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PERFORMANCE EVALUATION OF JAPANESE PADDY WEEDER AND TNAU CONOWEEDER IN SRI PADDY

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KEYWORDS

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ABSTRACT

A study was conducted for performance evaluation of weeding hand tools i.e. Japanese paddy weeder and TNAU conoweeder for weeding in SRI paddy (GR-11) at Main Rice Research Station, Anand Agricultural University, Nawagam of middle Gujarat region, India and compared with hand weeding by hand weeder "*Khurpi*". The time required for weeding operation by Japanese paddy weeder and TNAU conoweeder were observed 66.70 man-h/ha and 62.50 man-h/ha respectively as compared to hand weeding which required as high as 250 man-h/ha. It was observed that the Japanese paddy weeder and TNAU conoweeder showed a saving of 183.33 man-h/h and 187.50 man-h/ha over hand weeding method. The field capacity of Japanese paddy weeder and TNAU conoweeder were observed to be 0.015 and 0.016 ha/h while it was 0.004 ha/h by hand weeding method. The weeding efficiency of Japanese paddy weeder and TNAU conoweeder were observed 81.37 % and 81.94 % respectively while it was by hand weeding method as 90.67 %. Thus, Japanese paddy weeder was found more suitable for SRI weeding in middle Gujarat region.

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INTRODUCTION

Rice is an important staple food for about 50 per cent of the world's population providing 66-70 per cent body calories intake to the consumers (Barah and Pandey, 2005). Rice is the most important cereal food crop of the world providing major source of the food energy for more than half of the human population (Thawait *et al.*, 2014). Rice occupies a pivotal place in Indian agriculture and it contributes to 15 per cent of annual GDP and provides 43 per cent calorie requirement for more than 70 per cent of Indians. It is accounts for about 42 per cent of total food grain production and 55 per cent of cereal production in the country (Chowdhury *et al.*, 2014). Rice is grown on about 44 % of the total area under cereals and contributes about 45 percent of the total cereals production in India. Rice occupies about 7 to 8 % of the gross cropped area and grown on an average about 6.5 to 7.25 lakh ha of land comprising nearly 55 to 60% of transplanted rice in the Gujarat (Anonymous, 2010a). Thus, the spectacular increase in paddy production was restricted to irrigated belts of country only and to tackle the situation; SRI (System of Rice Intensification) technology is becoming eye catching. SRI involves the application of certain management practices which provides better growing conditions for rice plants, particularly in the root zone. This system seems to be promising to overcome the shortage of water in irrigated rice.

Weeding in rice crop is laborious and time consuming operation. The yield loss ranges from 10-50 % in transplanted rice depending on the extent of weed infestation (Pathak *et al*.1976). India is the second largest rice producing country in the world and represents about 10 % (225 million) of the total workforce in agriculture (Nag and Nag, 2004). Rice cultivation is facing severe labour problem. It is estimated that one third to one-half of the labour used in rice cultivation is for weed control with an average figures of 30-40% labour days per hectare and 8-10 man-hour per day (Hobbs and Belinder, 2004).

In SRI system of rice cultivation naturally weed growth is more in the fields because there is no stagnated water. Hand weeder "*Khurpi*", Japanese Paddy weeder and TNAU conoweeder are largely used by farmers. So, it is very necessary to use proper weeding implements to reduce drudgery and cost of cultivation.

The paper deals with study and performance evaluation of manually operated weeders in SRI cultivation and recommend the best manual weeder for the region

MATERIALS AND METHODS

Rice (*GR-11)* was sown at 25 x 25 cm plant to plant and row to row distance and all the agronomical parameters and agricultural operations were accomplished uniformly as per best recommendations laid down in the region and SRI guidelines. Weeding operations were carried out four times with an interval of 10-12 days starting from tenth day of transplanting of seedlings in the field (Fig.1). The study was conducted at Main Rice Research Station, Anand Agricultural University, Nawagam (Gujarat) to access draft and power requirement, effective field capacity, weeding efficiency, plant damage, number of clogging, performance index and cost of operation of Japanese paddy weeder and TNAU Conoweeder and compared with hand weeder "*Khurpi*" in three replications. All the parameters were measured and recorded in line with the RNAM test code. Detailed specifications of Japanese paddy weeder and TNAU conoweeder selected for study are presented in Table 1.

The draft, power, field capacity, weeding efficiency, plant damage, number of clogging, performance index, cost of operation were calculated as per the standard procedures as mentioned below and presented in Table 2.

