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RESEARCH ARTICLE

Effect of Pre and Early Post Emergence on Growth and Yield of Drum Seeded Rice under Puddled Condition

I. Chinnamani, N. Senthil kumar and A.Velayutham
Department of Agronomy
Agricultural College and Research Institute
Killikulam, Vallanadu- 628 252

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Abstract

Field experiment was conducted at Agricultural Research Station, Thirupathisaram during *Kumbapoo* season (November- March) of 2017 - 2018 to evaluate the effect of pre and early post emergence on growth and yield of drum seeded rice under puddled condition. Among the herbicides tried, the application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as Pre Emergence (PE) fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as Early Post Emergence (EPOE) recorded significantly higher plant height (102.0 cm), total number of tillers (373 m^{-2}) and highest dry matter production (13690 kg ha^{-1}) when compared to other treatments. Higher grain yield (6436 kg ha^{-1}) and straw yield (7210 kg ha^{-1}) was recorded in the application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE.

Keywords: *Drum seeded rice, Plant height, Dry matter production, Grain yield.*

Introduction

Rice (*Oryza sativa* L.) is the most important cereal crop and widely cultivated in the world. Asia is the home of rice as more than two billion people are getting 60-70% of their energy requirement from rice and its derived products (Raghavendra *et al.,* 2014*)*. About 90% of the world's rice is grown and produced 142 million ha area with production of 622 million tons in Asia (Harunur Rashid *et al*., 2012). Rice is one of the major contributors to the success by contributing approximately 43 per cent of total food grain production of India (Upendra *et al.,* 2013). In India rice is cultivated in an area of 44.38 million hectares with a production of 104.31 million tons. The country has to produce about 130 million tons of rice by 2025 to meet the food requirement of the growing population. In Tamil Nadu, rice is cultivated in a area of 20.37 lakh hectare with an annual production of 79.83 lakh tones (TNSTAT, 2016).

Transplanting rice is the ancient system of sowing and it is popular in many rice growing areas. Water resources, both at surface and underground are diminishing and water existence is doubtful. Moreover, transplanting operation is usually carried out by waged labours which are costly (Riaz *et al.,* 2007). The drum seeder equipment on puddled field is the best alternative idea for transplanting because it involves minimal use of labour. The drum seeding may benefit in cost reduction, faster growth and easiness in intercultural, lesser seed rate and higher yield compared to other method. Development of a suitable weed management strategy to alleviate weed pressure on the available resources is known to prop up the crop productivity considerably. Keeping the above aspects in view, effect of various herbicides was compared with weed free check and weedy check for evaluating increase in growth parameters and obtaining higher yields in drum seeded rice.

Material and Methods

Field experiment was conducted at Agricultural Research Station, Thirupathisaram during Kumbapoo season (November- March) of 2017 - 2018 evaluate the effect of pre and early post emergence on growth and yield of drum seeded rice under puddled condition. The experiment was laid out in a randomized block design with three replications. It consisted of nine treatments *viz.,* T_1- PE application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS fb Hand weeding on 30 DAS, T_2 -PE application of pyrazosulfuron ethyl @ 10% WP 20g a.i ha^{-1} on 8 DAS fb Hand weeding on 30 DAS, T_3 - PE application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS fb EPOE application of chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20g a.i ha^{-1} on 20 DAS, T_4 - PE application of pyrazosulfuronethyl @ 10% WP at 20g a.i ha^{-1} on 8 DAS fb EPOE application of chlorimuron ethyl 10% +

*Corresponding author's email: chinnamanisribhavan@gmail.com

metsulfuron methyl 10% @ 20g a.i ha^{-1} on 20 DAS, T_5 - PE application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS fb EPOE application of bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS, T_6 - PE application of pyrazosulfuron ethyl @ 10% WP 20g a.i ha^{-1} on 8 DAS fb EPOE application of bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS, T_7 - Hand weeding twice on 15 and 30 DAS, T_8 - Weed free check and T_9 - Unweeded control. Rice TPS 5 was used as a test variety. Pre-germinated seeds were used for wet drum seeding of rice. Pre emergence and early post emergence herbicides were applied as per the treatment schedule. Observation on plant height, total number of tillers m^{-2}, dry matter production and yield of rice were recorded.

