The Pharma Innovation Journal 2021; 10(12): 3178-3181

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 3178-3181

www.thepharmajournal.com
Received: 10-09-2021
Accepted: 19-11-2021

Chainu Ram Netam
College of Agriculture & Research Station, Marra Patan Durg, Chhattisgarh, India

Corresponding Author:
Chainu Ram Netam
College of Agriculture & Research Station, Marra Patan Durg, Chhattisgarh, India

Effect of different weed management options on weed dynamics, growth, and yield of rice under various crop establishment methods

Chainu Ram Netam

Abstract
A field experiment was conducted for two consecutive *Kharif* seasons of 2011 and 2012 at G. B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttarakhand) to the "Effect of different weed management options on weed dynamics, growth, and yield of rice under various crop establishment methods". The results revealed that the lowest density and dry matter of total weeds at 60 days after sowing/days after transplanting was obtained with transplanted rice. Amongst weed management methods, lower density of grasses, broad-leaved weeds and sedges at 60 DAT and higher weed control efficiency was recorded with Bispyribac sodium 20 g/ha fb one HW at 35 DAS/DAT followed by Penoxsulam 22.5 g/ha fb one HW at 35 DAS/DAT. This treatment produced the highest number of panicles/m^2 and rice grain yield (4145 and 3879 kg/ha). Among the weed management practices, application of bispyribac sodium 20 g/ha at 15 DAS/DAT followed by one hand weeding at 35 DAS/DAT recorded the minimum population and dry matter of total weeds and recorded the highest weed control efficiency which showed at par results with the application of bispyribac sodium 22.5 g/ha at 2-3 leaf stage of weeds followed by one HW at 35 DAS/DAT. This treatment produced the significantly higher number of panicles/m^2, grains/panicle and grain yield.

Keywords: Crop establishment methods, weed management, weed dynamics, yield, rice

Introduction
In India, rice is the staple food for millions of people and plays a vital role in the economy. It is generally grown by transplanting in puddled soil. Weeds are regarded as one of the major limiting factors of the crop production. Weeds share light, nutrients and water with the crop and thus, interfere with rice growth and production in many ways. The effective control of weeds at initial stages (0-40 DAT) can help in improving productivity of the crop. There are various factors responsible for low productivity of rice, in which weeds are predominant ones. In India, transplanting is the most common method of rice cultivation. However, owing to its several limitations *viz*; more labour and time consuming and requiring a lot of expenditure on raising nursery, it's uprooting and transplanting. In wet seeding, sowing of pre-germinated or sprouted seeds on puddled soil reduce substantially the cost of labour as it eliminates the excess use of seedlings and related operations such as seedling nursery operation, care of seedlings, pulling, bundling, transportation and transplanting (Serrano, 1975) [1]. Sometimes farmers do not get chance for weeding at appropriate time due to preoccupation. Hand weeding in wet seeded rice is more time consuming, cumbersome and not as easy as in transplanted rice (Moody, 1983) [8]. Direct dry seeded rice (DSR) which excludes puddling and drudgery of transplanting the young rice seedlings provide an option to resolve the edaphic conflict and enhance the sustainability of rice-wheat cropping system. Trans-planted rice has deleterious effects on the soil environment for the succeeding wheat and other upland crops. Puddling requires lot of scarce water at a time when there is little water in the reservoirs, destroys soil structure and adversely affects soil productivity. Non-development of ground water in *kharif*, late onset of monsoon and drudgery of operations often delays rice transplanting which leads to late vacation of fields, forcing farmers to sow wheat after the optimum time. DSR facilitates timely establishment of rice and succeeding winter crops. Unlike puddled fields, DSR fields do not crack and thus, help in saving irrigation water (Kumar, 2009) [7].

Farmers growing direct seeded rice are likely to encounter greater problems related to weed management in absence of standing water. The transition to direct seeding of rice can, therefore, be successful only if accompanied by effective weed management practices (Singh *et al*., 2003) [13]. Weeds cause 50-60 per cent grain yield reduction in puddled conditions and 91 per cent in un-puddled conditions (Ali and Sankaran, 1984) [1]. The use of weeding tools damage the rice as they move through the field, especially during early crop growth, and they also fail to remove some of the grassy weeds. Keeping these facts in view, the present investigation was undertaken to study the effect of crop establishment methods and weed management practices on weed dynamics and productivity of rice.

