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Nutrient uptake by rice and weeds as influenced by different weed management practices in dry direct seeded rice

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Abstract

A field experiment was conducted during *kharif* season of 2016 at National Rice Research Institute, Cuttack to study the effect of weed management practices on nutrients uptake by dry direct seeded rice and weeds. The experiment consisted of 10 treatments laid out in randomized complete block design with three replications. The findings clearly visualized that among the weed management practices of dry direct seeded rice, apart to weed free treatments early post emergence application of bispyribac sodium 30 g ha^{-1} (10 DAE) *fb* mechanical weeding (30 DAE) at 25 cm row spacing proved significantly better in reducing total weed density, total weed dry weight and nutrient removal by weeds and recorded significantly higher weed control efficiency, grain yield, straw yield and nutrient uptake as compared to rest of the treatments.

Keywords: Weed management, direct seeded rice, bispyribac-sodium and nutrient uptake

Introduction

Rice (*Oryza sativa* L.) is most important cereal and staple food meeting the requirement of majority (more than 60%) of the world's population. In India, rice is commonly established by transplanting seedlings in puddle soil (wet tillage). It is labour, water and energy intensive and is becoming less profitable as these resources are becoming inadequate. These factors lead to a major shift from transplanted rice (TPR) cultivation to direct seeded rice systems (DSRs). It eliminates the nursery raising, puddling and transplanting operations and thus 25 percent of total man power involved in rice cultivation were reduced and making rice production more profitable. Weed infestation is one of the major worldwide biological constraints that hinder the attainment of optimal yield of rice in DSR (Hossain *et al.*, 2016) [5]. Generally, severe weed infestation is prevalent in direct seeded rice, thus several hand weeding are require for growing a rice crop depending upon weed species, their intensity and nature of crop grown (Hasanuzzaman *et al.*, 2008) [4]. Since, these methods of weed control require intensive man power and current trend of a scarcity of man power and involves higher wages rate make it less practical. In this situation chemical weed control provides enormous flexibility of operation, are most effective and economical tools of weeds control in DSR systems (Rahman *et al.*, 2012) [11]. Likewise, complexity of weed flora exists in direct seeded rice systems that hinder the effective weed control through single herbicide either pre or post-emergence herbicides (Majhi *et al.,* 2009) [10]. Therefore, such studies suggested that sequential application of pre and post-emergence herbicides offer efficiently control of early and late flushes of weeds than sole application of herbicides in direct seeded rice (Mahajan and Chauhan, 2015) [9]. Excessive use of herbicides may comprise harmful effects on the environment and human health (Jurewicz and Hanke, 2008) [8]. Therefore, it is needed to decrease the herbicide load in environment. Mechanical weed control by using power weeder is another alternate option for economical and eco-friendly control of weeds under direct seeded rice by integrating with either pre or post-emergence herbicides. Keeping the above aspects in view, the present experiment was conducted to develop effective and economical weed management practices for direct seeded rice.

