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Research Article

EFFECT OF DIFFERENT HERBICIDES AND HAND WEEDING ON GROWTH ATTRIBUTES AND YIELD IN TRANSPLANTED RICE

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Abstract: The field investigation was carried out at Annamalai University, Faculty Agriculture, experimental farm, Annamalai Nagar to study the effect of different weed management practices in transplanted rice during *rabi* 2014. The experiment was laid out in a randomized block design with seven treatments and three replications using rice variety BPT 5204 as test crop. Weed management practices had significantly influenced the growth attributes in transplanted rice. The plant height, dry matter production, leaf area index, crop growth rate and relative growth rate were significantly higher under hand weeding twice at 20 and 40 DAT. However, it was comparable with application of Pretilachlor + Pyrazosulfuron ethyl @ 0.615 kg ha^{-1} as pre emergence (T_7).

Keywords: *Rice, Pretilachlor, Pyrazosulfuron ethyl, Dry matter production and growth attributes*

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Introduction

Rice is grown over an area of about 44 m. ha in India with the total production of 105 m tones, accounting 40% of the total food grain in the country [1]. To meet the future food requirements of ever-increasing population and to maintain self-sufficiency, the estimated rice production in India should be 350 million tonnes by 2020 AD [2]. One of the most important methods to increase rice production is to minimize crop loss by weed competition. Because weed competition is one of the prime yields limiting biotic constraints in rice, weeds compete in their early growth stages than at later stages and hence the growth of crops slows down and finally grain yield decreases [3]. Weeds not only reduce rice production but also have an adverse effect on rice grain quality. Hand weeding is the most effective method, however, high labour wages and non-availability of labour during peak periods of agricultural operations, timely weeding is not possible. For this, many pre-emergence herbicides *viz*., butachlor, pretilachlor and anilophos were recommended and used by farmers. But very few pre-emergence herbicides are available for the control of weeds in transplanted rice. So, there is a need to evaluate the new pre-emergence herbicides in transplanted rice. The recent trend of herbicide use is to find out an effective weed control measure by using low dose high efficiency herbicides which will not only reduce the total volume of herbicide use but also the application become easier and economical [4]. Hence the present investigation was carried out to find out the performance of Pretilachlor + Pyrazosulfuron ethyl on growth attributes of transplanted rice [5].

Materials and Methods

Site description

The experiment was conducted during rabi-2014 at Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu. The Experimental Farm is geographically located at 11°24' North latitude and 79°44' East longitude and an altitude of 5.79 m above mean sea level.

Weather and climate

The weather of Annamalainagar is moderately warm with hot summer months. During the cropping season of winter, the maximum temperature ranged from 34.8°C to 26.6°C with a mean of 30.17°C. The minimum temperature ranged from 24.8°C to 20.5°C with a mean of 23.2°C. The relative humidity ranged from 83 to 97 percent with a mean of 88.45 percent. The rainfall received was 1193.8 mm, distributed over 41 rainy days. The fertility status of the soil was found to be low in available nitrogen, medium in available phosphorus and high in available potassium. The pH of the soil was 6.5.

Experiment details

The experiment was laid out in a randomized block design with seven treatments, *viz*. T_1 – Unweeded control, T_2 – Two hand weeding on 20 and 40 DAT, T_3 – Butachlor @1.5 kg^{-1} (pre), T_4 – Pretilachlor @ 0.75 kg ha^{-1} (pre) , T_5 - Pyrazosulfuron ethyl @ 20 g ha^{-1} (pre), T_6 – (Pretilachlor + Pyrazosulfuron ethyl) @ 0.492 kg ha^{-1} (pre), T_7 – (Pretilachlor + Pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} (pre). Fertilizers were applied at the rate of 150: 50: 50 kg of N, P_2O_5 and K_2O ha^{-1}, respectively The entire dose of P_2O_5 and half dose of K_2O were applied as basal along with half dose of N. The remaining half dose of N and the balance K_2O were applied in two equal splits at 20 DAT and 40 DAT.

Measurements

Plant height was recorded at tillering (30 DAT) and flowering (60 DAT) stage by measuring from the ground level to the tip of the top most fully opened leaf or flag leaf at tillering and panicle initiation and mean values were expressed in cm. The leaf area index (LAI) was worked out with following formula [6].

