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Effect of Crop Establishment Methods and Weed Management Practices on Rice (*Oryza Sativa* L.) Yield

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Abstract

An experiment was conducted during *kharif* seasons of 2010 and 2011 to study the effect of weed control practices {(bensulfuron methyl 60 g ha^{-1}+ pretilachlor 600 g a.iha^{-1}as pre emergence application fb mechanical weeding at 30 DAS/T, bispyribac sodium@ 25 g ha^{-1}, farmer's practice ((hand weeding twice at 20 and 40 DAS direct seeded rice and transplanted rice, cono weeding thrice in SRI) and weedy check}and crop establishment methods (Direct sowing of sprouted seeds under puddled condition, system of rice intensification and transplanting)on weed density and yield of rice. The experiment was laid out in split plot design with three crop establishment methods as main plots and four weed control practices as sub treatments and were replicated thrice. Transplanted rice registered significantly higher grain yield and it was comparable with SRI during both the years. The lowest grain yield was recorded due direct seeded rice under puddle condition. Among weed management practices, farmer's practice (hand weeding twice at 20 and 40 DAS in direct seeded rice and transplanted rice and cono weeding in SRI) of weeding registered lower weed density and dry weight which resulted in significantly higher grain yield and it was comparable with application of bensulfuron-methyl 60 g + pretilachlor 600 g ha^{-1}followed by mechanical weeding at 30 DAS/T. The density of weeds as well as dry weight was higher in direct seeded rice under puddle condition. The highest weed control efficiency was recorded in farmer's practice of weeding.

Key Words: Establishment methods, weed management practices, transplanting and yield

Introduction

Rice (*Oryza sativa* L.) is one of the most important cereal crops as it is the staple food of more than 70% of the world's population. The method of establishment in rice largely affects the initial stand and uniformity. Although, transplanting in rice is considered as best for higher productivity of crop, it is not much profitable due higher labour wages and problem of unavailability of labour during the peak period of operation. Some alternatives such as SRI and direct sowing of sprouted seeds under puddle condition must be explored to overcome these problems. Weeds compete with crop plants for moisture, nutrients, light, space and other growth factors and these weeds appear much earlier, more so under direct sown conditions in rice. In the absence of effective control measures weeds remove considerable quantity of applied nutrients resulting in a significant yield loss. Manna (1991) reported a yield reduction of 25% in transplanted rice, 32% in puddle broadcast rice and 52% in direct sown upland rice due to weeds. Hence, the present experiment was conducted to find out an efficient weed management practice in relation to crop establishment methods.

Materials and Methods

An experiment was conducted during *kharif* seasons of 2010 and 2011 at College Farm, College of Agriculture, Acharya N.G. Ranga Agricultural University, Hyderabad. The soil was sandy loam with a pH of 7.8. The available nitrogen, phosphorus and potassium content in the soil was 234.5, 28.9 and 271.6 kgha^{-1}respectively. The main treatments comprised of three crop establishment methods *viz.,* SRI, Direct sowing of sprouted seeds under puddle condition and transplanting; and four weed management practices in sub plots bensulfuron-methyl 60g + pretilachlor 600 g a.iha^{-1}applied on 3 DAS/T followed by mechanical weeding at 30 DAS/T, bispyribac sodium @ 25 g *a.i*ha^{-1}as early post emergence at 15 DAS/T, famer's practice (hand weeding twice at 20 and 40 DAS in direct seeded rice and transplanted rice, cono weeding thrice with 10 days interval from 20 DAT in SRI) and weedy check. The experiment was laid out in split plot design with three replications. The crop was fertilized with 120 kg N, 60 kg P_2O_5 and 40 kg K_2Oha^{-1}. Half dose of N (60 kg) and full dose of phosphorus (60 kgha^{-1}) and potassium (40 kgha^{-1}) was applied as basal before sowing. The remaining half nitrogen (60 kgha^{-1}) was top dressed in two equal splits at

tillering and panicle initiation stages. Bensulfuron ethyl + pretilachlor mixture @ 60 + 600 g a.iha^{-1}was applied at 3 DAS/T by mixing with sand and mechanical weeding was done with push hoe at 30 DAS/T. Bispyribac sodium @ 25g a.iha^{-1}was applied when, weeds were at 2-3 leaf stage. A thin film of water is maintained at the time of herbicide application. Farmer's practice comprises hand weeding twice at 20 and 40 DAS/T was carried out in normal transplanting and direct seeding of sprouted seeds, cono weeding thrice from 20 DAT with 10 days interval in SRI. The un-weeded control as weedy check was kept undisturbed for the entire cropping period. The nursery for transplanting and SRI was sown on the same date of sowing of direct seeded rice. Weed density and weed dry weight was recorded and their original values were transformed using $\sqrt{x} + 2$ formula.