Materials and Methods

The experiment was conducted during *kharif* season of 2016 at the National Rice Research Institute, Cuttack in an alluvial (Haplaquept) clay loam soil with pH 6.37, organic carbon o.60%, available nitrogen 292 kg ha^{-1}, phosphorus 22 kg ha^{-1} and potassium 145 kg ha^{-1} to study the integration of chemical and mechanical weed management practices for controlling weeds in dry-direct seeded rice. Ten treatments Viz., Mechanical weeding twice at 20 and 40 days after emergence (DAE) at 25 cm row spacing (T_1), Pendimethalin 750 g ha^{-1} (PE) *fb* Bispyribac sodium 25 g ha^{-1} (POE) at 25 DAE at 25 cm row spacing (T_2), Pendimethalin 750 g ha^{-1} (PE) *fb* Mechanical weeding at 30 DAE at 25 cm row spacing (T_3), Bispyribac sodium 30 g ha^{-1} at 10 DAE *fb* Mechanical weeding at 30 DAE at 25 cm row spacing (T_4), One manual weeding at 30 DAE at 25 cm row spacing (T_5), One manual weeding at 30 DAE at 20 cm row spacing (T_6), Weed free (15, 30, 45& 60 DAE) at 25 cm row spacing (T_7), Weed free (15, 30, 45& 60 DAE) at 20 cm row spacing (T_8), Weedy check at 25 cm row spacing (T_9) and Weedy check at 20 cm row spacing (T_{10}) were assigned in a Randomized block design with three replications. The rice variety CR Dhan-304 (130 days duration) was sown during June 10, 2016 with 40 kg seed rate by direct hand drilling continuous in line was done at two different spacing at 20 cm and 25 cm row to row spacing. Full dose of P_2O_5 and K_2O (60 kg ha^{-1}) were applied before sowing at final land preparation and N (80 kg ha^{-1}) was applied equally in 3 splits at 30, 45 and 60 days after emergence (DAE). All the other agronomic and plant protection measures were adapted to as per recommended packages of rice crop. Data on grain and straw yield was recorded at the time of crop harvest from net plot area. The data on weed density and weed dry weight (at 60 DAE) were recorded with the help of quadrate (50 cm × 50 cm) and data were analyzed using transformation of square root of $\sqrt{(x+0.5)}$ prior to statistical analysis to normalize their distribution. The weed and plant samples were grind and sieved through 0.5 mm sieve. The required amount of samples was weighed out precisely and was subjected to acid extraction and N, P and K content was determined. Total nitrogen content in grain, straw and weed sample was estimated by modified microkjheldal method. The total phosphorus and potassium content of tri-acid digested grain, straw and weed samples were determined by vanadomolybdate phosphoric yellow colour method and total potassium content was determined using flame photometer (Jackson, 1973) [6].The N, P and K uptake of crop and weed was worked out by multiplying the nutrient content with dry weight and expressed in kg ha^{-1}. All the data were subjected to analysis of variance and treatment mean were compared using critical difference values (p=0.05) were used to determine the significance differences of means (Gomez and Gomez 1984) [3]

Results and Discussion

Effect on weeds

All the weed management treatments significantly reduced the density and dry weight of weeds as compared to weedy check (Table1). Among the weed management practices, treatment weed free condition at 20 cm row spacing (T_8) gave significantly lowest total weed density, total weed dry weight and highest weed control efficiency as compared to others but it was statistically comparable with weed free check at 25 cm row spacing (T_7). However, early post emergence application of bispyribac sodium 30 g ha^{-1}(10 DAE) *fb* mechanical weeding (30 DAE) at 25 cm row spacing (T_4) was found at par to weed free check at 25 cm row spacing (T_7). The reductions in density and dry weight of weeds in these treatments were mainly due to effective control of weeds by physical removal of weeds as an effective tools for their management and later also suppressed by shading effect of rice in above treatments due to quick and dense canopy closure (Baloch *et al.*, 2005) [1]. Whereas, highest total weed density, total weed dry weight and lowest weed control efficiency was observed with weedy check at 25 cm row spacing followed by weedy check at 20 cm row spacing. Weedy check at 20 cm row spacing (T_{10}) recorded lower total weed density and dry weight compared to weedy check at 25 cm row spacing (T_9) might be due to row spacing influences the crop canopy cover which in turns controls light penetration to weed seeds at or near the soil surface and the emergence of many weed seedlings will be reduced as a result of crop sown at narrow row spacing (Bradley, 2006) [2]. Uncheck weed growth efficiently exploited the available resources water, nutrient and light resulting in higher total weed density and dry weight. Several workers Sunil *et al.* (2010) [15] and Rawat *et al.* (2012) [13]. also reported that weedy check recorded higher total weed density and weed dry weight. Significantly lower removal of nutrients (N, P and K) by weeds at 60 DAE was noticed in weed free condition at 20 cm row spacing (T_8) which was at par with weed free check at 25 cm row spacing (T_7). However, treatment early post emergence application of bispyribac sodium 30 g ha^{-1}(10 DAE) *fb* mechanical weeding (30 DAE) at 25 cm row spacing (T_4) was found at par to weed free check at 25 cm row spacing (T_7). Weedy check at 25 cm row spacing (T_9) had registered maximum nutrients (N, P and K) removal by weeds at 60 DAE (Table1). This increase in nutrient removal by weeds was due to uncontrolled of weeds, which facilitates the weeds to utilize nutrient to the maximum extent. The results are in conformity with findings of Jena *et al.* (2002) [7]. and Rekha *et al.* (2003) [14].