Results and Discussion

Plant height

The plant height was increased with the advancement of crop growth from tillering stage and it reached maximum at harvest stage (Table. 1). At active tillering stage, significantly maximum plant height of (40.5 cm) was recorded in application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE. Application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i. ha^{-1} on 20 DAS as EPOE and application of pyrazosulfuron ethyl @ 10% WP 20 g a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE were the next best treatments. These two were on par with each other.

Table 1. Effect of effect of pre and early post emergence on plant height (cm) and total number of tillers m^{-2} of drum seeded rice at various growth stages

Treatment	Plant height (cm)			Total number of tillers m^{-2}		
	AT	PI	Harvest	AT	PI	Harvest
T_1-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	32.0	66.0	89.3	138	289	323
T_2-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	31.1	65.2	88.1	136	285	319
T_3-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb EPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1} on 20 DAS	38.9	76.5	99.0	166	335	363
T_4-PE application of Pyrazosulfuron ethyl @ 10% WP at 20g a.i.ha^{-1} on 8 DAS fb EPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1} on 20 DAS	36.2	73.0	95.0	154	318	347
T_5-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb EPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS	40.5	79.6	102.0	173	348	373
T_6-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fb EPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS	38.0	75.8	98.1	163	331	357
T_7-Hand weeding twice on 15 and 30 DAS	34.3	69.0	92.2	146	304	334
T_8-Weed free check	42.4	82.6	104.5	181	362	384
T_9-Unweeded control	26.4	61.2	84.0	125	264	287
SEd	0.7	1.2	1.1	3	6	4
CD (p=0.05)	1.6	2.5	2.3	7	12	9

AT- Active tillering and PI-Panicle initiation

At panicle initiation stage also, highest plant height of 79.6 cm was recorded in application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE. Application of pretilachlor @ 0.75 kg ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i.ha^{-1} on 20 DAS as EPOE and application of pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS as EPOE registered the plant height of 76.5 and 75.8 cm respectively. These two

were on par with each other. Application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE significantly produced taller plants (102.0 cm) at harvest stage. Application of pretilachlor @ 0.75 kg ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i ha^{-1} on 20 DAS as EPOE (99.0 cm) and application of pyrazosulfuron ethyl @ 10% WP 20 g a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE (98.1 cm) were the next best treatments and these two were comparable with each other. The increase in plant height in application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE was 21.4 % over unweeded control (84.0 cm). Adoption of different weed management practices produced distinct variations on the height of plants at all the stages. This might be due to effective weed control which enabled better availability of all resources *viz.,* light, moisture, space and nutrient to the crop plants at different stages. Unweeded control showed significant reduction in plant height at all growth stages of the crop due to higher weed competition and lesser input availability to plants thus reduced the plant height to a greater extent. This correlates with the findings of Sandeep Nayak *et al.,* (2014).

Table 2. Effect of effect of pre and early post emergence on DMP (Kg ha^{-1}) of drum seeded rice

Treatment	AT	PI	Harvest
T_1-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	1260	6642	10609
T_2-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	1215	6420	10208
T_3-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb EPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1} on 20 DAS	1534	7763	13002
T_4-PE application of Pyrazosulfuron ethyl @ 10% WP at 20g a.i.ha^{-1} on 8 DAS fb EPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1} on 20 DAS	1425	7307	11615
T_5-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb EPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS	1618	8087	13690
T_6-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fb EPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS	1509	7640	12315
T_7-Hand weeding twice on 15 and 30 DAS	1344	6975	11300
T_8-Weed free check	1698	8412	14380
T_9-Unweeded control	1036	5840	8828
SEd	39	161	341
CD (p=0.05)	79	323	685

AT- Active tillering and PI-Panicle initiation

Number of tillers

Among the different treatments tried, application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE significantly recorded higher tiller production at active tillering, panicle initiation and harvest stages (173, 348 and 373 tillers m^{-2} respectively). Next to these treatments, application of pretilachlor @ 0.75 kg ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i.ha^{-1} on 20 DAS as EPOE recorded higher number of tillers m^{-2} at active tillering, panicle initiation and harvest stages (166, 335 and 363 respectively). Which was on par with application of pyrazosulfuron ethyl @ 10% WP 20 g a.i.ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i.ha^{-1} on 20 DAS as EPOE (163, 331 and 357 tillers m^{-2} at active tillering, panicle initiation and harvest stages respectively). Lowest number of tillers (125, 264 and 287 m^{-2} at active tillering, panicle initiation and harvest stages respectively) was recorded in unweeded control. Reduced crop-weed competition at early growth stage of rice improved the growth structure such as tiller production. These results are in accordance with findings of Sunil *et al.,* (2010) and Vijay *et al.,* (2016).