Materials and Methods

The field experiments were conducted at College of Agriculture and Research Station, IGKV, Bemetara (CG) to the "Effect of different weed management options on weed dynamics, growth, and yield of rice under various crop establishment methods" during two *Kharif* seasons of 2011 and 2012. The soil of the experimental field was loam in texture. The soil was found high in organic carbon (0.87%), low in available nitrogen (262.0 kg/ha), medium in available phosphorus (21.8 kg/ha) and potassium (259.0 kg/ha) content with neutral pH (7.2). An experiment was conducted in split plot design with three replications; keeping rice establishment methods *viz.*, direct dry seeded rice (DSR), wet seeded rice (WSR- sprouted seeds) and transplanted rice (TPR) in main plots and six levels of weed management practices *viz.* penoxsulam 22.5 g/ha at 2-3 leaf stage of weeds, penoxsulam 22.5 g/ha at 2-3 leaf stage of weeds followed by (fb) one hand weeding (HW) at 35DAS/DAT, bispyribac sodium 20 g/ha at 15DAS/DAT, bispyribac sodium 20 g/ha at 15DAS/DAT fb one hand weeding at 35DAS/DAT, weed free and weedy check in sub plot.

In direct dry seeded rice, seeds were sown in lines 20 cm apart by using 40 kg/ha seed rate and covered by soil; while, sprouted seeds were sown in rows 20 cm apart in wet seeded rice by using manually operated drum seeder. Twenty one day old seedlings were transplanted in transplanting method and cultivar Sarju-52 was used in experiment. In direct dry seeding rice seed was sown on 20 June, 2011 and 22 June, 2012 during first and second year, respectively. Seed was water soaked for wet seeding and nursery raising for transplanting to same date of seed sown in direct dry seeding. Crop was fertilized uniformly with 150:60:40 kg/ha of N, P_2O_5 and K_2O, respectively through the use of NPK mixture (12:32:16), urea (46:0:0) and muriate of potash (0:0:60). Total amount of phosphorus was applied through NPK mixture while, nitrogen through NPK mixture and urea and potassium through NPK mixture and muriate of potash. The full amount of phosphorus and potassium and half dose of nitrogen were applied as basal just before sowing of rice seed/transplanting of rice seedling. Remaining half of the nitrogen was top dressed through urea in two splits; first at active tillering and second at panicle initiation stage in all methods of rice establishment.

Density and dry matter of weeds were recorded at 60 DAS/DAT days after seeding with the help of quadrate (0.5 x 0.5 m) and then converted in per square meter. Data on weeds were subjected to square root transformation before statistical analysis to normalize their distribution. All the data were analysed by using ANOVA, and the least significant difference (LSD) value at 5% level of significance were calculated and used to test significant differences between treatment means.

Results and Discussion

Total weed density

The experimental field was infested with grassy weeds, *viz. Echinochloa colona*, *Echinochloa crusgalli*, *Cynodon dactylon*, *Panicum repens* and *Paspalum distichum;* broad-leaved weeds, *viz. Ammania baccifera*, *Eclipta alba*, *Caesulia axillaris*, *Commelina benghalensis*, *Euphorbia hirta* and *Ludwigia parviflora;* and sedges, *viz*. *Cyperus iria*, *Cyperus difformis* and *Fimbristylis miliaceae.* Method of rice transplanting significantly influenced the weed density at 60 DAT (Table 1). The lower weed density was recorded under Transplanted Rice, which was significantly superior to Direct Seeded Rice. This might be due to effective control of all categories of weeds during intensive puddling, which was started two weeks before transplanting and sufficient time allowed for germination of weed seeds present in the soil. Amongst weed management methods, lower density of grasses, broad-leaved weeds and sedges at 60 DAT and higher weed control efficiency (Table 3) was recorded with Bispyribac sodium 20 g/ha fb one HW at 35 DAS/DAT followed by Penoxsulam 22.5 g/ha fb one HW at 35 DAS/DAT.

