IJARSE, Vol. No.4, Special Issue (02), February 2015 ISSN-2319-8354(E)

MECHANICAL WEED CONTROL BY CONOWEEDER IN SRI METHOD OF PADDY CULTIVATION

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ABSTRACT

The study revealed that weeders and methods selected for the study has its own strengths and limitations. Conoweeder can be recommended in the early stages of weed growth as the better weeding efficiency, more turning of the soil and uprooting of weeds overrules the higher cost of operation. Conoweeder performed the task with comparatively higher field capacity, better performance index in the early stages of weed infestation. The field performance analyses have shown that Weeding efficiency as 72.2 % for Conoweeder with damage factor of 4.1% respectively. It was found that a male subject took an average of 80.8 h/ha respectively for weeding operation with conoweeders; whereas the female subject took 125 h/ha. The hand weeding was a superior weeding system for crop growth parameters than any other system employed in this study. The Conoweeding system also showed consistently greater results which were comparable to hand weeding. The performance analysis results demonstrated that weeding tools can produce large reductions in the weeding costs and significant reductions in labour time, whereas hand weeding reached the best efficiency in weed control. The combination of Conoweeding and chemical weeding is very effective as compared to other treatments.

Keywords – SRI, Conoweeder, Mechanical weeding, Chemical weeding, Hand weeding

I. INTRODUCTION

Paddy is major crop of Gadchiroli district over 1,42,500 hec with average annual rainfall of 1440 mm. The System of Rice Intensification (SRI) method is new emerging technique in the farming community of Gadchiroli. As a new way of looking at rice cultivation SRI is emerging as an alternative to conventional water and chemical intensive rice cultivation. One of the major laborious and time consuming operations in rice cultivation is weeding. The global figure for crop yield loss is accepted as 10% of actual yield (Fletcher, 1983). The yield losses ranges from 10-50% in transplanted rice and 50-90% in upland rice depending on the extend of weed infestation (Pathak et.al., 1976). In Gadchiroli paddy growers grant their higher priority to hand weeding in traditional as well as in SRI method. As SRI paddy cultivation is now more popularizing and to mechanize the weeding, Conoweeders are used for weed control.

So it is highly significant to study the comparative evaluation of these weeding methods in terms of performance with competitive methods like manual and chemical weeding and its cost effectiveness. Therefore, this research project is undertaken.

II METHODOLOGY

This study is conducted on the farm of Krishi Vigyan Kendra, Sonapur – Gadchiroli. The farm selected has soil with clay fractions. The experimental field was well prepared through two ploughing, leveling and puddling with puddler. The PKV HMT variety of paddy was grown in bed nursery. After 15 days the crop was transplanted to the main field with a row to row spacing of 25cm and plant to plant spacing of 25 cm by manual transplanting as per the SRI method. The test field was divided into twenty five plots of 10 m x 10 m size. As per the treatments weed control operations were followed for manual, mechanical, chemical and combine treatments. After emergence of weeds Conoweeders was applied for intercultivation and weed reduction. Performance evaluation of Conoweeder was studied and the use of Conoweeder was compared with the conventional hand weeding and newly emerging chemical weeding. Effect of Conoweeder application on the yields of paddy was recorded.

Different characteristics, treatments and replications selected as below –

Characteristics **11**	**Treatments** **6**	**Replications** **5**
Weeding Efficiency (%)	Hand Weeding (T1)	5 for each treatment
Damage Factor (%)	Cono Weeding(T2)	
Field Capacity – Male ha/day	Chemical Weeding(T3)	
Field Capacity – Female ha/day	Cono + Hand(T4)	
Performance Index - Male	Chemical + Hand (T5)	
Performance Index - Female	Cono + Chemical (T6)	
Time reqd. – Male hr/ha		
Time reqd. – Female hr/ha		
Cost of operation – Male Rs/ha		
Cost of operation – Female Rs/ha		
Yield qtl/ha		

Experimental design and treatment details

Treatments	Symbol	Details of Treatment
T1	H	H – Hand weeding
T2	W	W – Conoweeder
T3	C	C – Chemical weedicide application
T4	WH	WH – Weeding using Conoweeder and one hand weeding
T5	CH	CH – Weeding using Chemical weedicide Butachlore and one hand weeding
T6	WC	WC – Weeding using Conoweeder and chemical weedicide application

There were six treatments as above and each replicated five times.

The specifications of the Conoweeder selected for analysis is as shown below

Specifications	Conoweeder
Weight (kg)	6.5
Effective width (cm)	16
Depth of cut (cm)	4
Handle length (cm)	42
Handle circumference (cm)	9
Rotor spacing (cm)	25
Float Width (cm)	9.5
Float Length (cm)	35
Weeder Height (cm)	109
Weeder Length (cm)	171
Angle of Inclination (Degree)	32.5

Evaluation of Field Performance of Weeders

To evaluate the field performance of Conoweeder and other methods different parameters like weeding efficiency, damage factor, field capacity, performance index, time required for weeding etc. were measured with standard formulas.