Results and Discussion

Effect of crop establishment methods

The crop establishment methods influenced the plant height at harvest significantly during both the years (Table 1). The taller plants and more number of grains panicle^{-1}wereobserved under transplanted rice and it was comparable with SRI, but was significantly higher than that of direct seeded rice under puddle condition. However no such differences were noticed in panicles m^{-2}, panicle length (cm) and test weight (g).

The grain yield of transplanted crop during both the years, being at par with that of SRI, was found significantly greater to that of direct seeded rice under puddle condition. Submerged conditions in transplanted rice facilitate availability of more nutrients by reducing leaching and keep the salt content under control which encouraged tiller production and thus contributing to higher dry matter production and grain yield. Similar findings were observed by Sreelatha (2011). The lowest grain yield was noticed with direct seeded rice under puddle condition. Higher straw yield during both the years was recorded under transplanting, probably due to greater dry matter production per unit area, caused by better nutrient absorption from the soil, and the increased rate of metabolic processes, higher light absorption and photosynthetic activity with more number of leaves (Yadhav and Singh, 2006).

Effect of weed management practices

Different weed management practices in rice significantly influenced the rice plant height. Taller plants were recorded with farmer's practice of weeding and it was on par with application of bensulfuron methyl 60 g + pretilachlor 600 g a.iha^{-1}followed by mechanical weeding at 30 DAS/T. Bispyribac sodium @ 25 g a.iha^{-1}resulted in significantly lower plant height compared to famer's practice and bensulfuron methyl 60 g + pretilachlor 600 g a.iha^{-1}followed by mechanical weeding at 30 DAS/T. Number of grains per panicle was significantly influenced by weed management practices. Significantly higher number of grains per panicle was noticed with farmer' practice (hand weeding twice at 20 and 40 DAS/T in direct seeded rice and transplanted rice and cono weeding in SRI) treatment followed by application of bensulfuron methyl 60g + pretilachlor 600 g a.iha^{-1}followed by mechanical weeding at 30 DAS/T and bispyribac sodium @ 25 g a.i/ha respectively, over weedy check. Farmer's practice was comparable with application of bensulfuron methyl 60g + pretilachlor 600 g a.iha^{-1} followed by mechanical weeding at 30 DAS/T and both were significantly superior to bispyribac sodium @ 25 g a.iha^{-1}. Similarly, the highest grain and straw yield was registered with farmer' practice and this treatment was followed by application of bensulfuron methyl 60 g + pretilachlor 600 g a.iha^{-1} followed by mechanical weeding at 30 DAS/T and both were at par. The higher grain yield is due to decreased weed competition and minimum nutrient removal by weeds, which provided a competition free environment for rice and this might have increased N, P and K uptake by crop due to adoption of farmer's practice. This has further enhanced the source and sink sizes and resulted in panicle number per m^2, panicle length, number of grains per panicle and filled grains per panicle. Saha and Rao *et al*. (2010) and Sunil *et al*. (2010) found similar findings in their study. Weedy check recorded significantly lower grain yield due to high weed population and weed competition for resources like water, nutrients, light and space. Similar results were reported by Sreedevi *et al*. (2001). Interaction effect of establishment methods and weed management practices on yield components and yield was found non significant during both the years.

Weed control

The important weeds infesting the cropped area were *Cynodon dactylon,Panicum sps. Cyperus rotundus, Cyperusiria, Cyperus difformis, Echinochloa colonum, Ammania baccifera* and *Eclipta alba.*

The higher population of weeds was recorded in direct sown rice under puddled condition. The lowest density was recorded under transplanting and this was followed by SRI and both were comparable**.** Continuous submergence of the transplanted crop effectively suppressed the weed population and weed seed germination under transplanted rice. The results are in agreement with the findings of Subramanayam *et al.* (2007) Weed management practices influenced the weed population greatly. All the weed management treatments resulted in control of weed population. The lowest weed population was recorded in farmer's practice. The next best treatment was application of bensulfuron methyl 60g + pretilachlor 600 g a.iha^{-1}followed by mechanical weeding at 30 DAS/T (Table 2).

