RESEARCH ARTICLE

EFFECT OF SEQUENTIAL APPLICATION OF PRE AND POST EMERGENCE HERBICIDES IN RICE UNDER SODIC SOIL IN TIRUCHIRAPPALLI REGION OF TAMIL NADU

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Abstract: Field experiments were conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli during *rabi* 2011-12 and 2012-13. The soil was sandy clay loam with pH of 8.82 and 8.96 during *rabi* 2011-12 and 2012-13, respectively. Medium duration rice cultivar TRY 1 was used during both the years. The experiments were laid out in a strip plot design with three replications. The results revealed that direct planting system (DPS) recorded higher weed control efficiency and productivity of rice and among weed management practices, hand weeding twice at 20 and 40 DAT/S registered higher weed control efficiency and productivity of rice and it was comparable with PE pyrazosulfuron ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE bispyribac sodium 20 g a.i. ha^{-1} at 15- 20 DAT / 20 DAS during both the years of study.

Keywords: Rice, Weed control efficiency, Yield

INTRODUCTION

Rice is one of the most important food grains produced and consumed more than half of the world's population which influences the livelihoods of several billion. Rice crop suffers from various biotic and abiotic production stresses. Severe competition from weeds is one of the important biotic factors deterring productivity and sustainability. Weeds can cause a reduction of 28-45 % of grain yield in transplanted rice [7]. There are many weed control methods are practiced for better control of weeds in rice crop. For weed management, herbicides look better option than other methods because of their performance in controlling weeds and decreasing weed competition with crop. In recent years, chemical weed management is considered as an effective weed control method by using low dose high efficiency herbicides. Some of the promising low dose high efficacy pre- and post-emergence herbicides are available for control of wide spectrum of weed flora in lowland rice [4]. In the present study, work was carried out to study the effect of establishment methods and weed management practices on weed control efficiency, yield of rice under sodic soils.

MATERIAL AND METHOD

Field experiments were conducted during *rabi* 2011-12 and 2012-13 at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli. The soil was sandy clay loam with pH of 8.82 and 8.96 during *rabi* 2011-12 and 2012-13, respectively. Medium duration rice cultivar TRY 1 was used during both the years. The field experiments were laid out in strip plot design with three replications. Four crop establishment methods viz., manual line transplanting, mechanical line transplanting, direct planting system (DPS) and drum seeded rice and six weed management practices viz., pre-emergence pyrazosulfuron ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + post-emergence almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS, pre-emergence pyrazosulfuron ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + post-emergence bispyribac sodium 20 g a.i. ha^{-1} at 15- 20 DAT / 20 DAS, pre-emergence londax power 10.0 kg ha^{-1} at 0-3 DAT / 10-15 DAS + post-emergence almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS, pre-emergence londax power 10.0 kg ha^{-1} at 0-3 DAT / 10-15 DAS + post-emergence bispyribac sodium 20 g a.i. ha^{-1} at 15-20 DAT / 20 DAS, two hand weeding at 20 and 40 DAT/S and un-weeded control were taken for the experiments. Fertilizers were applied at the rate of 150: 50: 50 kg of N, P_2O_5 and K_2O ha^{-1}, respectively. Data on weed dry weight showed high variation. Hence the data were subjected to square root transformation using the formula $\sqrt{X} + 2$ and analysed statistically. From that weed control efficiency was worked out during both the years. Grain and straw were separated from net plot area, sun dried, weighed and expressed in kg ha^{-1}.

RESULT

Weed flora of the experimental fields

Weed flora of the experimental rice fields was observed in un-weeded control plots at 60 DAT/S. In general, weed density was higher during *rabi* 2012-13 than that in *rabi* 2011-12. Weed flora of the experimental fields during both the years of study were two species of grass weeds, one species of

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sedge weed and three species of broad leaved weeds. Predominant weeds in rice fields were *Echinochloa colonum* among grasses, *Cyperus rotundus* was only sedge weed and *Eclipta alba* among broad leaved weeds.

