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Studies on different weed management practices for drum seeded wet rice under puddled condition

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ABSTRACT

Field experiment was conducted during rabi 2013-14 at Agricultural College and Research Institute, Killikulam to study the effective weed management strategies for drum seeded wet rice. The experiment was laid out in randomized block design with three replications. The treatment consisted of eleven weed management practices viz., T_1- PE Pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS, T_2 - PE Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS, T_3 - EPoE Bispyribac sodium 10% 25 g ha^{-1} at 15 DAS + Rotary Weeding on 40 DAS, T_4 - PE Pretilachlor 0.75 kg ha^{-1} on 8 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS, T_5 - PE Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS, T_6 - EPoE Bispyribac sodium 10% 25 g ha^{-1} at 15 DAS + PoE 2,4 - D Sodium salt 80%WP 1.25 kg ha^{-1} on 45DAS, T_7 - HW on 20 and 40 DAS, T_8 - Rotary Weeding on 10, 20, 30 and 40 DAS, T_9 - Rotary Weeding on 20 and 40 DAS, T_{10} - Weed free plot and T_{11} - Unweeded control. Among the treatments, weed free plot recorded the lowest weed density, weed dry matter and higher weed control efficiency as well as recorded the yield attributes and grain yield. Results indicated that apart from weed free plot, pre-emergence application of pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS significantly recorded the least weed density, weed dry matter and highest weed control efficiency at 30 and 45 DAS as well as higher yield attributes and grain yield (5430 kg ha^{-1}) and was on par with pre-emergence application of pyrazosulfuron ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS.

Key words : *Drum seeder, rice, weed management, weed dynamics, yield*

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INTRODUCTION

Rice is one of the most important cereal crops, which plays a key role for food security. In India, rice is cultivated in an area of 44.1 m ha with a production of 103.4 million tones [16]. The country has to produce about 130 million tones of rice by 2025 to meet the food requirement of the ever growing population [3]. Meeting the targeted demands of rice is a challenging task. Increasing water scarcity is becoming real threat for rice cultivation. Hence water saving technology which also maintains soil health and sustainability and as well as economically beneficial needs to be developed [15]. Establishing rice by transplanting is labour intensively and increasingly difficult due to higher cost and shortage of labour. Inadequate plant population with hired labour for transplanting is the major lacuna in this method [7]. Sowing of sprouted rice seeds in wet puddled soils offers an attractive, alternative and labour saving technique for stand establishment to the traditional transplanting. Wet seeded rice is gaining momentum in India and it have the advantages of quick and easier planting, reduces labour requirement and increased water use efficiency [5]. Drum seeding is an alternative method to transplanting. It reduces labour requirement and perform as good as transplanting method at many places. However, weed infestation and competition are severe in puddle drum seeded rice as compared to transplanted rice, because of the simultaneous growth of both crops and weeds [6].The yield loss due to unchecked weed growth was reported upto 30-48 % in direct seeded rice [11]. At present, no herbicide is available which may provide effective wide spectrum control of grasses, sedges and broad leaved weeds as pre or post

emergence application. Hence, an attempt was made to study the effective weed management strategies for weed control efficiency and productivity in drum seeded wet rice under puddled condition.

MATERIAL AND METHODS

Field investigation was carried out at central farm, Agricultural College and Research Institute, Killikulam during *rabi* season of 2013-14 to study the effective weed management strategies for drum seeded wet rice. The experiment was laid out in randomized block design with three replications. The treatment consisted of eleven weed management practices *viz*., T_1- PE Pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS, T_2 - PE Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS, T_3 - EPoE Bispyribac sodium 10% 25 g ha^{-1} at 15 DAS + Rotary Weeding on 40 DAS, T_4 - PE Pretilachlor 0.75 kg ha^{-1} on 8 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS, T_5 - PE Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS, T_6 - EPoE Bispyribac sodium 10% 25 g ha^{-1} at 15 DAS + PoE 2,4 - D Sodium salt 80%WP 1.25 kg ha^{-1} on 45DAS, T_7 - HW on 20 and 40 DAS, T_8 - Rotary Weeding on 10, 20, 30 and 40 DAS, T_9 - Rotary Weeding on 20 and 40 DAS, T_{10} - Weed free plot and T_{11} - Unweeded control. Sowing of sprouted seeds of rice variety ADT 45 was done through four row drum seeder with inter and intra row spacing of 20 and 10 cm, respectively. The crop was fertilized with recommended dose of 150:50:50 kg NPK ha^{-1}. Pre emergence herbicide was mixed with fine sand at the rate of 50 kg/ha and applied uniformly in the field on 8 DAS. The post emergence herbicides were mixed with water at the rate of 500 litres ha^{-1} and sprayed by using knapsack sprayer fitted with deflector nozzle. A thin film of water was maintained at the time of herbicide application. Rotary weeding was carried out as per the treatment schedule. All other agronomic and plant protection measures were adopted as per the recommended packages. Weed observations on weed flora, weed density, weed dry matter and weed control efficiency were recorded. Yield attributes, grain and straw yield were also recorded and documented.

