Short Communication

Weed density and control efficiency of different weed control methods in transplanted rice in Nepal

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ARTICLE INFORMATION

ABSTRACT

This study was performed to evaluate the weed density and weed control efficiency (WCE) on transplanted rice under different treatments at a farmer's field, Bhanu-11, Rupakot, Nepal during Rainy season of 2017. Ten treatments (one manual weeding at 21 days after transplanting (DAT) (T_1); two manual weeding at 21 and 42 DAT (T_2); three manual weeding at 21, 42, and 63 DAT (T_3); single *cono* weeding at 21 DAT (T_4); double *cono* weeding at 21 &42 DAT (T_5); triple *cono* weeding at 21, 42, and 63 DAT (T_6); butachlor as pre emergence (T_7); butachlor with single manual weeding at 21 DAT (T_8); butachlor with double manual weeding at 21 & 42 DAT (T_9) and weedy check (T_{10}) were laid in randomized complete block designs (RCBD) with three replications. At 30 DAT, the highest weed density was recorded at unweeded check (T_{10}) while it was the lowest at butachlor with double manual weeding (T_9). At 60 DAT the effective weed control method on weed density was found to be double manual weeding (T_2). At 90 DAT triple *cono* weeding (T_6) was found to be more effective on controlling weed density (30) and was at par double manual weeding (T_2), double *cono* weeding (T_5) and butachlor with double manual weeding (T_9). WCE was the highest in the plot treated with butachlor with double manual weeding at 21 and 42 DAT (T_9) and the lowest in the plot treated with butachlor pre emergence (T_7) at 30 DAT. At 90 DAT, WCE in the plot treated with triple weeding (T_6) was found the highest (78.63%) and the lowest in the plot treated with butachlor as pre emergence (T_7) (26.14%).

Introduction

Rice is one of the principal staple food crop of Nepal. It fulfills the 50% calories requirement of Nepalese people (Gautam et al. 2019; Adhikari et al. 2019). The area, production and productivity of rice in Nepal during fiscal year 2016/017 was 1552469 ha, 5230327 tons and 3.37 tons ha^{-1},

respectively (MoAD, 2017/18). Rice is said to be on the front line to fight against the hunger and national poverty. Increasing rice production can solve this food-deficit problem and save millions of rupees now spent by the government every year on bringing grains into food-deficit areas of Nepal. The production and productivity of rice has not geared up as much as required with traditional system of cultivation along with several biotic (weed, insect, pest and diseases) as well as abiotic factors (drought, flood, etc.). Among biotic factors, weed infestation in rice field in different growth stage is a major problem especially in rainfed ecosystem (Kandel et al. 2019). Crop weeds are always considered as one of the most important pest with regard to its negative effect on crop with final yield. There are so many definitions of weeds such as a plant out of place, any plant growing where it is not desirable, an unwanted plant, special form interferes with human activities or human welfare (Ranjit, 2017). Weeds compete with crops for moisture, space, light, nutrients and air. About 17 - 47% losses in yield is due to the high weed infestation in transplanted rice and about 14-93% in direct seeded rice / upland rice which depends upon type and density of weeds (Ranjit et al. 1989; Singh et al. 2004; Mondal et al*.* 2005; Mandal et al. 2013). The greatest loss caused by the weeds resulted from their competition with crop for growth factors such as nutrients, soil moisture, light and space (Walia, 2006).The major rice weed flora found in western mid hills of Nepal were *Fimbristylis miliacea, Rotata indica, Ageratum conyzoides, Cyperus iria, Polygonum barbatum and Cynodon dactylon* on both Direct Seeded Rice (DSR) and Transplanted Rice (TPR) whereas, *Digitaria* sp.,*Amischophac elusaxillaris* L.,*Echinochloa crusgalli* , *Paspalum distichum* L.,*Alternanthera sessiles* L.,*Echinochloa colona* L., were minor and *Rotata indica* was found the major weed in TPR (Paudel et al. 2017). The main objective of weed management in any crop field is to decrease weed density below the critical threshold level while not the eradication of any species. Weed control methods may varies depending upon the size of farm, culture, crops and economic status of farmers (Ranjit, 2017). The main purpose of this research was to evaluate the weed density and weed control efficiency under different weed control practices in transplanted rice in western mid hill conditions of Nepal.