Effect on the performance of rice

Grain yield, straw yield and nutrient uptake by crop were highly influenced by different weed management practices (Table 2). Among the different treatments, significantly highest grain yield, straw yield and nutrient uptake (N, P and K) by crop was registered under weed free condition at 20 cm row spacing (T_8), but it was at par with weed free check at 25 cm row spacing (T_7). However, early post emergence application of bispyribac sodium 30 g ha^{-1}(10 DAE) *fb* mechanical weeding (30 DAE) at 25 cm row spacing (T_4) was found at par to weed free check at 25 cm row spacing (T_7). Cumulative effect of lesser weed density as well as dry weight, higher WCE and lesser nutrient removal by weeds occurred as a result of reduced crop weed competition, better crop environment and higher uptake of nutrients by rice crop which all favoured increased the growth and yield attributing characters might be attributed for higher grain and straw yields in above treatment. Similar finding was also reported by Yadav *et al.* (2009) [17] and Veeraputhiran and Balasubramanian (2013) [16]. The lowest grain yield, straw yield and nutrient uptake by crop was registered under weedy check at 25 cm row spacing (T_9) followed by weedy check at 20 cm row spacing (T_{10}) might be due to fact that weed compete with crop for all resources like nutrients, space, light and moisture suppressed the growth of rice which resulted in lower growth, yield attributes, nutrient uptake and grain yield. Uncontrolled weeds in rice might reduce yields to the tune of 62-65 percent reported by Yaduraju *et al.* (2006) [18] and Ramana *et al.* (2007) [12].

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Table 1: Total density and dry weight of weeds, weed control efficiency and nutrient removal by weeds as influenced by weed management practices in dry direct seeded rice at 60 DAE

Treatment	**Total density of weeds at 60 DAE (no m^{-2})**	**Total weed dry weight at 60 DAE (g m^{-2})**	**Weed control efficiency at 60 DAE (%)**	**Nutrient removal by weeds at 60 DAE (kg ha^{-1})**		
				N	**P**	**K**
T_1	7.10 (50.00)	5.44 (29.15)	72.33	11.40	2.26	8.09
T_2	5.70 (32.00)	4.40 (18.90)	82.06	7.32	1.42	5.22
T_3	6.77 (45.33)	5.17 (26.22)	75.12	10.20	2.02	7.23
T_4	4.91 (23.67)	3.96 (15.18)	85.60	5.85	1.14	4.19
T_5	8.82 (77.33)	6.59 (43.00)	59.19	17.04	3.36	11.95
T_6	8.46 (71.00)	6.27 (38.76)	60.28	15.31	3.01	10.73
T_7	4.10 (16.33)	3.05 (8.78)	91.67	3.39	0.66	2.41
T_8	3.61 (12.67)	2.71 (6.88)	92.95	2.67	0.52	1.90
T_9	13.01 (168.67)	10.28 (105.36)	-	42.84	8.30	29.45
T_{10}	12.35 (152.00)	9.90 (97.58)	-	39.24	7.65	27.17
SEm ±	0.28	0.32	2.45	0.93	0.18	0.65
CD (p=0.05)	0.84	0.96	7.27	2.77	0.54	1.92

Square root $\sqrt{(x + 0.5)}$ transformed values. Values in the parentheses are original values

Table 2: Grain yield, straw yield and nutrient uptake of dry direct seeded rice as influenced by weed management practices