Bispyribac sodium 20 g/ha at 15 DAS/DAT fb one HW at 35 DAS/DAT followed by Bispyribac sodium 20 g/ha at 15 DAS/DAT had significantly lower broad-leaved weeds and sedges and higher weed control efficiency as compared to the Penoxsulam22.5 g/ha at 2-3 leaf stage of weeds fb one HW at 35 DAS/DAT followed by Penoxsulam22.5 g/ha at 2-3 leaf stage of weeds at 60 DAT. This was due to integration of chemical and mechanical method of weed control resulting in broad-spectrum control of weeds, reported by Mukherjee and Maity (2011) [14].

Table 1: Effect of crop establishment methods and weed management practices on weed density at 60 DAS/DAT (Pooled mean of 2 years)

Treatment	Weed density (no./m^2)			Total weed density (no./m^2)
	Grasses	Broad-leaved weeds	Sedges	
Rice establishment method				
Direct seeded rice	6.67 (74.7)	3.49 (15.2)	4.15 (22.9)	3.7 (126.0)
Wet seeded rice	5.4 (38.6)	2.28 (9.4)	3.5 (15.9)	3.3 (73.1)
Transplanted rice	4.48 (26.8)	1.96 (7.8)	2.6 (10.8)	2.8 (51.7)
S.Em±	0.28	0.21	0.48	0.08
LSD (P=0.05)	1.1	0.31	NS	0.33
Weed management practice				
Penoxsulam 22.5 g/ha	7.8 (48.2)	3.39 (10.4)	4.25 (13.8)	4.4 (84.3)
Penoxsulam 22.5 g/ha fb one HW at 35 DAS/DAT	3.88 (11.1)	0.66 (1.8)	0.54 (1.3)	2.6 (16.0)

Bispyribac sodium 20 g/ha	7.43 (43.6)	4.06 (13.3)	4.88 (18.4)	4.4 (89.4)
Bispyribac sodium 20 g/ha fb one HW at 35 DAS/DAT	3.23 (8.5)	0.99 (2.4)	1.03 (2.67)	2.6 (15.6)
Weed free	0	0	0	0
Weedy check	12.11 (353.1)	6.3 (36.9)	8.7 (58.7)	5.7 (297.8)
S.Em±	0.46	0.54	0.52	0.14
LSD (P=0.05)	1.33	1.565	1.48	0.40

Original values given in parentheses, DAS- Days after sowing, DAT- Days after transplanting, fb- followed by, HW- hand weeding, NS- Non-significant

Effect on rice growth: In case of rice transplanting methods, transplanting rice recorded significantly higher plant height (cm), No. of shoots (cm), Crop dry matter (g m^{-2}), dry matter accumulation and leaf area index as compared to Direct seeded rice (Table 2). It might be due to low crop weed competition on growth attributes in transplanting rice as compared to direct seeded rice. Amongst weed control methods, Bispyribac sodium 20 g/ha fb one HW followed by Penoxsulam 22.5 g/ha fb one HW recorded significantly higher plant height, no. of tillers/hill, dry matter accumulation and leaf area index. This might be due to comparatively less weed competition for nutrients, and better weed control. Resulted in significantly higher plant height, no. of tillers/hill, and dry matter accumulation and leaf area index in comparison to conventional scheduling of nitrogen. The significant variations in growth attributes were observed due to nitrogen application when needed by crop as observed by Islam *et al.* (2009) [5].

Table 2: Effect of crop establishment methods and weed management practices on growth attributes in rice at 60 DAS/ DAT (Pooled mean of 2 years)

Treatment	Plant height (cm)	Number of shoots (m^{-2})	Crop dry matter (g m^{-2})	Leaf Area Index
Rice establishment method				
Direct seeded rice	69.87	216	297.24	3.50
Wet seeded rice	71.62	238	327.81	3.68
Transplanted rice	71.56	244	334.29	3.77
S.Em±	0.45	3.58	4.92	0.07
LSD (P=0.05)	NS	13.99	19.25	NS
Weed management practice				
Penoxsulam 22.5 g/ha	69.59	209	282.79	3.31
Penoxsulam 22.5 g/ha fb one HW	73.40	286	394.56	4.31
Bispyribac sodium 20 g/ha	70.72	208	280.92	3.31
Bispyribac sodium 20 g/ha fb one HW	73.62	286	395.02	4.31
Weed free	75.36	298	418.53	4.37
Weedy check	63.70	109	146.84	2.28
S.Em±	0.69	6.54	8.97	0.19
LSD (P=0.05)	2.0	18.90	25.89	0.55