Effect of treatments on Weed control efficiency

Among crop establishment methods, direct planting system recorded laudably higher weed control efficiency of 76.67 and 78.23 per cent at 45 DAT/S during *rabi* 2011-12 and 2012-13, respectively **(Table 1)**. With regard to weed management practices, higher weed control efficiency was recorded (81.40 and 80.91 per cent at 45 DAT/S during *rabi* 2011-12 and 2012-13, respectively) in two hand weeding at 20 and 40 DAT/S **(Table 1)**. Followed by PE pyrazosulfuron ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE bispyribac sodium 20 g a.i. ha^{-1} at 15- 20 DAT / 20 DAS recorded higher weed control efficiency.

Table 1. Effect of crop establishment methods and weed management practices on weed control efficiency (per cent) in rice at 45 DAT/S during *rabi* 2011-12 and 2012-13

Treatments	*Rabi* 2011-12	*Rabi* 2012-13
Establishment methods		
M_1 - Manual line transplanting	73.81	74.36
M_2 - Mechanical line transplanting	76.03	74.68
M_3 - Direct Planting System (DPS)	76.67	78.23
M_4 - Drum seeded rice (Sprouted seeds)	72.32	74.38
Weed management practices		
S_1 - PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE Almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS	72.62	73.52
S_2 - PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE Bispyribac Sodium 20 g a.i. ha^{-1} at 15- 20 DAT / 20 DAS	75.51	78.48
S_3 - PE Londax power 10.0 Kg ha^{-1} at 0-3 DAT / 10-15 DAS + POE Almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS	70.83	68.52
S_4 - PE Londax power 10.0 Kg ha^{-1} at 0-3 DAT / 10-15 DAS + POE Bispyribac sodium 20 g a.i. ha^{-1} at 15-20 DAT / 20 DAS	73.17	75.64
S_5 - Two hand weeding at 20 and 40 DAT/S	81.40	80.91
S_6 - Un-Weeded control	-	-

(Data statistically not analysed)

Effect of treatments on productivity of rice

Among crop establishment methods, direct planting system recorded significantly higher grain yield of 5048 and 4639 kg ha^{-1} during *rabi* 2011-12 and 2012-13, respectively **(Table 2)**. Distinctly lower grain yield was obtained with drum seeded rice (3756 and 3466 kg ha^{-1} during *rabi* 2011-12 and 2012-13, respectively). Regrading weed management practices, hand weeding twice at 20 and 40 DAT/S recorded significantly higher grain yield **(Table 2)** Followed by PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT/8 DAS + POE Bispyribac Sodium 20 g a.i. ha^{-1} at 15- 20 DAT/20 DAS registered higher grain yield during both the years.

Table 2. Effect of crop establishment methods and weed management practices on grain yield (kg ha^{-1}) of rice during *rabi* 2011-12 and 2012-13

Treatments	*Rabi* 2011-12					*Rabi* 2012-13				
	M1	**M2**	**M3**	**M4**	**Mean**	**M1**	**M2**	**M3**	**M4**	**Mean**
S1	4157	4479	4926	3765	**4332**	4084	4240	4471	3398	**4048**
S2	4935	5061	5424	4295	**4929**	4634	4705	5107	4101	**4637**
S3	4078	4393	4715	3334	**4130**	3906	3987	4300	3167	**3840**
S4	4728	4776	5284	3817	**4651**	4350	4550	4786	3579	**4316**
S5	5268	5471	5759	4843	**5335**	5060	5194	5486	4508	**5062**

S6	3345	3986	4179	2480	**3497**	3018	3230	3685	2040	**2993**
Mean	**4418**	**4694**	**5048**	**3756**		**4176**	**4318**	**4639**	**3466**	
	M	**S**	**M at S**	**S at M**		**M**	**S**	**M at S**	**S at M**	
S.Ed.	101	176	176	223		85	162	132	188	
C.D.(P=0.05)	246	392	399	497		207	360	300	420	