Draft

Draft exerted by the weeder was measured by force measuring device. A calibrated spring is inserted between handle pipe and main frame tube in such a way that compressing of springs makes change in the position of the marker showing force applied to the weeder. Line of force is not horizontal, measurement of angle of push was made and horizontal component of draft force was calculated as follows:

$$\text{Draft} = \text{Force recorded X Cos } \theta$$

Where, is the angle made between line of push and a line parallel to the direction of forward movement of the weeder.

Power

Power used by the weeder was calculated by the formula as below.

$$\text{Power (hp)} = \frac{\text{Draft X Speed}}{75}$$

Where, Draft in kgf and Speed in m s^{-1}

Field capacity

Theoretical field capacities, effective field capacities and field efficiencies were calculated from following formulae

$$\text{Theoretical field capacity} = \frac{\text{Working width X Speed}}{10}$$

Where, Working width in metre and speed in km h^{-1}

Effective field capacity is an average output of the weeder per hour, calculated from the total area weeded in hectares and the total work time which includes time loss in turning at headlands, rests and for any breakdown or adjustments.

$$\text{Effective field capacity (ha/h)} = \frac{\text{Area covered by weeder}}{\text{Total time taken X } 10{,}000}$$

Where, Area covered in m^2 and total time in hour

Weeding efficiency

A square loop (0.25 m^2) was randomly thrown to the field and number of weeds including in loop will be counted before and after weeding (Rangasamy *et al.*, 1993). Five sets of observations were taken and average value of weeding efficiency was calculated as below.

$$\text{Weeding efficiency (\%)} = \frac{W1 - W2}{W1} \text{X } 100$$

Where,

W_1 = Number of weeds before weeding

W_2 = Number of weeds after weeding

Plant damage

Plant damage is the measure of damage on crop plants during weeding operation. Plant damage was observed in terms of buried plants by soil mass as well as cutting of plant leaves/ tops by rotating action of weeding drums and blades.

Number of plants in 10 m row length before and after weeding was observed and the plant damage factor was calculated by using following relation (Gupta, 1981).

$$\text{Plant damage (\%)} = \frac{Q2}{Q1} \text{ x } 100$$

Where,

Q_1 = Number of total plants in 10 m row length before weeding

Q_2 = Number of plants damaged along 10 m row length after weeding

Clogging of the weeder

Number of events of clogging in 20 m run of the weeder was note down and average value for five sets of observations was calculated.

Performance index

The overall performance was assessed through performance index by using the following relation as suggested by Gupta (1981).

$$\text{Performance Index} = \frac{a \text{ x } q \text{ x } e}{p}$$

Where,

a = effective field capacity, ha h^{-1}

q = 100 - PDF

e = weeding efficiency, %

Cost of operation

Cost of operation was calculated by simple straight line method. This method was used for depreciation and cost estimation in this study. Salvage value of the weeders was assumed negligible. Taxes, shelter, fuel charges and insurance are not applicable in the case of hand weeders. The equation for cost of operation can be written as below:

$$\text{Cost of operation} = \frac{P\left(\frac{1}{Y} + 0.5I\right) + RM + AL}{AC}$$

Where,

P = Purchase price (Rs.) = 2500

I = rate of interest (assumed as 12% per year)

Y = estimated life (year) (assumed 10 years)

RM = repair and maintenance costs (assumed as 5% of purchase price)

C = field capacity (ha h^{-1})

L = labour cost (Rs. h^{-1}) (assumed as 200 Rs. per day)

A = annual working hours (assumed as 150 h per year)

RESULTS AND DISCUSSION

The results pertaining to different parameters as mentioned

Table 1: Specifications of Japanese paddy weeder and TNAU conoweeder

Sr No.	Specifications	Japanese paddy weeder	TNAU conoweeder
1	Weight (Kg)	4.5	6.5
2	Effective width (cm)	15	16
3	Depth of cut (cm)	4	4
4	Handle length (cm)	35	50
5	Rotor spacing (cm)	20	21.50
6	Float width (cm)	14	9.5
7	Float length (cm)	17	35
8	Weeder length (cm)	132	170

Table 2: Performance data of different weeding methods

Sr.No	Parameters	Japanese paddy weeder	TNAU conoweeder	Khurpi
1	Depth of operation (cm)	4.0	4.0	-
2	Speed (m/s)	0.274	0.317	-
3	Draft, kgf	30	31	-
4	Power (hp)	0.110	0.118	-
5	Time required for weeding, h/ha	66.70	62.50	250
6	Effective field capacity, ha/h	0.015	0.016	0.004
7	Weeding efficiency (%)	81.37	81.94	90.67
8	Plant damage (%)	12.50	11.25	2.50
9	Number of clogging	5.33	6.33	-
10	Performance index	1015.43	947.67	-
11	Cost of operation, Rs/ha	1872	1755	6250

Figure 1: Weeding by Japanese paddy weeder and TNAU conoweeder

earlier are presented in Table 2.