LAI = L x W x K x Number of leaves plant^{-1} / Land Area occupied by plant

Where,

K = Adjustment factor (0.68 for dry season and 0.75 for wet season)

L = Length of leaf (cm)

Table-1 *Effect of difference herbicide application and hand weeding on growth attributes and yield in transplanted rice*

Treatments	Plant height (cm)		Leaf area index	Dry matter production (tha^{-1})		grain yield (tha^{-1})
	30 DAT	60 DAT		30 DAT	60 DAT	
T_1 - Unweeded control	34.50	53.84	3.92	3.95	7.50	3.15
T_2 - HW twice at 20 and 40 DAT	47.56	78.58	5.88	6.95	14.64	5.73
T_3 - Butachlor @ 1.5 kg ha^{-1}(pre)	38.51	64.07	4.62	5.63	9.94	4.03
T_4 - Pretilachlor @ 0.75 kg ha^{-1}(pre)	36.18	59.89	4.35	5.20	8.23	3.91
T_5 - Pyrazosulfuron ethyl @ 20 g ha^{-1}(pre)	41.71	67.88	4.95	5.88	11.51	4.50
T_6 - (Pretilachlor + Pyrazosulfuron ethyl) @ 0.492 kg ha^{-1}(pre)	43.47	73.53	5.32	6.30	13.26	5.16
T_7 - (Pretilachlor + Pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} (pre)	46.49	76.89	5.76	6.85	14.37	5.61
S.Ed±	0.76	0.86	0.07	0.08	0.18	0.05
CD (p=0.05)	1.67	2.63	0.17	0.17	0.40	0.17

W = Width of leaf (cm)
K = Correction factor (0.75)

For calculating the dry matter production, the samples were drawn from outside in the net plot area on 30 and 60 DAT and air dried in hot air oven at 70.0°C ± 5°C for 48 hours. The oven dry weight of the plant samples was computed in t ha^{-1} and recorded. AGR is expressed as g of dry matter produces per day. The crop growth rate (CGR) was estimated at tillering to panicle initiation by using the formula [7] and expressed in g m^2 day^{-1}. Relative growth rate (RGR) during different growth periods were calculated using the following equations [8] and expressed in g kg^{-1} day^{-1}.

$$AGR=W_2-W_1/t_2-t_1$$

$$CGR=1/p.\ W_2-W_1/t_2-t_1$$

Where,
W_1 = Dry weight of plant/m^2 recorded at time t_1,
W_2 = Dry weight of plant/m^2 recorded at time t_2, t_1 and t_2 were the interval of time, respectively.

$$RGR=\ln W_2-\ln W_1/t_2-t_1$$

Where,
ln = Natural log (loge), W_1 = Dry weight of plant/m^2 recorded at time t_1,
W_2 = Dry weight of plant/m^2 recorded at time t_2, t_1 and t_2 were the interval of time, respectively and is expressed as g/g/d.

Results and Discussion

Plant height of rice

Adoption of different weed management practices had distinct variations on the height of plants at all the stages of observation [Table-1]. The data shows that among the weed control measures hand weeding twice at 20 and 40 DAT registered highest plant height with 47.56 cm and 78.58 cm on 30 and 60 DAT, respectively. The higher plant height obtained in hand weeded plots was due to effective suppression of the weeds and also the better availability of all resources *viz*., light, moisture, space and more nutrients to the crop plants at different stages put forth the higher plants. This is in line with the findings of Sunil, *et al*., (2010) [9]. However, hand weeding at 30 and 60 DAT (T2) was on par with application of (pretilachlor + pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} with height of 46.49 cm and 76.89 cm on 30 and 60 DAT, respectively. The number of dominant broadleaved, grass and sedge weeds were gradually decreased with the application of herbicide results in significantly lower weed density and better weed control was observed with the application. These results were conformity with Angirs and Kumar Suresh (2005) [10] and Chopra and Chopra (2003) [11].

Leaf area Index

The higher leaf area index was recorded under hand weeding twice at 30 and 40 DAT recorded highest values in leaf area index at flowering stage (5.88) [Table-1]. However, it was on par with pre emergence application of pretilachlor + pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} (5.76). This might be due to the better control of weeds and reduced competition provided better environment for the full development of the canopy of the crop accounted for enhanced LAI. Leaf area index also determines the total assimilating area available to the plant and quantum of source that would ultimately be available for translocation to the sink as well new emerging shoots which the fourth enhanced the LAI. These finding were similar to the earlier reports of Sunil, *et al*., (2010) [9] and Thiyagarajan, *et al*., (2002) [12].

Dry matter production

From the [Table-1], the dry mater production increased with the age of crop and reached peak at maturity. Different weed management practices significantly influence the dry matter production of rice. Among the treatments hand weeding twice significantly recorded the highest dry matter production of 6.95 and 14.64 t ha^{-1} on 30 and 60 DAT, respectively. It was on par with pre emergence application pretilachlor + pyrazosulfuron ethyl @ 0.615 kg ha^{-1} in which 6.85 and 14.37 t ha^{-1} were recorded. This is in consistent with the findings of Sunil et al., (2010), who reported lesser weed competition as weeds might have been killed from their germination phase and keeping weeds at lower densities, favoured the crop with competition free condition for expressing higher growth rate resulted in more DMP. These treatments were followed by pre emergence application of pretilachlor + pyrazosulfuron ethyl) @ 0.492 kg ha^{-1} registered crop DMP of 13.26 t ha^{-1}. The lowest dry matter production 7.5 t ha^{-1} was recorded in unweeded control at 60 DAT.

