RESEARCH ARTICLE

PERFORMANCE EVALUATION STUDIES ON ICAR-NRRI, CUTTACK DEVELOPED TWO ROW POWER WEEDER

Pushpraj Diwan*, Nenavath Manikyam[1], Prabhat Kumar Guru[2], Rajesh Kumar Naik[3] and Suryakant Sonwani[1]

[1]*SVCAET & RS, IGKV, Raipur (C.G.)*
[2]*ICAR-NRRI, Cuttack (Odisha)*
[3]*(FMPE), PI-AICRP-FIM, SVCAET & RS, IGKV, Raipur (C.G.)*

Received-09.11.2019, Revised-28.11.2019

Abstract: Rice is the most important crop in India. Mechanization in farming is always helpful to improve the productivity of the field. Weeding is a most problematic operation and solution of the weeding operation is very important. A two row power operated mechanical weeder was developed in ICAR-NRRI, Cuttack. Performance of the developed weeder is observed in terms of weeding efficiency, plant damage, cost of operation etc.

Keywords: Mechanical weeding, Weeding efficiency, Plant damage, Cost of operation

INTRODUCTION

Technology in rice was continuously improving and mechanization always helping to improve its production and productivity. Weed is a factor which reduces the production of rice. Different weeding methods manual hand picking, chemical weeding and mechanical weeding by weeders are now in trending to remove the weeds. That was designed by using a special kind of cutting blade, which cost serrated edge and flat edge blade on the periphery of the rotor to reduce the soil sticking problem and improve the churning effect on soil. The power weeder was fabricated in the agricultural engineering workshop of ICAR-NRRI, Cuttack (Odisha) by considering the agronomical parameters like row spacing in different system of paddy cultivation (Sarala *et al.*, 2011; Dass *et al.*, 2013 and Singh *et al.*, 2009), by mechanical rice transplanter (Yadav *et al.*, 2007; Goel *et al.*, 2008 and Thakur *et al.*, 2010) and period of weeding (Mann *et al.*, 2007 and Latif *et al.*, 2009). Ergonomical parameters (Mohanty *et al.*, 2016) also considered for design user friendly weeder. Fabricated weeder shown in Figure 1.

MATERIALS AND METHODS

Experiment was conducted with different variable parameters (row spacing of plant, peripheral speed of blade and depth of cut) with their three levels. Paddy of *Pooja* variety was sown in field for performance evaluation of the weeder. Row to row spacing of the plant was maintained at 20 cm, 22.5 cm, 25 cm and working depth of blade was 4 cm, 5 cm and 6 cm were used for performance evaluation. The peripheral speed of blade was observed at minimum, half and full throttle opening by adjusting accelerator lever and peripheral speed was observed 1.74 m/s, 1.88 m/s and 2.03 m/s respectively. Statistical design (Factorial RBD) was also used for analysis of collected data set (Sabaji, 2014). Independent variables with their different levels are given in Table 1. After weeding operation at different level of independent variables weeding efficiency (%), plant damage (%) and fuel consumption (l/h) at 25 DAT and 40 DAT were observed.

Fig. 1. Developed two row power weeder

*Corresponding Author

Travelling speed of the power weeder was determined at different depth of cut and speed (m/s) of blade. The maximum speed of weeder was found at blade peripheral speed 2.03 m/s with depth of cut 4 cm, which was observed 2.2 km/h. Minimum travelling speed of the developed weeder was found at blade peripheral speed 1.74 m/s with depth of cut 6cm, which was measured 1.92 km/h.

Table 1. Independent variables taken for experiment and their different level

S.No.	Factors	Level 1	Level 2	Level 3
1.	Depth of cut	4 cm	5 cm	6 cm
2.	Peripheral blade speed	1.74 m/s	1.88 m/s	2.03 m/s
3.	Plant spacing	20 cm	22.5 cm	25 cm

We found that the variation of travelling speed of weeder depends on the depth of cut and speed of blade but fluctuates very little. Travelling speed of power weeder was directly proportional to speed of blade and inversely proportional to the depth of cut. Fuel consumption of the power weeder was measured with the use of fuel measuring cylinder, which was attached to the engine at the time of operation. Variation occurred in fuel consumption at different test condition. Fuel consumption was observed at the range of 0.77-0.84 l/h. Maximum fuel consumption was found at blade speed 2.03 m/s with depth of cut 6 cm and minimum at blade speed 1.74 m/s with depth of cut 4 cm.