RESULTS AND DISCUSSION

Effect on weeds

The important weed species observed in the experimental field were *Echinocloa colonum, Echinocloa gruscalli,, Cyperus rotendus, Cyperus differmis, Cyperus iria, Eclipta alba, Marsilia quadrifolia,* and *Bergia capensis.* The results revealed that there was no weed growth in weed free plot at early crop growth stage. Thus resulted in the lowest weed density, weed dry weight and higher weed control efficiency. Apart from the weed free condition, pre emergence application of Pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS recorded lower weed population and dry weight of weeds, respectively. It was on par with pre emergence Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS. This may be due to the fact that pretilachlor effectively controlled early flushes of weeds and Rotary weeding controlled latter flushes of weeds. These results in agreement with the findings of Nandal and Hari om [4] and Sangeetha [8]. Where as unweeded check recorded significantly higher weed population and weed dry weight, respectively (Table 1). The next best treatment was with the early post emergence application of Bispyribac sodium 10% 25 g/ha at 15 DAS + Rotary Weeding on 40 DAS in reducing the total density and dry weight. Yadav *et al*. [14] reported that post emergence application Bispyribac sodium 25 g ha^{-1} significantly reduced the density and dry weight of weeds in wet seeded rice.

The lowest density and dry weight of total weeds with higher weed control efficiency (77 %) was registered with pre emergence application of Pretilachlor 0.75 kg/ha on 8 DAS + Rotary Weeding on 20 and 40 DAS which was followed by pre emergence application of Pyrazosulfuron Ethyl 10% WP 20 g ai/ha on 8DAS + Rotary Weeding on 20 and 40 DAS and these two weed management practices were at par with each other. This was mainly due to better control of weeds growth resulting in lower dry weight of weeds. The results are in conformity with the findings of Sunil *et al*. [12].

Effect on yield attributing characters and yield

Weed management practices caused significant variations in terms of grain yield during both years irrespective of weed control treatments (Table 2). Good weed management contributed to superior performance over the poor one in terms of yield and yield contributing characters. Among the treatments, the highest grain yield was recorded from weed free treatment. Similar trends in yield components were also observed in this treatment. Apart from the weed free treatment, the higher yield attributes viz., panicle length (cm), No. of grains panicle^{-1}, No. of panicles m^{-2} and grain yield of drum seeded rice significantly when the plot was treated with pre emergence application of Pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS which was on par with pre emergence application of Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS. The straw yield also followed similar trend as that of grain yield. This might be due to effective control of all the categories of weeds during critical period of crop weed competition, which lead to increased growth

resources and better translocation of photosynthates from source to sink [2]. Drum seeded associated with application of pretilachlor followed by mechanical weeding or pyrozosulfuron followed by mechanical weeding produced maximum and significantly higher grain yield of rice than all other weed management practices. Similar results were also reported by Singh *et al*. [9] and Deeba Hasan *et a*l. [1]. The next best weed management practice to obtain broad spectrum of weed control with increased yield attributes and yield with early post emergence application of Bispyribac sodium 10% 25 g ha^{-1} at 15 DAS + Rotary Weeding on 40 DAS. This might be attributed to better growth of plants under the condition of reduced weed competition at critical crop growth stages thereby resulting in increased availability of nutrients, water and light. These results are in accordance with the findings of Subramanian *et al*. [11].