M_1 – Manual line transplanting
M_2 – Mechanical line transplanting
M_3 – Direct Planting System (DPS)
M_4 – Drum seeded rice (Sprouted seeds)

S_1 – PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE Almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS
S_2 – PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE Bispyribac Sodium 20 g a.i. ha^{-1} at 15- 20 DAT / 20 DAS
S_3 – PE Londax power 10.0 Kg ha^{-1} at 0-3 DAT / 10-15 DAS + POE Almix 4 g a.i. ha^{-1} at 21-25 DAT / 20 DAS
S_4 – PE Londax power 10.0 Kg ha^{-1} at 0-3 DAT / 10-15 DAS + POE Bispyribac sodium 20 g a.i. ha^{-1} at 15-20 DAT / 20 DAS
S_5 – Two hand weeding at 20 and 40 DAT/S
S_6 – Un-Weeded control

DISCUSSION

Absence of rain in second year of study period (*rabi* 2012-13) leads to higher weed population than that in *rabi* 2011-12. In this study, weed control efficiency was higher in direct planting system. This results showed that in direct planting system, besides weeding treatment, rotary weeder was used to thin the plant stand twice at early stages of crop growth which was greatly reduced the weed density as well as weed dry weight. Higher weed density and dry weight in drum seeded rice is subjected to lower weed control efficiency during both the years. This might be due to the reason that in direct seeded rice weed control is difficult to identify grassy weeds and separate it from rice seedlings because of weeds and crops grown simultaneously [5]. Among weed management practices, hand weeding had higher weed control efficiency this is because of the reason that manual weeding was more efficient to identify and destroy all group of weed at later stages of crop. [1] Hand weeding twice at 20 and 40 DAT resulted in significantly lower weed density and dry weight as compared to herbicide treatment and un-weeded check.

In both the seasons, PE pyrazosulfuron ethyl at 3 DAT / 8 DAS + POE bispyribac sodium at 15 - 20 DAT / 20 DAS gave higher weed control efficiency due to the reason that this herbicided combination effectively contolled weeds at early and later stages of crop accordingly it was recorded reduced weed dry weight when compared to other treatments during both the years of study. This rice herbicide controlled sedge weeds and broad leaved weeds effectively [6] and [3].

Significantly higher yield was registered in direct planting system might be due to the reason that which possessed single seedling maintained like system of rice intensification due to rotary thinning at early stages, wider spacing (25×25 cm) better soil aeration due to rotary thinning and incorporation of weeds as well as extra seedling in to soil serves additional nutrient to crop. Grain yield is the product of number of productive tillers m^{-2} and number of filled grains per unit area [2]. Mechanical line transplanting was also gave higher yield during both the years. Lower rice yield was observed under drum seeded rice was mainly because of the reason that higher weed infestation leads to severe crop weed competition at early stages of crop which resulted in reduced yield.

Manual weeding gave better weed controlled environment which provides higher rice yield. [8] Hand weeding at 20 and 40 DAT recorded highest plant height, dry matter production, tillers m^{-2}, nutrient uptake by crop and lowest nutrient uptake by weeds throughout the crop growth period and registered higher grain and straw yield. Followed by sequential application of pre and post emergence herbicides had better weed control due to which decreases the crop weed competition and increases the crop yield. Pyrazosulfuron-ethyl, a new herbicide, was found effective for complex weed flora in rice [3].

It is concluded that direct planting system recorded higher weed control efficiency, and productivity of rice during both the years of study. Among weed management practice, hand weeding recorded higher weed control efficiency and grain yield followed by PE Pyrazosulfuron Ethyl 30 g a.i. ha^{-1} at 3 DAT / 8 DAS + POE Bispyribac Sodium 20 g a.i. ha^{-1} at 15-20 DAT / 20 DAS during both the years. Hand weeding is time consuming, expensive and tedious though much effective. Under the present situation of

unavailability of labourers and high wages, chemical weed management emerged as effective, timely and cost-effective weed control practice.

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