RESULTS AND DISCUSSION

The weeding efficiency of power weeder was found highest in row spacing 20 cm at 40 DAT with full throttle opening of accelerator lever which was observed to be 77.5%. Minimum weeding efficiency was found to be 53.13% at 25 DAT with minimum throttle opening of accelerator lever and row spacing 25 cm. Data showed that weeding efficiency for different row spacing and velocity of blade at 25 DAT differ significantly at 5% level of significance and at 40 DAT significant difference found in depth of cut at 5% level of significance but it was very little. There was no significance difference between the observations recorded for different depth of operation at 25 DAT represented in Table 2. Weeding efficiency was more in row spacing 20 cm, and less in 25 cm in all speed of blade and depth of cut, because the blade width of was constant i.e. 12 cm. In 20 cm row spacing more weeds were interacted by the weeder than 25 cm row spacing.

The plant damage of developed weeder was found more at the plant spacing 20 cm at 40 DAT which was 5.77% at 6 cm depth of cut with full throttle opening of the accelerator lever. The minimum plant damage was measured to be 0.93%, because the width of blade was 12 cm which work properly in row without much damaging the plants. The plant damaged percentage of power weeder is given in Table 3.

Table 2. Effect of different row spacing, depth of cut and peripheral blade speed on weeding efficiency of power weeder.

Plant spacing, cm	Peri. blade speed, m/s	Weeding efficiency,%					
		25 DAT			40 DAT		
		D_1	D_2	D_3	D_1	D_2	D_3
20	1.74	70.47	70.86	71.42	71.13	71.86	72.06
	1.88	72.05	72.8	73.38	73.8	74.29	74.42
	2.03	75.38	76.88	76.92	77.06	77.13	77.5
22.5	1.74	63.1	63.8	64.2	64.2	64.85	66.06
	1.88	64.2	64.28	65.01	65.21	66.5	66.95
	2.03	66.99	67.22	67.56	68.08	68.48	69.76
25	1.74	53.13	53.64	54.7	55.36	55.96	56.61
	1.88	56.32	57.13	57.19	57.26	58.26	59.13
	2.03	58.77	59.53	60.07	60.24	61.03	62.08

D_1= Depth of cut 4 cm, D_2= Depth of cut 5 cm, D_3= Depth of cut 6 cm

Data showed that plant damage percentage of power weeder at 25 DAT and 40 DAT found significant difference at 5% level of significance on row spacing, depth of cut and peripheral speed of blade. Plant damage mainly depends on the row spacing of paddy. Cost of operation determined by considering the cost of machine which was ₹ 23000.00. Cost of operation was calculated ₹ 1389.08/ha by adding fixed cost (18%) and variable cost (82%) of machine, shown in Fig. 1 and Fig. 2 respectively.

Table 3. Effect of different row spacing, depth of cut and peripheral blade speed on plant damage by power weeder.

Plant spacing, cm	Peri.blade speed, m/s	Plant damage,%					
		25 DAT			40 DAT		
		D_1	D_2	D_3	D_1	D_2	D_3
20	1.74	0.93	0.93	0.95	0.95	1.93	2.91
	1.88	0.95	1.88	1.88	1.93	2.86	3.76
	2.03	2.91	2.91	2.89	2.83	2.89	5.77
22.5	1.74	0.93	0.93	0.95	0.95	1.88	0.95
	1.88	0.95	0.95	2.80	1.90	0.95	2.80
	2.03	1.90	2.89	4.77	2.80	2.89	5.72
25	1.74	0.95	0.95	0.93	0.95	1.39	0.93
	1.88	0.93	1.91	2.83	0.98	1.91	1.88
	2.03	1.85	2.91	3.73	1.96	4.71	4.74

D_1= Depth of cut 4 cm, D_2= Depth of cut 5 cm, D_3= Depth of cut 6 cm

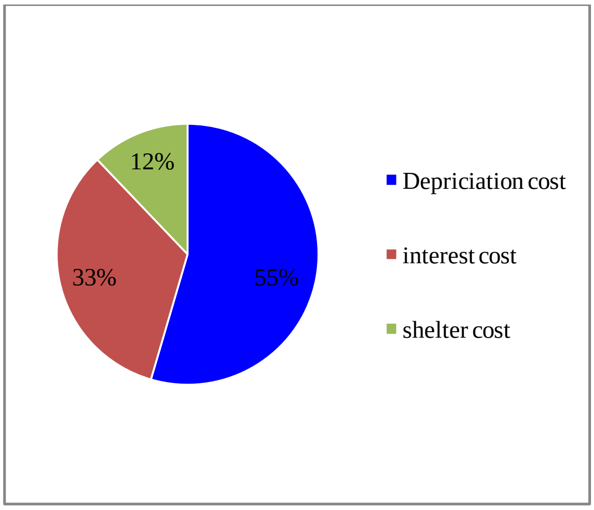

Fig. 1. Fixed cost of power weeder (₹/h)