Different treatments significantly influenced the dry weight of weeds. Direct seeded rice under puddle condition recorded the highest dry weight of weeds during both the years, whereas transplanting recorded lowest.

Weed management practices improved the weed control efficiency greatly during both the years. The highest weed control efficiency of 88.09 and 90.37 % during both the years respectively was recorded under farmer's practice and this treatment was followed by bensulfuron methyl 60 g + pretilachlor 600 g a.i/ha followed by mechanical weeding at 30 DAS/T (83.78 and 86.90%).

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Table 1: Effect of crop establishment methods and weed management practices on growth, yield attributes and yield of rice during *kharif* 2010 and 2011.

Treatment	Plant height (cm)		Grains/ panicle		Test weight (g)		Grain yield (kg/ha)		Straw yield (kg/ha)	
Main treatment	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
SRI	82.70	84.36	92.10	95.68	20.14	20.16	4265	4438	5364	5697
Direct sown rice	78.37	79.83	82.58	88.33	19.29	20.03	3894	4075	4948	5300
Transplanting	84.16	85.50	94.41	98.08	20.31	20.38	4408	4593	5579	5811
SEm±	1.04	1.14	2.05	1.61	0.26	0.35	91	90	99	97
CD (5%)	4.09	4.47	8.03	6.33	NS	NS	356	354	387	381
Sub treatment										
Bensulfuron methyl+ Pretilachlor followed by mechanical weeding at 30 DAS/T	84.27	87.54	105.29	106.94	20.39	20.85	5326	5585	6489	6824
Bispyribac sodium	80.53	82.29	84.82	91.92	19.91	19.77	3975	4158	5023	5433
Farmer's practice	86.77	90.08	109.10	111.86	20.93	21.30	5601	5857	6766	7134
Weedy check	75.40	73.02	59.57	65.39	18.43	18.83	1854	1874	2911	3019
SEm±	1.34	1.11	1.39	1.70	0.30	0.34	95	107	106	109
CD (5%)	3.98	3.31	4.12	5.06	NS	NS	283	318	316	323
Interaction										
SEm±(MxS)	2.32	1.93	2.40	2.95	0.52	0.59	165	185	184	188
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SEm± (SxM)	2.15	2.19	3.74	3.16	0.52	0.68	177	182	194	193
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Weed density, weed dry weight and weed control efficiency as influenced by crop establishment methods and weed management practices of rice during *kharif* 2010 and 2011.

Treatment	Weed density (No./m^2)		Weed dry weight (g/m^2)		WCE (%)	
Main treatment	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
SRI	8.14(64.48)	7.69 (57.43)	6.29 (37.67)	5.97 (33.67)		
Direct sown rice	8.81 (75.63)	8.30 (66.69)	6.75 (43.49)	6.44 (39.47)		
Transplanting	7.68 (57.00)	7.23(52.62)	5.98 (33.73)	5.85 (32.20)		
SEm±	0.17	0.15	0.12	0.10		
CD (5%)	0.66	0.60	0.45	0.41		
Sub treatment						
Bensulfuron methyl + Pretilachlor followed by mechanical weeding at 30 DAS/T	6.06(34.68)	5.78(31.45)	4.16(15.32)	3.72 (11.86)	83.78	86.90
Bispyribac sodium	8.48 (69.92)	7.92(60.80)	5.84(32.13)	5.57 (29.06)	65.99	67.98
Farmer's practice	5.60 (29.31)	5.26(25.65)	3.64 (11.25)	3.28 (8.74)	88.09	90.37
Weedy check	11.44 (128.92)	10.94(117.73)	9.82(94.48)	9.63 (90.78)		
SEm±	0.17	0.21	0.18	0.19		
CD (5%)	0.50	0.64	0.54	0.57		
Interaction						
SEm±(MxS)	0.29	0.37	0.31	0.34		
CD (5%)	NS	NS	NS	NS		
SEm± (SxM)	0.34	0.33	0.29	0.31		
CD (5%)	NS	NS	NS	NS		

Values in parenthesis are original values