Growth analysis

Growth analysis *viz*., CGR, AGR and RGR was distinctly influenced by different weed management practices. Among the weed management practices pre emergence application pretilachlor + pyrazosulfuron ethyl @ 0.615 kg ha^{-1} was accounted higher AGR of 7.52 g of dry matter per day at tillering to panicle initiation stage (figure 1), CGR values of 0.0109 g m^2 day^{-1} (figure 2) and RGR of 0.0557g kg^{-1} day^{-1} at tillering to panicle initiation next to weed free check. This might be due to pre emergence application (pretilachlor + pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} significantly reduced the weed growth. The effective control of weeds reduces the competition of natural resources such as light, moisture and nutrients.

The higher availability of these resources may favourably increase the growth which in turn results in increased DMP. The higher increment of DMP has evidence for obtaining higher growth rate in rice crop. Conducive crop growth environment with minimum stresses due to biotic factors like lesser weed competition reflects further on better growth of crops. This is in consistent with the findings of Sunil, *et al*., (2010) [9].

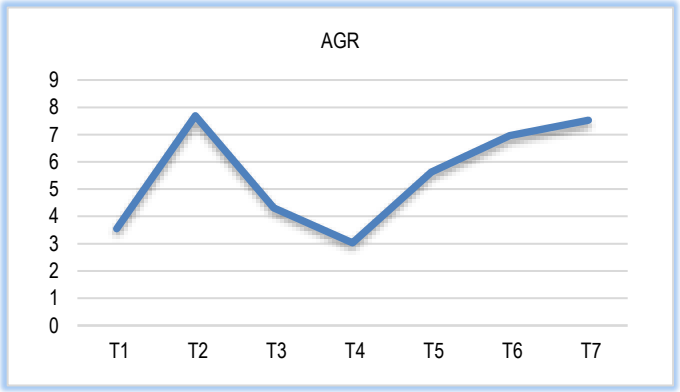

Fig-1 Effect of difference herbicide application and hand weeding on Absolute Growth Rate (g day^{-1}) in transplanted rice.

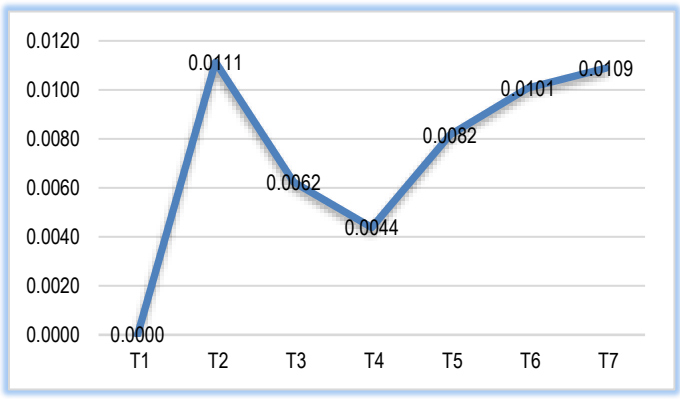

Fig-2 Effect of difference herbicide application and hand weeding on Crop Growth Rate (g kg^{-1} day^{-1}) in transplanted rice.

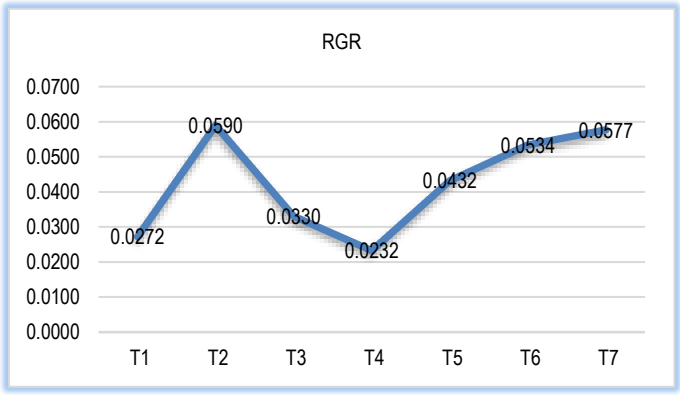

Fig-3 Effect of difference herbicide application and hand weeding on Relative Growth Rate (g $g^{-1}day^{-1}$) in transplanted rice.

Conclusion

From the present study, it is concluded that the weed control by either twice hand weeding on 20 and 40 DAT or by pre emergence application of (Pretilachlor + pyrazosulfuron ethyl) @ 0.615 kg ha^{-1} could be an effective weed control programme for transplanted rice. However, pre emergence application of (pretilachlor + pyrazosulfuron) @ 0.615 kg ha^{-1} could be suggested as the cost-effective weed management option especially in the present situation with inadequacy in labour and comparatively higher cost incurred in hand weeding.

Application of research: Studies on different weed management practices in transplanted rice

Research Category: Weed management

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Study area / Sample Collection: Experimental Farm, Annamalai University, Annamalainagar

Cultivar / Variety / Breed name: Rice

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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