Table 1. Effect of weed management practices on weed dynamics of drum seeded rice

Treatments	Weed density (No.m^{-2})		Weed dry matter (g m^{-2})		Weed Control Efficiency (%)	
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS
T_1- PE Pretilachlor 0.75 kg ha^{-1} on 8DAS + Rotary Weeding on 20 and 40 DAS	(15.3) 3.98	(13.0) 3.68	(6.6) 2.67	(6.3) 2.73	78	80
T_2- PE Pyrazosulfuron Ethyl 10% WP 20g a.i ha^{-1} on 8DAS + Rotary Weeding on 20 and 40 DAS	(16.0) 4.06	(13.3) 3.71	(7.0) 2.73	(6.6) 2.67	76	79
T_3- EPoE Bispyribac sodium 10% 25g ha^{-1} at 15 DAS + Rotary Weeding on 40 DAS	(22.0) 4.74	(20.3) 4.56	(11.3) 3.43	(9.6) 3.17	62	70
T_4- PE Pretilachlor 0.75 kg ha^{-1} on 8 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	(27.0) 5.24	(24.0) 4.94	(13.3) 3.71	(11.6) 3.47	55	64
T_5-PE Pyrazosulfuron Ethyl 10% WP 20g a.i ha^{-1} on 8DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	(27.3) 5.27	(24.6) 5.0	(13.6) 3.75	(12.3) 3.57	54	62
T_6-EPoE Bispyribac sodium 10% 25g ha^{-1} at 15 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	(22.3) 4.78	(21.0) 4.63	(11.6) 3.47	(10.0) 3.31	61	69
T_7-HW on 20 and 40 DAS	(30.0) 5.52	(27.3) 5.27	(15.3) 3.98	(14.0) 3.80	49	57
T8-Rotary Weeding on 10, 20, 30 and 40 DAS	(19.6) 4.48	(17.3) 4.21	(9.0) 3.08	(8.0) 2.91	70	75
T_9-Rotary Weeding on 20 and 40 DAS	(20.0) 4.52	(17.6) 4.25	(9.6) 3.17	(8.3) 2.96	68	74
T_{10}-Weed free plot	(0.0) 0.7	(0.0) 0.7	(0.0) 0.7	(0.0) 0.7	100	100
T_{11}-Unweeded control	(71.6) 8.49	(76.3) 8.77	(30.0) 5.52	(32.6) 5.80	-	-
S.Ed	0.09	0.12	0.09	0.07		
CD (p=0.05)	0.20	0.20	0.21	0.15	NA	NA

Values in parentheses are original values. NA – Not Analyzed

The lowest grain yield attributes and yield were recorded with unweeded check. The reduction in grain yield in unweeded check was 15 percent competed to the best weed management practice. These results are in conformity with those of Tiwari *et al*. [13].

From the study, it may concluded that pre emergence application of Pretilachlor 0.75 kg ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS exhibited better weed control efficiency thereby resulted in higher grain yield followed by application of Pyrazosulfuron Ethyl 10% WP 20 g a.i ha^{-1} on 8 DAS + Rotary Weeding on 20 and 40 DAS. These weed management methods were found to be promising to control weeds in drum seeded wet rice under puddle condition.

Table 2. Effect of weed management practices on yield attributes and yield of drum seeded rice

Treatments	Panicle length (cm)	No. of grains Panicle^{-1}	No. of Panicles m^{-2}	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1-PE Pretilachlor 0.75 kg ha^{-1}on 8DAS + Rotary Weeding on 20 and 40 DAS	24.6	221.8	218.2	5430	5795
T_2-PE Pyrazosulfuron Ethyl 10% WP 20g a.i ha^{-1} on 8DAS + Rotary Weeding on 20 and 40 DAS	23.8	216.5	214.5	5360	5730
T_3-EPoE Bispyribac sodium 10% 25g ha^{-1} at 15 DAS + Rotary Weeding on 40 DAS	19.2	195.4	194.0	5025	5490
T_4-PE Pretilachlor 0.75 kg ha^{-1}on 8 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	17.3	180.3	181.5	4860	5320
T_5-PE Pyrazosulfuron Ethyl 10% WP 20g a.i ha^{-1} on 8DAS + PoE 2,4 – D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	17.0	178.2	178.6	4830	5250
T_6-EPoE Bispyribac sodium 10% 25g ha^{-1} at 15 DAS + PoE 2,4 - D Sodium salt 80% WP 1.25 kg ha^{-1} on 45DAS	18.6	190.5	191.2	4975	5460
T_7-HW on 20 and 40 DAS	15.5	170.0	171.5	4725	5155
T8-Rotary Weeding on 10, 20, 30 and 40 DAS	21.5	208.0	206.3	5230	5640
T_9-Rotary Weeding on 20 and 40 DAS	21.0	204.2	201.5	5180	5590
T_{10}-Weed free plot	26.0	232.0	225.4	5540	5890
T_{11}-Unweeded control	14.2	160.5	164.3	4620	5060
S.Ed	0.5	3.4	2.7	46	38
CD (p=0.05)	1.1	7.2	6.0	95	80

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