FABRICATION OF MANUAL RICE TRANSPLATING EQUIPMENT

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Abstract*:* Agriculture is most important sector of the India economy. It is the most important source of employment for the majority of the work force in the country. Rice is a primary crop cultivated in India. As the large work force is engaged in the sector, traditional method is costly, time consuming and intensive labor work . Timely availability of laborers 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 transplanted as major tool in this process. The user friendly rice transplanted for small scale formers in order to increase production as well as quality of rice. A rice transplanted is specialized equipment best fitted to transplanted rice seeding on the wet muddy paddy field. This product is focused on developing a machine which addresses labor problem faced by small scale farmers. The newly developed manual rice transplanting equipment can harvest up to two rows of paddy at a time.

Keywords: – Agriculture, Cultivation, Paddy and Transplanting equipment.

I. INTRODUCTION

India is mainly an agricultural country. Agriculture is the most important occupation for most of the Indian families. In India, agriculture contributes about sixteen percent (16%) of total GDP and ten percent (10%) of total exports. It takes 5,000 liters of water to produce 1 kg of irrigated rice. To plow 1 hectare of land in the traditional way, a farmer and his water buffalo must walk 80 km .Agriculture is the backbone of Indian economy. The rice transplanting machine is a device which is used to plant paddy by using a mechanism. It increases the area that a person can plant when compared to manual transplanting. The final objective is to make a machine that is cost effective so that the small scale farmers can cultivate their farm by cutting the labor costs and time.

II. LITERATURE REVIEW

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. This study was conducted which gives the parameters, specification, problems arising in already exists transplanter and development & design methodology of transplanter. The unavailability of the rice transplanter in western Maharashtra zone gave the reason to find proper research in this zone and designing transplanter. In this review mechanized rice transplanters in the field of rice cultivation are been discussed by studying various parameters related to transplanter and its field performance. Transplanting essentially refers to the planting of 20- 35 days old and 20-30 cm high seedlings rose in nurseries and uprooted for transplanting either manually or mechanically Mehta et al., (1990). In India rice is mainly cultivated during the Kharif session. In traditional transplantation of rice in the paddy field mostly female workers are indulged.

III COMPONENTS OF MANUAL RICE TRANSPLANTER

1. FOUR BAR LINKAGE:

In this four bar linkage one link is fixed and other three linkages are in motion. The links are connecting rod, lever, crank and planting finger or fork. It is mounted on the driven shaft.

2. CHAIN:

The function of chain is to transmit torque from driver to driven sprockets. The chain is simplex type.The chains are used to transmit the power from hand driving wheel to the shaft in which forks are attached and it is also to transmit the power to the four bar mechanism

3. SPROCKETS:

The main function of sprockets is to transmit torque through chain. There are two sprocket-one drivers and other driven mounted on respective shafts. 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.

4. TRAY:

This is used to store the rice plant from where the planting finger pick the plant and saw in the ground. This tray has two vertical guide slots.

5. SHAFT:

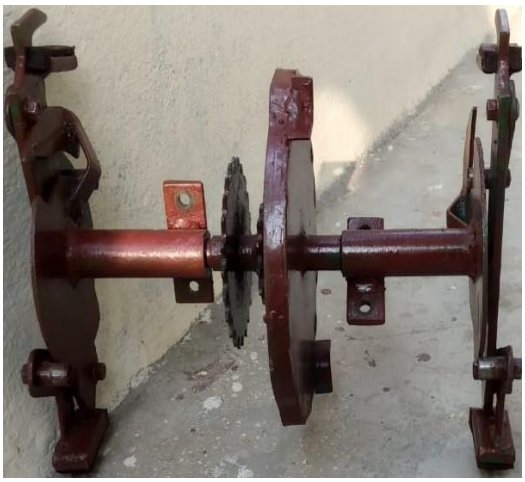
A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft.

6. FORK:

The fork 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.

(a)

(b)



(c)

(d)

(e0 (f)

(a) Four bar linkage (b) Chain (c) Shaft

(d) Tray (e) Fork (f) Skid

III. ASSEMBLY

Working model of manual rice transplanting

IV. WORKING

Paddy seedling are kept in tray and allowed to flow down under gravity. The fork which is attached to shaft picks up the seedling from the tray and keeps it in horizontal position on the skid. The motion for the shaft is given by hand using chain and sprocket arrangement. Here, simple four bar mechanism is used to plant paddy seedling into the land. 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 wheels are provided with the fins so that they can travel easily in the mud. 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. The fork is designed in such a way that rice plant should be easy to pick during the motion and also it should pick during the downward motion only.