Materials and Methods

The experiment was conducted in Bhanu-11 Rupakot, Tanahun, Nepal during rainy season 2017. It was located at 28 7' to 28 10' North latitude and 84 24' to 84 28' east longitude at an altitude of 800 m above mean sea level (DPT, 2016). The experiment was conducted using a Randomized complete block design (RCBD) with 10 treatments (one manual weeding at 21 DAT (T_1); two manual weeding at 21 and 42 DAT (T_2); three manual weeding at 21 42 and 63 DAT (T_3); single *cono* weeding at 21 DAT (T_4); double *cono* weeding at 21 and42 DAT (T_5); triple *cono* weeding at 21,

42 and63 DAT (T_6); butachlor as pre emergence (T_7); butachlor with single manual weeding at 21 DAT (T_8); butachlor with double manual weeding at 21 and 42 DAT (T_9) and weedy check (T_{10}). and 3 replications. The dimensions of the individual plot were 3 m length and 2 m breadth (6 m² area). The crop geometry was 20 x 20 cm. The net plot size was determined by deducting 4.4 m². The total net plot area was 2.20 m length and 2 m of breadth (4.40 m²), 11 rows of 2 m long. Sukhadhan-3 (Farmers preferred rice variety) variety of rice was used in the experiment. Data on weed density and weed control efficiency was taken and analysis of data was carried out by statistical Package R. The weed density and weed control efficiency was calculated as under practices and formula.

Weed density

The total number of weeds was counted from the sampled weeds of all observation dates taken from the sampling area of each plot. It was expressed in numbers per square meter.

Weed control efficiency

Weed control efficiency (WCE) expresses the percentage reduction in weed population due to weed management practices over control. The weed control efficiency (WCE) was calculated using following formula (Mani et al. 1973).

$$\text{WCE} = \frac{WP_c \; - \; WP_t}{WP_c} \times 100$$

Where, WP_c = Weed population (number/ m²) in control plot, WP_t = Weed population (number/m²) in treated plot.

Results and Discussion

The experimental findings obtained during the investigation were analyzed and an effort has been made to elicit the influences of different weed control methods on weed density and final yield expressions of rainfed lowland rice. The results are presented through tables below, structured according to the main experiments conducted.

Weed density (Number of weeds m⁻²)

Statistically significant difference was observed in the treatments used in the experiment on weed density at 5% level of significance (Table 1). At 30 DAT, the highest weed density was recorded at unweeded check (T_{10}) (55 weeds/m²) followed by Butachlor applied as pre-emergence (T_7) (32 weeds/m²) while it was the lowest at butachlor with double manual weeding (T_9) and triple manual weeding (T_3) (16 weeds/m²).Statistically, single manual weeding (T_1) (20 weeds/m²), double manual weeding (T_2) (19 weeds/m²), single *cono* weeding (T_4) (23 weeds/m²), double cono

weeding (T_5) (23 weeds /m²) were not significantly different or they were statistically at par. Similarly, the treatments like double *cono* weeding (T_5) (23 weeds/m²) and butachlor applied as pre emergence (T_7) were statistically at par (32 weeds/m²). Statistically significance differences found on plant density at 60 DAT. The highest weed density was found in unweeded plot (T_{10}) (119 weeds /m²) followed by butachlor applied as pre emergence (T_7) (52 weeds/m²). Statistically non significance differences was found in T_{10} and T_7 plots on weed density while differ with other remaining treatments. Similarly, except T_7 and T_{10}, all remaining treatments were statistically at par (Table 1). There was significance differences found on weed density at 90 DAT.

Table 1. Effect of different weed control methods on total weed density (number of weeds m⁻²) of transplanted rice.

Treatments	Weed density (Number of weeds/m⁻²)			Grain yield (ton ha⁻¹)
	30DAT	60DAT	90 DAT	
T_1 SMW at 21 DAT	16[d]	36[bc]	80[c]	4.267[b]
T_2 DMW at 21 and 42 DAT	20[cd]	27[c]	43[de]	5.530[a]
T_3 TMW at 21, 42 and 63 DAT	19[cd]	28[c]	63[cd]	5.490[a]
T_4 SCW at 21 DAT	23[c]	34[c]	62[cd]	4.257[b]
T_5 DCW at 21 and 42 DAT	23[bc]	38[bc]	45[de]	5.493[a]
T_6 TCW at 21, 42 and 63 DAT	23[c]	30[c]	30[e]	5.130[a]
T_7 B as pre-mergence	32[b]	52[b]	104[b]	5.907[a]
T_8 BSMW at 21 DAT	17[d]	28[c]	73[c]	5.557[a]
T_9 BDMW at 21 DAT and 42 DAT	16[d]	33[c]	46[de]	5.763[a]
T_{10} Unweeded (check)	55[a]	119[a]	142[a]	3.660[b]
F test (at 5%)	* *	* *	**	*
LSD (= 0.05)	5.03	16.99	21.18	0.86
CV (%)	6.7	3.7	4.4	9.79
Grand Mean	24	42	69	5.11

Note: DAT=days after transplanting; SMW=single manual weeding; DMW= double manual weeding, TMW=triple manual weeding, SCW=single *cono* weeding; DCW= double *cono* weeding, TCW= triple *cono* weeding, B= Butachlor, BSMW= Butachlor+ single manual weeding; BDMW= Butachlor + double manual weeding; * Significant; **highly significant.

