Suman Pandipati *et al*, International Journal of Advances in Agricultural Science & Technology, Vol.9 Issue.7, July-2022, pg. 10-14

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

FABRICATION OF PADDY TRANSPLANTER MACHINE

Suman Pandipati[1]; D. Dhilleswara Varma[2]; T. Saiprazwal[3]; T. Avinash[4]; K.Anil[5]; Roopsandeep Bammidi[6]

Department of Mechanical Engineering, Aditya Institute of Technology and Management (A), AITAM – Tekkali, India – 532201

Corresponding Author: Suman Pandipati, Email Id: suman.inertia09@gmail.com

DOI: 10.47856/ijaast.2022.v09i07.002

Abstract: India is an agrarian country. About 58% of Indians are dependent on agriculture for their livelihood. At least 12 crore families in India are dependent on agriculture. India is world's second largest producers of rice, accounting for 20% of all world rice production. Rice is usually grown by planting paddy in the fields manually. A major population of India is engaged in agriculture. Rice being the major crop cultivated in India, a huge amount of workforce is engaged in rice production. The common practice of rice cultivation is manual transplanting of seedlings inthe puddled soil. Rice is primary and major crop cultivated in India. As the large workforce is engaged in this sector, Traditional method is costly, time consuming and labor intensive work. To make the transplanted system several attempt has been made to design and fabricate this machine. So our main of our project is to design and fabricate a paddy transplanted by using this machine we use decrease the labor cost and increased the productivity. So this machine works ona simple mechanism which is easy to maintain and it is eco-friendly. And no skilled labors are required, only single person is required to operate the machine. In this work, the difficulties while planting the seedlings in the field by the farmers are eliminated.

Keywords: Agriculture, Paddy Plants, Design and Fabrication, Eco-Friendly, Machine

Introduction: India is a country of villages, having large population around two third of its population are dependent on agriculture. India is the second largest producer of rice. It came in second place with 122 million metric tons of milled rice in that crop year. It produces nearly 24% of rice around the world, while Bangladesh produces over 7% of total global production. Paddyis the rice grain with husk. It is a wetland crop, which is extensively grows all over the world. Rice cultivation is well suited to countries and regions with low labor cost and high rainfall. As per this criteria's India is well suitable for production of rice. So in 20th century, transplanted was invented to plant the seedlings into land which reduce the human efforts and consumed the human efforts and consumed less time. So that The Government of India has also started taking steps in the form many initiatives and subsidies 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, Threshing. Introducing the technology to the rice farming will result in many advantages such as better production, good quality of produce, less labor required, saves time, low cost. Due to the impact of modernization and

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

urbanization the agriculture sector is experiencing a labor shortage and the increased cost of the wages which can be detrimental to the average farmer. Generally, 8- 12 labors are required to transplant one acre. However, if a manually paddy Transplanter is used, two people can transplant 1 acre in 6.31 hours. For initializing this project, we searched different types of information regarding of transplanting field with literature review of different research paper. At first we analyzed G.Singh et al. conducted experimentation on manual rice transplantation at the International Rice Research Institute farm. He started his survey in 1985.The results states that at this field the transplanted complete the process with capacity of 3.4 ha/h in different water depth. He reported that irrigated rice is largely grown by manual transplanting of seedlings. Manual transplanting of rice seedlings takes about 250-300 man-hours/ha, which is roughly 25 percent of the total labor requirement of the crop.

Sharma and Singh developed a mat type nursery-raising device for rice planter. They reported that72.02 and 33.33% saves the time and labor 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 where as it was Rs. 1608.75 with manual method. Sivaswami and Anie John found that nearly 85% of labor cost was reduced by the introduction of paddy transplanters compared to manual transplanting. And we also analyzed the other literature survey for the better results of our fabrication transplanted machine. In 2012 Pateriyaet al conducted an experiment on design modifications of mat type rice trans planter, the observations indicated that all the modified components worked satisfactorily. From the results, it appears that the percentage of missing hill varied 8.06 to 9.75, plants per hill ranged2 to 4, planting depth was 50 to 65 mm. The hill to hill spacing was 95 to 102.5 mm at low gear and 147.7 mm at high gear, the row to row spacing varied 230 to 235mm. Pragyaet al. carried out an Ergonomic Study on Human Drudgery and Musculoskeletal Disorders by Rice Transplanting. They reported that the 7 majority of respondents were suffering from pain in neck, both shoulder, upper back, lower back and thighs because they were compelled to adopt bending and sitting posture during manual uprooting and transplanting [1-8]. To solve the problem of high physiological workload, human drudgery and musculoskeletal disorders mechanical rice transplanting could be considered as the most promising option.