V. CALCULATION:

1. FOUR BAR LINKAGE:

Length of crank =3.5 cm

Length of lever = 6 cm

Length of connecting rod = 10 cm

Length of fixed frame = 8 cm

2. Chain**:**

Length of chain L = Lp x Pd

Where Lp is the Length of continuous chain in multiples of pitches (i.e. approximate no. of links)

Pd = Pitch diameter

Now to find Pitch diameter Pd,

a = (30-50) Pd

Where a is the center distance and assumed it as 140cm

140 = 50Pd

Pd = 2.8 cm

Now to find length Lp,

Lp= 2ap + (Z1+Z2)/2 + (((Z1-Z2)/(2X3.14))2/ap)

Where ap is the approx. center distance in multiples of pitches.

ap = a/P= 140/2.8 = 50cm

Lp= 2(50) + (36/2) + ((12/(2x3.14))2/50)

= 100 + 18 + 1.25

Lp= 119.25 cm

Length of chain,

L =Lp x Pd

= 129.25 x 2.2 L

= 284cm

Length of first chain = 284cm

Length of second chain = 85 cm

3. SPROCKETS :

Z1=No. of teeth on sprocket pinion

Z2=No. of teeth on sprocket wheel

N1=Speed of rotation of pinion

N2=Speed of rotation of wheel

Speed of wheel driven by hand (N2) =25 rpm (optimum value)

No. of teeth in sprocket when (Z2) =40

No. of teeth in sprocket pinion (Z1) =18

Transmission Ratio 'i' N1/N2= Z2/Z1 = 40/18 = 2.2

Therefore, N1 = 2.2 x 25

Speed of rotation of pinion = 55rpm.

4. DIMENSIONS OF TRAY**:**

Length of sheet metal =53.5cm

Breadth of sheet metal = 26 cm

Thickness of sheet metal = 0.1cm

5. SHAFT DIMENSIONS**:**

Length of the shaft = 30 cm (it is space required between the paddy seedlings)

Diameter of shaft = 2 cm (it is the optimum diameter for 30cm shaft)

VI. EXPERIMENTAL RESULTS

The design of rice transplanter is easy as the basic machine design knowledge is applied to design the parts like shafts, bearings, wheels, chain and sprocket assembly and synthesis of four bar mechanism which uses the standards formulas. The cost of the transplanter is low as possible because use available and local material which leads to lower downs the price in case of mass production. The mechanism used is four bar mechanism in place of cam-follower and rocker-arm mechanism. The availability and use of transplanter in western Maharashtra makes us to fabricate the transplanter with minimum cost used by small scale farmers.

PARAMETERS	VALUE	UNIT
No. of teeth on sprocket wheel	40	-
No. of teeth on sprocket pinion	18	-
Speed of the wheel driven by hand	25	rpm
Speed of rotation of pinion	55	rpm
Length of the first chain	284	cm
Length of the second chain	85	cm
Length of the shaft	30	cm
Diameter of the shaft	2	cm
Length of sheet metal	53.5	cm
Distance between the forks	25	cm

Trial run of transplanter is conducted and from this it is seen the time taken for transplanting per square meter of paddy field is 56 seconds. No. of sapling is transplanter per square meter is 135.

VII. CONCLUSION

The rice transplanter which we fabricated working is found to be satisfactory. The cost is cheaper than motor paddy transplanters. The four-bar mechanism gives the each operating and maintenance with less parts which reduces the weight. After further improvement, this two-row paddy transplanter can be transplant 0.2 to 0.3 hectare/day while manual hand operated gives 0.1 to 0.1.5 hectare/day by considering 8 hours per day of working

VIII. REFERENCES

[1]Chetan Choudhary, "Theoretical Development of Rice Transplanting Machine" ǁ**,** Gov. College of Engineering, Aurangabad, Aug 2016. ISSN: - 2277-9655.

[2] Bala Ibrahim & Wan Ishak Wan Ismail "Development of System Rice Intensification (SRI) Paddy Transplanter"ǁUniversity Putra Malaysia.

[3] F.C .Das,"Status and Prospects of Mechanization in Rice", Central Rice Research Institute, Cuttack.

[4] Uttam Kumar and EV Thomas, "Determination of force acting on the rice transplanter finger", CIGR International Commission of Agriculture and Bio-system Engineering, March 2015.

[5] R.N.Pateriya and R.K.Datta, "Design Modifications of Mat type Rice transplanter", , International Journal of Advanced Technology and Engineering Research, Nov. 2012.

[6] V.B.Bhandari "Design of Machine Elementsǁ" , Third Edition, McGraw Hill Education Private Limited

[7] www.nzdl.org

[8] A.Dixit, R Khurana, J. Singh, G. Singh, Agric. Rev., **28** (2007) 262-269.

[9] S.V. Balbhudhe, D. H. Baghele, D.N. Shirke, M.C. Gaikwad, P.S. Bobde, U.G. Bisen, H.M.Bansod, Int. J. Ana. Exp. FEA, **3** (2016) 9-12.

[10] K.H. Ryu, Proc. Int. Conf. Small Farm Equipment for Developing Countries: Past experiences and Future Priorities, (1986) 237-254.