A square loop (0.25 m^2) was randomly thrown to the experimental plots and the number of weeds included in the loop was counted before and after weeding. Five sets of readings were taken and the average was calculated. The weeding efficiency or weeding index is calculated using the formula:

Weeding Efficiency (WE)

WE = W1 –W2 /W1,

Where, W1 = Number of weeds before weeding

W2 = Number of weeds after weeding

Damage Factor (DF)

DF or quality of work done is the measure of damage on crop plants, while weeding operations, denoted by the expression given below.

DF % = Q2/Q1 x 100,

Q1 - Number of plants in 10 m row length before weeding

Q2 – Number of plants damaged along 10 m row length after weeding.

Performance Factor (PF)

The performance factor was calculated as:

PF = Field Capacity (ha/h) x (100 – DF (%)) x WE (%) / Power (Hp)

Where , DF = Damage Factor (%)

WE = Weeding Efficiency (%)

III RESULTS

3.1 Weeding Efficiency

Weeding efficiency was 83.4, 72.2, 80.3, 86.4, 82.4 and 88.8 respectively for Hand weeding, Conoweeding, Chemical weeding, Cono + Hand Weeding, Chemical + Hand weeding and Conoweeding + Chemical weeding. The increased soil contact and soil inversion capacity of Conoweeder add greater values to its higher weeding efficiency. Conoweeder gives better performance on initial stages of weed growth. If the weeds are matured the Conoweeder just rolls over the weeds with minimum uprooting and inversion. Chemical weedicide applied is Butachlore with 2.5 lit/ha dose. This is pre emergence weedicide. Weeds grown after application of Butachlore were measured.

3.2 Damage Factor

The damage factor 0.76%, 4.1%, 0%, 4.16% and 0.54% and 4.04% for Handweeding, Conoweeding, Chemical Weeding, Cono + Hand Weeding and Chemical + Hand weeding. The higher percentage damage in the case of Conoweeder due to the higher effective width of cut of weed rolls and uneven transplanting. Moreover, greater depth of cut and inversion of Conoweeder cause the uprooting of crop, which are extending to the row spacing.

3.3 Velocity & Field Efficiency of weeding operations

Conoweeder had higher velocity of operation. For male subjects, the velocity of weeding is 0.44 m/s and for female subjects 0.32 m/s respectively. The time loss for turning was 1.73 h/ha for male subjects and 2.4 h/ha for female subjects. For Conoweeder the field efficiency was 86.5%. The time loss independent of area, which is required for the operation, was about 4 h /ha. The time loss for turning was 1.83 h/ha for male subjects and 2.51 h/ha for female subjects for the same.

3.4 Field capacity

It is observed that Conoweeder had higher field capacity. The field capacities of Conoweeder were 0.16 ha/day and 0.12 ha/day for male and female subjects respectively. In case of hand weeding by male and female laborers, field capacities were obtained as 0.0232 ha/day and 0.0202 ha/day respectively. That is the male and female laborers took an average of 367 and 310 labour hours per hectare respectively. In case of chemical weeding field capacity of female is 0.91 ha/day and for male is 1.132 ha /day.

3.5 Performance Index

Performance index of a weeding implement would be directly related to the field capacity, weeding efficiency and (100-damage factor in percentage) inversely related to power exerted. The performance index for male and female that of Conoweeder were 372 and 371. The performance index of Chemical weeding was higher than that of the hand & Cono weeding; this is because of higher field capacity and minimal or no damage factor.

3.6 Time required for Weeding

The study shows that the time required for hand weeding per hectare was in the range of 360-380 h (average value 360 h) for male labours and that for female labours was 300-320 h (average value 310 h). For the same area, male labours took an average of 80 h for conoweeding and female labours performed the task in 125 h for conoweeding respectively. For chemical weeding hr/ha required for male & female were 45 & 63 respectively.

3.7 Economic Analysis

The economic aspects of weeding were analyzed using the straight-line method. The expenses associated with different weeding operations are depicted in Table 2. The study showed that cost of weeding for female labours could be reduced by 2.5 times by using Conoweeder, compared to hand weeding. While for male labours the weeding cost could be reduced by 4.5 times by using Conoweeder compared to hand weeding.

Table 1 . Mean performance characteristics of different weeding operations

Characteristics	Hand Weeding	Cono Weeding	Chemical Weeding	Cono + Hand	Chemical + Hand	Cono + Chemi
Weeding Eff. (%)	83.4	72.2	80.3	86.4	82.4	88.8
Damage Factor (%)	0.76	4.1	0	4.16	0.54	4.04
Field Capacity – Male ha/day	0.0232	0.15858	1.132	0.0414	0.1262	0.10978
Field Capacity – Female ha/day	0.0202	0.11156	0.91	0.052	0.1342	0.0848
Performance Index – Male	427.4	372	515.8	366	492.2	877.8
Performance Index – Female	442	371	499.6	363	503.2	814.8
Time reqd. – Male hr/ha	367	80.8	45.4	115.2	65.8	123.6
Time reqd. – Female hr/ha	310	125	63	144.8	75.2	151.6
Cost of operation – Male Rs/ha	5716	1250	1680	1596	1942	3220
Cost of operation – Female Rs/ha	4646	1840	1900	2252	2180	3780
Yield qtl/ha	22.56	26.38	23.3	30.44	28.6	31.32