Methodology: Manually paddy transplanted consists of a finned ground wheel, tray for seeding, power transmission system, chain and sprocket, pinion gear, shafts, picking arms, Base, and handle. We are also using 4 wheels when an effort is made to push the transplanted in forward direction, ground wheel shaft rotates. The driver sprocket attached with the ground wheel shaft will then rotate and hence transmit power to the driven sprocket attached to the driven shaft. The four bar mechanism attached to the driven shaft will in turn oscillate and pick the seedling from the tray by means of a picking arm to the tip of four bar mechanism. We are using aluminium tray 690 × 570 mm. The tray can accommodate 30- 40 seedlings at a time. A four bar linkage, also called a four-bar, is the simplest movable closed chain linkage. It consists of four bodies, called bars or links. These links are connected in a loop by four joints. The worker provides the force which initializes the start of this mechanism, the paddy transplanted moves forward rotating the wheels that touch the ground. The wheels are provided with the fins so that they can travel easily in the mud. The finned wheel ensures proper spacing between successive planting. Then we have larger sprocket is provided on the same shaft with the finned wheel and hence at the same time sprocket will also rotate. The larger sprocket is in engagement with the pinion gear by using the chain drive. As the power will get transmitted to the sprocket, it will rotate. 3:1 gear ratio is used to increase the speed. On the same shaft planting finger will be attached to the four bar linkage so that it will oscillate for

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

certain angle. As the planting finger oscillates, it will pick the paddy saplings from the tray and plant them in the mud. The planting finger is designed in such a way that rice plant should be easily picked during the downward motion. The various processes those were used in making the Base, picking arms, shafts, tray and handle are Metal cutting, Grinding, Frame welding, Round filing, Drilling, Lathing and Step turning. The final product after performing all the processes is shown below in figure 1.

Fig. 7 Total Assembling of Paddy Transplanter

Results and Discussions: In this work, 600cm × 35cm size field is considered for the experiment. Thevarious factor considered to determine the time required to complete the transplanting of seedling is shown in table 1.

Table. 1 Experimental Parameters and Factors

Parameters	Value	Units
Size of the field.	66×35	cm×cm
No of saplings planted	4	-
No of rows.	2	-
Gap between row1 to row 2	66	cm
Distance between two samplings.	25	cm
Time taken for the completion two rows.	3.88	sec
No of revolution of a ground wheel per two rows.	1	-
Size of the field	600×35	cm×cm
No of rows planted	7	-
Time taken for the completion seven rows	11:86	sec
Gap between row1 to row 2	66	cm

Plantation parameters:

i. Time = 3.58 sec

ii. Planting = 2 rows.

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

iii. For 1 row = 2crops.
iv. For total 3.88 sec, there are 4 crops are goin to be planted .
v. No of revolutions = 1
vi. Speed of Ground wheel at 3.8 sec = [1/3.88 × 60] = 15.46 rpm.
vii. Distance between the plants = 25cm.
viii. At a speed of 15.46 rpm of ground wheel 4 plants are planted.
ix. For 600cm length there are 7 rows are planted within 11:86 sec.
x. Row 1 to Row2 distance = 66cm.

Circumference of ground wheel = $3.14 \times D_w$
Circumference of ground wheel (C_w) = 3.14×64=2.0096mm

Speed of ground wheel =N_w
(W_w) = 0.5295 (rad/min)

Sprocket and pinion gear ratio:
Z_1/Z_2 = sprocket teeth/free wheel (pinion gear) = 44/18 = 2.45
N_2/N_1 = speed of the pinion gear (free wheel)/speed of the sprocket
$N_2 = (N_1)$ (2.45) , N_1 = 5.059, N_2 = 12.394.