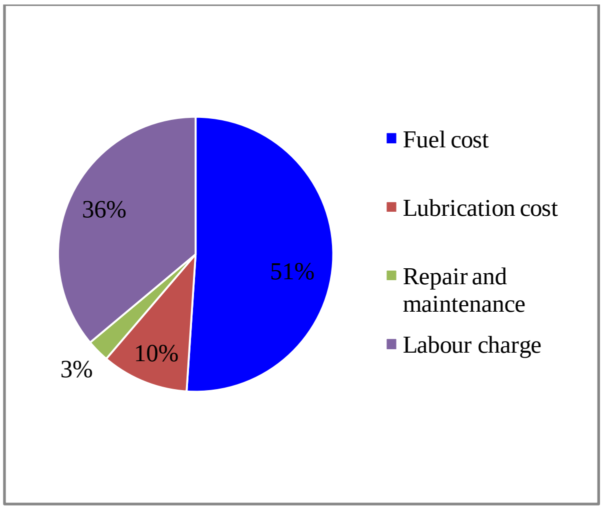

Fig. 2. Varialbe cost of power weeder (₹/h)

CONCLUSION

Weeder was performing well weedy situation with less drudgery and operational time. Different of operational parameters was affecting the performance of the machine. When the row spacing was less weeder performed good in terms of weeding but bad in terms of plant damage and field capacity because of working width was less. Mechanical weeding proved that it save the time and cost of operation in cultivation.

REFERENCES

Dass, A. and Chandra, S. (2013). Irrigation, spacing and cultivar effects on net photosynthetic rate, dry matter partitioning and productivity of rice under system of rice intensification in Mollisols of northern India. Experimental Agriculture, 49(4), pp.504-523.

Goel, A. K., Behera, D. and Swain, S. (2008). Effect of sedimentation period on performance of rice transplanter. Agricultural Engineering International: CIGR Journal.

Latif, M.A., Ali, M.Y., Islam, M.R., Badshah, M.A. and Hasan, M.S. (2009). Evaluation of management principles and performance of the System of Rice Intensification (SRI) in Bangladesh. Field Crops Research, 114(2), pp.255-262.

Mann, R.A., Ahmad, S., Hassan, G. and Baloch, M.S. (2007). Weed management in direct seeded rice crop. Pak. J. Weed Sci. Res, 13(3-4), pp.219-226.

Mohanty, S.K. (2016). Grading of Workload of Male and Female Agricultural Workers. J. Agric. Technol., 3(1): 64-70.

Sabaji, T.D., Sahoo, P.K. and Iquebal, D.D.M.A. (2014). Design and development of ridge profile power weeder. Journal of Agricultural Engineering, 51, p.4.

Sarala, A. and Chellappan, M. (2011). Comparison of the system of rice intensification (SRI), recommended practices, and farmers' methods of rice (Oryza sativa L.) production in the humid tropics of Kerala, India. Journal of Tropical Agriculture, 49, pp.64-71.

Singh, Y., Humphreys, E., Kukal, S.S., Singh, B., Kaur, A., Thaman, S., Prashar, A., Yadav, S., Timsina, J., Dhillon, S.S. and Kaur, N. (2009). Crop performance in permanent raised bed rice–wheat cropping system in Punjab, India. Field Crops Research, 110(1), pp.1-20.

Thakur, A.K., Rath, S., Roychowdhury, S. and Uphoff, N. (2010). Comparative performance of rice with system of rice intensification (SRI) and conventional management using different plant spacings. Journal of Agronomy and Crop Science, 196(2), pp.146-159.

Yadav, R., Patel, M., Shukla, S.P. and Pund, S. (2007). Ergonomic evaluation of manually operated six-row paddy transplanter. International Agricultural Engineering Journal, 16(3-4), pp.147-157.