It was observed that that an average field capacity 0.015 ha/h and 0.016 ha/h was recorded for the Japanese paddy weeder and TNAU conoweeder respectively while it was 0.004 ha/h for hand weeding with "*Khurpi*". Similar results was also reported by Sharma *et al.*,1987. The hand weeding was labour intensive operation which required as high as 250 man- h/ha as compared to 66.70 and 62.50 man-h required with Japanese paddy weeder and TNAU conoweeder respectively which showed that a saving of 183.33 and 187.50 man-h/ha could be achieved by using the weeders respectively. It was observed that there was no significant difference in weeding efficiency of both the weeder but, hand weeder gave highest weeding efficiency as 90.67 %. This result is in agreement with the finding of Shekar *et al*., 2010 and a similar result was also reported by Nagesh Kumar *et al*., 2014.

Performance evaluation of Japanese paddy weeder and TNAU conoweeder were found better than hand weeder *"khurpi"* in the area. Conclusion was drawn from the result analysis that the cost of operation is observed more in hand weeding (7020 Rs/ha) as compared to TNAU conoweeder (1755 Rs/ha) and Japanese paddy weeder (1872 Rs/ha). The hand weeder was found labour intensive with 250 man-h/ha. While Japanese paddy weeder and TNAU conoweeder required 66.70 man-h/ha and 62.50 man-h/ha respectively. Thus, labour requirement of 183.33 man-h/ha and 187.50 man-h/ha could be saved in Japanese paddy weeder and TNAU conoweeder respectively for weeding operation over hand weeder. More plant damage (12.50 %), lower number of clogging (5.33) and higher performance index (1015.43) were observed in Japanese paddy weeder than TNAU conoweeder.

REFERENCES

Anonymous 2010$_a$. Annual Rice Group Meeting report presented by, DWSR Coordinating Centres.

Barah, B. C. and Pandey, S. 2005. Rainfed rice production systems in Eastern India: An on farm diagnosis and policy alternatives. *Indian J. Agril. Eco.* **60(1):** 110-136.

Chowdhury, Md. Riton, Vinod Kumar, Abdus Sattar and Koushik, B. 2014. Studies on the water use efficiency and nutrient uptake by rice under system of intensification. *The Bioscan.* **9(1):** 85-88

Gupta, C. P. 1981. Report on weeders. *Regional Network for Agricultural Machinery, Manila, Philippines.*

Hobbs, P. R. and Bellinder, R. R. 2004. Weed management in less developed countries. *Encyclopedia of Plant and Crop Science. Marcel Dekker, Inc.* NY: pp. 1295-1298.

Nag, P. K. and Nag, A. 2004. Drudgery, accidents and injuries in Indian agriculture. *Industrial Health:* **42:** 149-162.

Nagesh Kumar, T. Sujay Kumar, A. Madhusudan Nayak and Ramya, V. 2014. Performance evaluation of weeders. International Journal of Science, Environment and Technology, Vol.3. No. **6:** 2160-2165.

Pathak, M. D., Ou, S. H. and S. K. De Datta. 1976. *Pesticides and Human Welfare*. (Ed. D. L Gunn and J. G. R. Stephens), Oxford University Press.

Rangasamy Remesan, M. S. Roopesh, N., Remya and Preman, P. S. 2007. Wet Land Paddy Weeding- A Comprehensive Comparative Study from South India. Agricultural Engineering International: the CIGR E-journal. Manuscript PM 07 011. Vol. IX. December.

Sharma, V. K., Garg, I. K., Singh, S. and Sodhi, S. 1987. Performance evaluation of weeding equipment on wheat crop, *J. Agril. Engg.* **24(2):** 122-126.

Shekar, S. Chandra, S and Roy, D. K. 2010. Performance evaluation of different weeding tools in maize, *Indian J. Weed Science.* **42(1&2):** 95-97.

Thawait, D., Patel, A. K., Kar, S., Sharma, M. K. and Meshram, M. R. 2014. Performance of transplanted scented rice (Oryza sativa L.) under sri based cultivation practices; a sustainable method for crop production. *The Bioscan.* **9(2):** 539-542.