Angular velocity of the sprocket (W_1):
$W_1 = N_1 \times 2л /60$
W_1 = 0.5925 rad / sec.

Linear Distance travelled by transplanter $.л \times D_w$
= 3.14 × 640mm

Linear velocity of chain (V):
V = Z_1 × (chain link pitch) × (N_1) / 60×10 m/sec
V = 0.04822 m/sec

Power transmitted by sprocket to pinion gear through by chain:(P_c) = m × a × V_c = 0.1116479 watt

Tension in chain (T_c):
T_c = 1000 × power / V_c = 1000×P_c/V_c = 2.314N

Torque transmitted by shaft to the chain (T_s):$P_s = 2лN_sT_s/60$ watt = 2×3.14 × (Ns) × (Ts)/60Ft
= (3.46) × (0.048229)

Ft = 0.16687N, Ts = 1.168N- mm

Power transmitted by the shaft for 1 revolution
(P_s) 1 rev = 2лNs Ts/60 watt = (P_s)1 rev = 2×3.14×12×0.001168 = 0.12250×10^{-3} watt

Chain length (L_c): $L_c = (2 \times C) + (Z_1/2 + Z_2/2 + A/C)$

ISSN: 2348-1358
Impact Factor: 6.901
NAAS Rating: 3.77

Sprocket tooth (Z_1) = 44, Free wheel (or) pinion wheel gear tooth's (Z_2) = 18A = Z_1- Z_2 = 44 -18 = 26,

L_c = [(2×345) + (44/2 + 18/2 + 17.12/345)] L_c = 640.461 mm.

Picking arm: Dia = 5.5 cm (or) 55 mm(S) = Θ/360 × 3.14 × (55) = 43.175mm

Conclusions: The fabricated manual method of paddy transplanting gives a quite satisfactory result. By incorporating mechanical means of transplanting seed reduces human effort in comparison to conventional transplanting. The results obtained from the experiment are that small amount of time is lost during turning of the transplanter in between the consecutive rows as well as time lost during any repairing. The distance between two saplings is found to be 25cm. It is seen that total time taken for the 4046.856 square meters(an acre) is 6.31 hours at an average speed of 0.1694m/min.

References

[1] "**Development of System Rice Intensification (SRI) Paddy Transplanter" Ibrahim B and Ismali WIW.2014. Asian Journal of Agricultural Sciences 6 (2): 48-53.**

[2] "Studies on the performance of selfpropelled rice transplanter and its effect on crop yield" M.V. Manjunatha, BG Masthana Reddy, SD Shashidhar and VR Joshi. 2009.. Karnataka Journal of Agricutural Sciences 22(2): 385-387.

[3] "Status, challenges and strategies of farm mechanization in India" Mehta CR, NS Chandel, T Senthilkumar, 2014. Agricultural Mechanization in Asia, Africa and Latin America 45(4): 43-50.

[4] "Field performance evaluation of a manual rice transplanter" Singh G, Sharma TR and BockhopCW. 1985. Journal of Agricultural Engineering Research 32: 259-268.

[5] "Self-propelled rice transplanter for economizing labour" Tripathi SK, Jena HK and Panda PK. 2004. Indian Farming 54: 23 - 25.

[6] "Mechanized Transplanting of Rice" Baldev Raj Kamboj, Dharam Bir Yadav, Ashok Yadav, Narender Kumar Goel, Gurjeet Gill, Ram K. Malik, Bhagirath Singh Chauhan, (Oryza Sativa L.) In Nonpuddled and No-till Conditions in The Rice-wheat Cropping System in Haryana, India, American Journal of Plant Sciences, 2013, 4, 2409-2413 .

[7] "Ergonomic Evaluation of Manually Operated Six-row Paddy Transplanter" Rajvir Yadav, Mital Patel, S.P. Shukla, S. Pund, International Agricultural Engineering Journal 2007, 16(3-4):147-157.

[8] "Design & Development of Rice Planter Machine" Dhanesh D. Patil & Dr. Mangesh R. Phate, Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-8, 2016, 1241-1246.