DAS- Days after sowing, DAT- Days after transplanting, fb- followed by, HW- hand weeding, NS- Non-significant

Table 3: Effect of crop establishment methods and weed management practices on yield attributes, yield, weed index and weed control efficiency (Pooled mean of 2 years)

Treatment	Yield attributes				Grain yield (t/ha)	Weed index (%)	Weed control efficiency (%)
	Number of panicles/m^2	Panicle length (cm)	Grains/panicle	Test weight (g/1000 seeds)			
Rice establishment methods							
Direct seeded rice	174.42	25.04	154.44	23.49	3.30	34.73	75.95
Wet seeded rice	197.47	25.19	156.36	23.66	3.61	29.79	76.35
Transplanted rice	218.36	25.43	158.72	23.76	4.01	23.61	76.95
S.Em±	2.05	0.29	0.82	0.13	0.06	1.30	0.50
CD (P=0.05)	8.02	NS	3.21	NS	0.22		NS
Weed management practices							
Penoxsulam 22.5 g/ha at 2-3 leaf stage of weeds	157.39	24.77	152.33	23.33	2.90	43.70	80.00
Penoxsulam 22.5 g/ha at 2-3 leaf stage of weeds fb one HW at 35 DAS/DAT	262.00	25.80	162.33	23.91	4.86	5.54	99.00
Bispyribac sodium 20 g/ha at 15 DAS/DAT	159.56	24.73	152.11	23.61	2.91	43.32	80.25
Bispyribac sodium 20 g/ha at 15 DAS/DAT fb one HW at 35 DAS/DAT	264.28	25.66	163.67	23.91	4.92	5.18	99.05
Weed free	277.83	26.03	167.72	24.08	5.14	0.00	100.00
Weedy check	59.44	24.32	139.61	22.98	1.11	78.52	0.00
S.Em±	5.58	0.50	1.98	0.21	0.09	1.39	0.66
LSD (P=0.05)	16.10	NS	5.71	NS	0.25	4.01	1.87

DAS- Days after sowing, DAT- Days after transplanting, fb- followed by, HW- hand weeding, NS- Non-significant

Rice yield and weed control efficiency

The differences in 1000-grain weight were non-significant due to rice transplanting method. Transplanted rice had significantly higher number of panicles/hill, no. of

grains/panicle and higher grain yield as compared to direct seeded rice (Table 3). Higher values of yield attributes and grain yield under transplanted rice were perhaps due to better partitioning of photosynthates from source to sink as a result of lower crop-weed competition owing to favourable growing conditions in transplanting rice. The results were corroborated with the findings of Jaiswal and Singh (2001) [6]. Amongst weed control treatments, Bispyribac sodium 20 g/ha at 15 DAS/DAT fb one HW at 35 DAS/DAT followed by Penoxsulam 22.5 g/ha at 2-3 leaf stage of weeds fb one HW at 35 DAS/DAT had significantly more 1000-grain weight, no. of panicles/ hill, no. of grains/panicle and grain yield. This might be due to effective control of weeds which in turn significantly increased the no. of panicles/hill and grains/panicle consequently improving the grain yield. Control of weeds by herbicides during early stages of rice followed by Penoxsulam22.5 g/ha at 2-3 leaf stage of weeds fb one HW at 35 DAS/DAT resulted in lower competition for growth resources that influenced the crop to grow better as evidenced in increased yield attributes. Similar findings were also observed by Singh *et al*. (2005) [12] and Ramachandra *et al.* (2012) [15] resulted in significantly more 1000- grain weight, no. of panicles/hill, grains/panicle and grain yield in comparison to conventional scheduling of nitrogen application. Higher values of yield attributes and grain yield were probably owing to more utilization and uptake of nitrogen at active growing stages, *viz.* tillering and panicle initiation. Similar findings were also observed by Awasthi (2009) [16] and Gill and Walia (2013) [17]. It can be concluded that Bispyribac sodium 20 g/ha at 15 DAS/DAT fb one HW at 35 DAS/DAT followed by Penoxsulam22.5 g/ha at 2-3 leaf stage of weeds fb one HW at 35 DAS/DAT, under transplanting could be recommended for effective weed management and higher rice yield.