The weed density per square meter trend was found similar with 60 DAT. The highest weed density was found in unweeded plot (T_{10}) (142 weeds /m²) followed by T_7 (104 weeds/m²) and T_1 (80 weeds /m²). Triple *cono* weeding (T_6) was found to be higher effective on controlling weed density (30 weeds /m²) and was at par with double manual weeding (T_2) (43 weeds /m²), double *cono* weeding (T_5) (45 weeds /m²) and butachlor with double manual weeding (T_9) (46 weeds

/m²). Athaulla et al. (2017) reported maximum weed population found in unweeded rice with low grain yield, which is accordance to our research results. In contrast Adhikari et al. (2019) reported the number of weed species per meter square was non-significantly influenced by different weed management practices. Among treatments, the lowest weed density and highest yield was obtained in butachlor application plus single manual weeding which might be more economical and profitable business compared to other treatments.

Weed control efficiency (WCE %)

Mean Weed Control Efficiency (WCE) at 30, 60 and 90 DAT was found 54.81%, 70.9% and 57.2% respectively. WCE was significantly influenced by different weed management practices at 30 60 and 90 DAT. Among the different treatments, WCE was the highest in the plot treated with single manual weeding (T₁) (70.07%) and the lowest in the plot treated with butachlor pre emergence (T₇) at 30 DAT. At 90 DAT, WCE in the plot treated with triple *cono* weeding (T₆) was found highest (78.63%) and the lowest in the plot treated with butachlor as pre emergence (T₇) (26.14%).

Table 2. Effect of different weed control methods on weed control efficiency of transplanted rice.

Treatments	Weed control efficiency (%)			Grain yield (ton ha^{-1})
	30DAT	60DAT	90 DAT	
T$_1$ SMW at 21 DAT	70.07^a	69.61^a	43.96^c	4.267^b
T$_2$ DMW at 21 and 42 DAT	63.31^{ab}	77.27^a	69.82^{ab}	5.530^a
T$_3$ TMW at 21,42and 63 DAT	65.16^{ab}	76.01^a	54.61^{bc}	5.490^a
T$_4$ SCW at 21 DAT	57.10^b	71.13^a	56.54^{bc}	4.257^b
T$_5$ DCW at 21 and42 DAT	57.71^b	67.13^{ab}	68.59^{ab}	5.493^a
T$_6$ TCW at 21, 42 and 63 DAT	57.26^b	73.73^a	78.63^a	5.130^a
T$_7$ B as pre-mergence	39.90^c	56.05^b	26.14^d	5.907^a
T$_8$ BSMW at 21 DAT	69.32^a	76.28^a	48.82^c	5.557^a
T$_9$ BDMW at 21 DAT and 42 DAT	70.43^a	70.64^a	67.42^{ab}	5.763^a
T$_{10}$ Unweeded (check)	-	-	-	3.660^b
F test (at 5%)	* *	* *	**	*
LSD (=0.05)	8.36	12.28	14.42	0.86
CV,%	7.0	11.7	4.6	9.79
Grand Mean	54.81	70.9	57.2	5.11

Note: DAT, days after transplanting; SMW=single manual weeding; DMW= double manual weeding, TMW=triple manual weeding, SCW=single *cono* weeding; DCW= double *cono* weeding, TCW= triple *cono* weeding, B= Butachlor, BSMW= Butachlor+ single manual weeding; BDMW= Butachlor + double manual weeding; * Significant; **highly significant.

Conclusion

Statistically, high significant result was obtained for weed density at 30, 60 and 90 DAT respectively. Maximum weed density was found in unweeded field for 30, 60 and 90 DAT respectively. WCE was the highest in the plot treated with single manual weeding (T_1) (70.07%) and the lowest in the plot treated with butachlor pre emergence (T_7) (39.90%) at 30 DAT. At 90 DAT, WCE in the plot treated with triple *cono* weeding (T_6) was found the highest (78.63%) and the lowest in the plot treated with butachlor as pre emergence (T_7) (26.14%). It is concluded that application of butachlor plus double manual weeding gave the best results for controlling weed efficiently while triple *cono* weeding results was also found interesting.

Conflicts of Interest

No conflicts of interest have been declared**.**

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