Dry matter production

Adoption of different treatments had significant influence on the dry matter production of rice at active tillering, panicle initiation and harvest stages (Table. 2). Generally the dry matter increased as the stage of the crop progressed to harvest and attained the maximum level at harvest. Application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE significantly recorded highest

dry matter production with a DMP of 1618, 8087 and 13690 kg ha^{-1} at active tillering, panicle initiation and harvest stages respectively. Next to these treatments, application of pretilachlor @ 0.75 kg ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i ha^{-1} on 20 DAS as EPOE recorded a DMP of 1534, 7763 and 13002 kg ha^{-1} at active tillering, panicle initiation and harvest stages respectively and it was on par with application of pyrazosulfuron ethyl @ 10% WP 20 g a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE (1509, 7640 and 12315 kg ha^{-1} at active tillering, panicle initiation and harvest stages respectively). The increase in DMP in application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE was 55.1 per cent over unweeded control. The lowest dry matter production was recorded in unweeded control plot, which registered a DMP of 1036, 5840 and 8828 kg ha^{-1} at active tillering, panicle initiation and harvest stages respectively.

Table 3. Effect of effect of pre and early post emergence on grain yield and straw yield (Kg ha^{-1}) of drum seeded rice

Treatments	Grain yield kg ha^{-1}	Straw yield kg ha^{-1}
T_1-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	5460	6157
T_2-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fb Hand weeding on 30 DAS	5306	6125
T_3-PE application of Pretilachlor @ 0.75 kg ha^{-1} on 8 DAS fbEPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1}on 20DAS	6240	6985
T_4-PE application of Pyrazosulfuron ethyl @ 10% WP at 20g a.i.ha^{-1}on 8 DAS fbEPOE application of Chlorimuron ethyl 10% + Metsulfuron methyl 10% @ 20g a.i.ha^{-1}on 20DAS	5940	6608
T_5-PE application of Pretilachlor @ 0.75 kg ha^{-1}on 8 DAS fbEPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1}on 20 DAS	6436	7210
T_6-PE application of Pyrazosulfuron ethyl @ 10% WP 20g a.i.ha^{-1} on 8 DAS fbEPOE application of Bispyribac sodium @ 25 g a.i.ha^{-1}on 20 DAS	6181	6890
T_7-Hand weeding twice on 15 and 30 DAS	5740	6379
T_8-Weed free check	6632	7432
T_9-Unweeded control	3828	4360
SEd	91	109
CD (p=0.05)	194	220

The dry matter production was significantly influenced by different weed management practices. Among the various weed management practices adopted the application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE recorded highest dry matter production at all stages. This is in consistent with the findings of Sunil *et al.,* (2010) and Walia *et al.,* (2012). This might be due to the lesser weed competition as weeds might have been killed from their germination phase and keeping weeds at lower densities.

Economic yield

Grain yield and Straw yield of rice was significantly influenced by various weed management practices adopted (Table. 3). Among the different treatment combinations tried, application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE recorded significantly produced higher grain (6436 kg ha^{-1}) and straw yield (7210 kg ha^{-1}) over the rest of the treatments. The increase in yield was mainly attributed to better control of weeds throughout the crop growth resulting in better availability of nutrients, moisture and light to the crop growth .This was reflected through increased leaf area, DMP, which contributed to higher plant height, more number of productive tillers m^{-2} and higher yield. Earlier findings by Walia *et al*., (2012) agreed with the present findings. Application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb chlorimuron ethyl 10% + metsulfuron methyl 10% @ 20 g a.i.ha^{-1} on 20 DAS as EPOE and application of

pyrazosulfuron ethyl @ 10% WP 20 g a.i.ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE recorded a grain yield of 6240 and 6181 kg ha^{-1} and these two were on par with each other. Unweeded control significantly resulted in lowest grain yield of 3828 kg ha^{-1}. This clearly indicated severe competition exerted by weeds on the crop and thus turn in lower yield obntained in unweeded plot as reported by (Vijay Singh *et al*., 2016). From the above results, it could be concluded that application of pretilachlor @ 0.75 kg a.i ha^{-1} on 8 DAS as PE fb bispyribac sodium @ 25 g a.i ha^{-1} on 20 DAS as EPOE was found to be the viable and effective weed management practice for drum seeded rice under puddled condition to realise through higher yield.

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