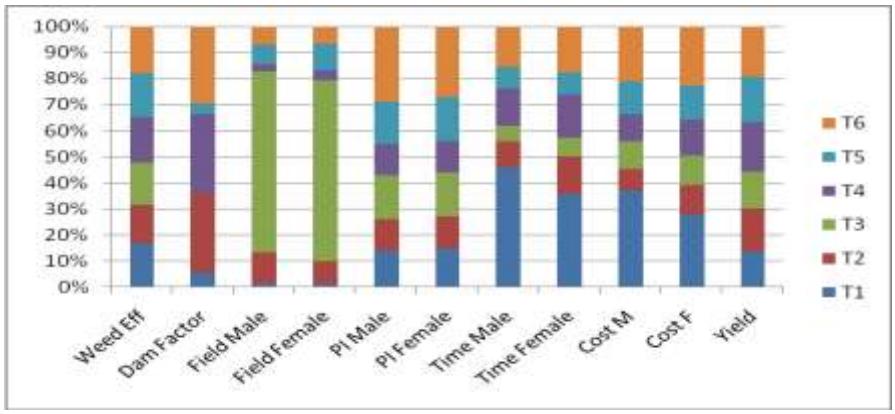
3.8 Statistical Analysis

Statistical analysis is done for the five treatments and five replications with characteristics as shown in the table

From the statistical analysis it is revealed that Treatment T6 (Conoweeder + Chemical Weeding) recorded weeding efficiency of 88.8 % and was at par with T4 (Conoweeding + Hand Weeding) which recorded weeding efficiency of 86.4%. Treatment T4 (Conoweeder + Hand Weeding) recorded weeding efficiency of 86.4 % and was at par with T1 (Hand Weeding) which recorded weeding efficiency of 83.4%. T4 & T1 were significantly superior over T5 (82.4%), T3 (80.3%) & T2 (72.2%).

Characteristics / Treatments	WE (%)	DF (%)	FCM ha/day	FCF ha/day	PI – Male	PI – Female	TM hr/ha	TF hr/ha	Cost Male Rs/ha	Cost– Female Rs/ha	Yield qtl/ha
Hand Weeding (T1)	83.4	0.76	0.0232	0.0202	427.4	442	367	310	5716	4646	22.56
Cono Weeding (T2)	72.2	4.1	0.1585	0.11156	372	371	80.8	125	1250	1840	26.38
Chemical Weeding (T3)	80.3	0	1.132	0.91	515.8	499.6	45.4	63	1680	1900	23.3
Cono + Hand (T4)	86.4	4.16	0.0414	0.052	366	363	115.2	144.8	1596	2252	30.44
Chemical + Hand (T5)	82.4	0.54	0.1262	0.1342	492.2	503.2	65.8	75.2	1942	2180	28.6
Cono + Chemi (T6)	88.8	4.04	0.1097	0.0848	877.8	814.8	123.6	151.6	3220	3780	31.32
SE	0.51	0.07	0.02	0.01	4.38	6.64	2.68	2.96	61.41	51.91	0.62
CD	1.5	0.21	0.05	0.04	12.93	19.6	7.92	8.74	181.12	153.11	1.84
CV	1.39	7.17	13.2	13.97	1.93	2.98	4.51	4.57	5.35	4.2	5.14
Significance	S	S	S	S	S	S	S	S	S	S	S

Graphical representation of the weed control treatments is as below



IV CONCLUSION

The study revealed that the weeders and methods selected for the study has its own strengths and limitations. Conoweeder can be recommended in the early stages of weed growth as the better weeding efficiency, more turning of the soil and uprooting of weeds overrules the higher cost of operation. Conoweeder performed the task with

comparatively higher field capacity, better performance index in the early stages of weed infestation. The field performance analyses have shown that Weeding efficiency as 72.2 % for Conoweeder with damage factor of 4.1% respectively. It was found that a male subject took an average of 80.8 h/ha respectively for weeding operation with conoweeders; whereas the female subject took 125 h/ha. The hand weeding was a superior weeding system for crop growth parameters than any other system employed in this study. The Conoweeding system also showed consistently greater results which were comparable to hand weeding. The performance analysis results demonstrated that weeding tools can produce large reductions in the weeding costs and significant reductions in labour time, whereas hand weeding reached the best efficiency in weed control. The combination of Conoweeding and chemical weeding is very effective as compared to other treatments. Farmers avoid the chemical weed control if manual and mechanical options are available. More precision is required to use the chemical weedicides. This is the good option in the scarcity of labours on time. The study could conclusively identify weeding operation, as one of the major factors which can pose a great influence on crop yield.

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