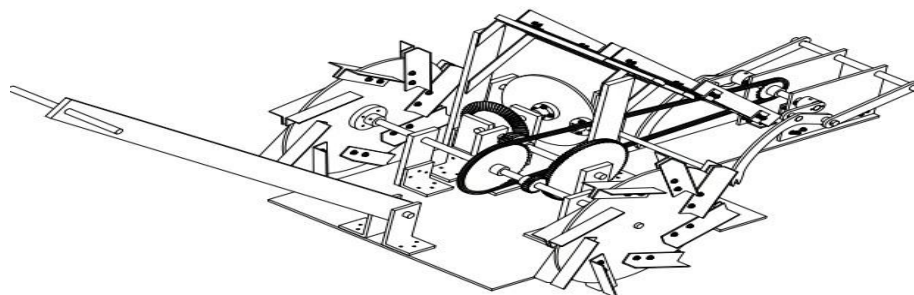


Fig. Element view of trasplanter

D. New Modification

At the place of the manual plant operate, we use the motor drive mechanism at the place of the hand operating system and the driving is held by the engine.

Specification Of The Engine Which We Use For Driving Whole Mechanism

Equipment	Specification
Engine capacity	2.4kw
Fuel	Diesel
Walk mechanism	Single wheel drive with float
Working mechanism	Separate connecting rod transplanting mechanism

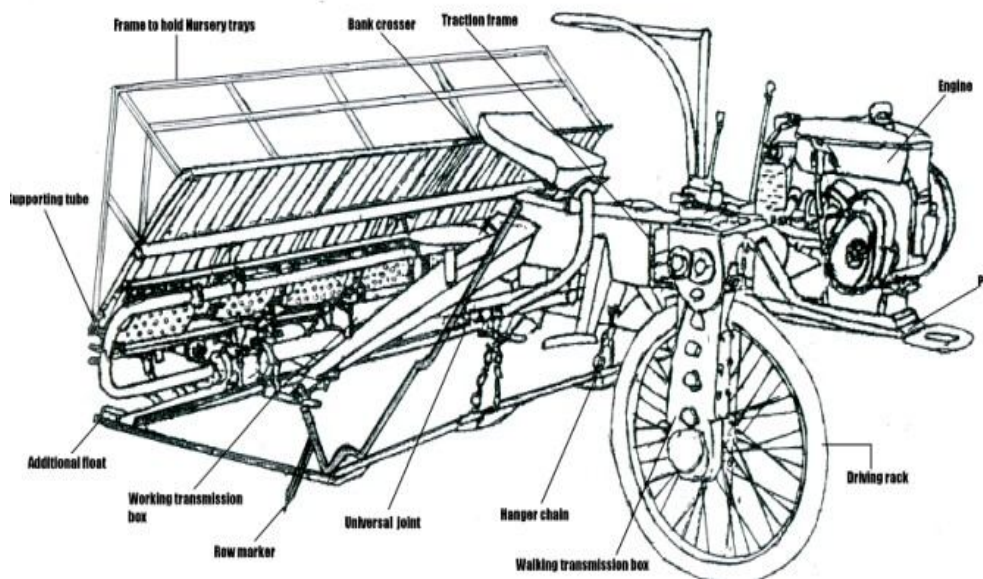


Fig.Engine Operated Multirow Rice Transplanter

With the use of the engine we reduce the more human effort as well as time duration also.by using this mechanism we increase the number of planting in the single rotation by increasing the span of the plate.

BENEFITS-

E. square planting

- 1) The transplanter can plant seedling with 24cm row to row spacing.
- 2) The gear box is provided for the changing the speed as well as the kepping the plant to plant spacing equal and row to row.

Comparison Made Between The Hand Planting And The Machine Planting



24*24

By Machine Transplantig



Randomly Transplant By Man

1st wedding



Field View After 1st Wedding



Field View After Second Weeding



Field After Third Weeding



F. Compare

PARTICULAR	TWO ROW	MULTI ROW
Plant to plant spacing	According to size of the wheel 20cm	24
Row to row spacing	Distance between both wheel(20cm)	24
Frequency of non planting	0-5	0-4
Diesel consumption(liter/acre)	Manually operated	1.5-2.75
Time taken (hr)per acre	5 -6	2-2.5

III. RESULT

- A. By the use of the two row or multi row trans planter we can reduce the human effort.
- B. By the use of the multi row transplanting system we can reduce the time of the transplanting as well as the money spending on the worker also.
- C. In 2-3 liter of diesel we can transplant rice in 1 acre of field
- D. Crop establishment after planting is vary between (98-100)%.
- E. By changing the gear ratio from the gear box we can cover 1 acre in 2-2.5 hr.
- F. Diesel pump is provided for calibrated to pump exact amount of the diesel so that transplanter consume 1.5 -1.75 liter of diesel for 1 acre of operation.

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