Treatment	**Grain yield (t ha^{-1})**	**Straw yield (t ha^{-1})**	**HI (%)**	**Nutrient uptake by crop (kg ha^{-1})**		
				N	**P**	**K**
T_1	4.81	5.39	47.14	78.42	18.78	90.93
T_2	5.06	5.66	47.21	83.32	21.01	97.63
T_3	4.87	5.46	47.16	80.06	19.60	92.88
T_4	5.17	5.76	47.34	86.51	22.39	100.59
T_5	4.36	4.95	46.81	70.60	16.19	82.04
T_6	4.45	5.04	46.85	72.19	17.04	84.55
T_7	5.33	5.87	47.58	91.45	23.67	107.03
T_8	5.55	6.10	47.62	94.77	24.99	110.46
T_9	2.87	3.28	46.70	45.38	10.38	53.76
T_{10}	2.94	3.36	46.73	47.01	10.90	55.32
SEm ±	0.09	0.11	0.92	2.71	0.78	3.08
CD (p=0.05)	0.25	0.33	NS	8.06	2.31	9.16

Reference

1. Baloch MS, Hassan G, Morimoto T. Weeding techniques in transplanted and wet seeded rice in Pakistan. Weed Biolog. Mang. 2005; 5:190-196.
2. Bradley KW. A review of the effects of row spacing on weed management in corn and soybean. Crop Manag, 2006, 5 http://dx.doi.org/10.1094/CM-2006-0227-02-RV.
3. Gomez AK, Gomez AA. Statistical procedures for Agricultural Research. An International Rice Research Institute book, A Wiley-Inter Science publication, 1984.
4. Hasanuzzaman M, Islam MO, Bapari MS. Efficacy of different herbicides over manual weeding in controlling weeds in transplanted rice. Australian Journal of Crop Science. 2008; 2:18-24.
5. Hossain MM, Begum M, Rahman MM, Akanda MM. Weed management on direct-seeded rice system - a review. Progressive Agriculture. 2016; 27:1-8.
6. Jackson ML. Soil chemical analysis, Ed. Prentice Hall of India Pvt. Ltd., New Delhi, 1973, 121-125.
7. Jena SN, Tripathy S, Sarangi SK, Biswal S. Integrated weed management in direct seeded rainfed lowland rice. Indian J. Weed Sci. 2002; 34 (1, 2):32-35.
8. Jurewicz J, Hanke W. Prenatal and childhood exposure to pesticides and neurobehavioral development: review of epidemiological studies. International Journal of Occupational Medicine and Environmental Health. 2008; 21(2):121-132.
9. Mahajan G, Chauhan BS. Weed control in dry direct-seeded rice using tank mixtures of herbicides in South Asia. Crop Protection. 2015; 5:90-96.
10. Majhi S, Thakur R, Upasani RR, Singh MK, Pal SK. Growth and Productivity of direct seeded upland rainfed rice as influenced by integrated weed management. Indian J Weed Science. 2009; 41(3, 4):160-162.
11. Rahman M, Juraimi AS, Suria J, Azmi BM, Anawar P. Response of weed flora to different herbicides in aerobic rice system. Sci. Res. Essay. 2012; 7:12-23.
12. Ramana AV, Naidu GJ, Murthy KV. Integrated weed management in rainfed upland rice. (*Oryza sativa*). Indian J Agron. 2007; 52:311-314.
13. Rawat A, Chaudhary CS, Upadhyaya VV, Jain V. Efficacy of Bispyribac-Sodium on weed flora and yield of drilled rice. Indian J Weed Sci. 2012; 44(3):183-185.
14. Rekha BK, Mahavishnan K, Raju MS. Effect of weed management on crop-weed competition, grain yield and nutrient uptake in rice. The Andhra Agric. J. 2003; 50(3, 4):211-215.
15. Sunil CM, Shekara BG, Kalyanamurthy KN, Shankaralingappa BC. Growth and yield of aerobic rice as influenced by integrated weed management practices. Indian J Weed Sci. 2010; 42(3, 4):180-183.
16. Veeraputhiran R, Balasubramanian R. Evaluation of bispyribac-sodium in transplanted rice. Indian J Weed Sci. 2013; 45(1):12-15.
17. Yadav DB, Yadav A, Punia SS. Evaluation of bispyribac sodium for weed control in transplanted rice. Indian J Weed Sci. 2009; 41(1, 2):23-27.
18. Yaduraju NT, Prasad Babu MBB, Chandla P. Herbicide Use. In: Agriculture and Environment. Swaminathan MS, Chadha KL (Eds.) Malhotra Publishing House, New Delhi, India. 2006; 192-210.