References

1. Ali MA, Sankaran S. Crop-weed competition in direct seeded low land and upland bunded rice. Indian J. Weed Sci. 1984;16:90-96.
2. Awasthe R. Nitrogen management in transplanted rice (*Oryza sativa*) in mid-hill acidic soils of Sikkim Himalayas. Indian Journal of Agronomy. 2009;54(1):47-51.
3. Jayadeva HM, Hugar AY, Somashekarappa PR, Malleshappa C. Efficacy of azimsulfuron in Combination with metsulfuron-methyl on weed control in transplanted rice. Mysore Journal of Agricultural Sciences. 2010;44(2):246-254.
4. Gill JS, Walia SS. Effect of establishment methods and nitrogen levels on basmati rice (*Oryza sativa*). Indian Journal of Agronomy. 2013;58(4):506-511.
5. Islam MS, Hasanuzzaman R, Nahar K. Effect of split application of N fertilizer on morpho-physiological parameters of rice genotypes. International Journal of Plant Production. 2009;3(1):51-62.
6. Jaiswal VP, Singh GR. Effect of planting methods, source and level of nitrogen on the growth and yield of rice (*Oryza sativa*) and on succeeding wheat (*Triticum aestivum*). Indian Journal of Agronomy. 2001;46(1):5-11.
7. Kumar R. 2009;16:57. http://agropedia.iitk.ac.in/?q=content/direct-seeded-rice (Submitted by shuklarajeew on Tue, 30/06/2009 - 16:57).
8. Moody K. The status of weed control in rice in Asia. In Proceeding in Women in Rice Farming. International Rice Research Institue, Los Banos, Laguna, Philippines, 1983, 467-480.
9. Mukerjee PK, Maithy SK. Weed control in transplanted and wet seeded rainy season rice. Indian J. Agric. Sci. 2011;81(2):134-139.
10. Ramchandra C, Denesh GR, Sydanwarulla. Weed management practices in transplanted rice by using glyphosate. Biennial Conference on "Recent Advances in Weed Science Research -2010", Feb 2010, Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG). 2010;63:25-26.
11. Serrano FB. Twenty-six Years of Rice Research and Development. National Research Council of the Philippines, Diliman, Quezon City, Philippines; c1975. P.122.
12. Singh G, Singh VP, Singh V, Singh SP, Kumar A, Mortimer M, et al. Characterization of weed flora and weeds management practices in rice under different cropping systems in Western Gangetic plains of India. Indian J. Weed Sci. 2005;37(1-2):45-50.
13. Singh G, Singh Y, Sing VP, Singh RK, Singh Pratibha, Johnson DE, et al. Direct seeding as an alternative to transplanting rice for the rice - wheat system of the Indo-gangetic plains. Sustainability issues related to weed management. Proc. BCPC Conference- crop science and technology. F-9, 2003, 1035-1040.
14. Mukherjee, Pulok K, Niladri Maity, Neelesh K Nema, Birendra K Sarkar. Bio-active compounds from natural resources against skin aging. Phytomedicine. 2011;19(1):64-73.
15. Ramachandra TV, Bharath H Aithal, Durgappa D Sanna. Insights to urban dynamics through landscape spatial pattern analysis. International journal of applied earth observation and geo-information. 2012;18:329-343.
16. Awasthi, Niranjan, Suqin Guo, Wagner BJ. Posterior capsular opacification: a problem reduced but not yet eradicated. Archives of ophthalmology. 2009;127(4):555-562.
17. Gill Jagjot Singh, Sohan Singh Walia. Effect of establishment methods and nitrogen levels on basmati rice (*Oryza sativa*). Indian Journal of Agronomy. 2013;58(4):506-511.