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Effect of weed management practices on weed flora, growth and yield of direct seeded rice (*Oryza sativa* L.)

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Abstract

A field experiment entitled “Effect of weed management practices on growth and yield of direct seeded rice (*Oryza sativa* L.)” was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during *kharif* season of 2015-16 and 2016-17. The experiment was laid out in randomized block design with twelve treatments consist in three replications. Result revealed that application of Pendimethaline *fb* Bispyribac-Na @ 1000 fb 25 g a.i. ha⁻¹ + HW 40 DAS was recorded significantly least density of difference weed flora and dry weight of weed as compare to weedy check. Maximum values (81.97 and 84.50%) of WCE was found with application of Pendimethaline *fb* Bispyribac-Na @ 1000 fb 25 g a.i. ha⁻¹ + HW 40 DAS, however, weed index values (1.82 and 3.88%) calculated minimum during both the years. All the growth and yield plant height, dry matter, LAI, as well as grain and straw yield were significantly higher in Significantly higher and lower values of yield attributes and yield, as well as lower and higher values of density and dry matter of weeds were recorded with weed free and weedy treatment, respectively.

Keywords: Weed flora, growth, *Oryza sativa* L.

Introduction

Rice (*Oryza sativa* L.) is the staple food of more than 60% of world population. It is globally grown in 155.62 m ha area with the production of 432.41 m tones (Anonymous, 2015). India ranks first in acreage with 43.81 m ha, but second in production with 96.43 m t, after China. In Uttar Pradesh rice is grown over an area of about 5.19 m ha with a production of 16.24 m tones and productivity of about 3.13 tones ha⁻¹ (Anonymous, 2015). Uttar Pradesh is the largest rice growing state after West Bengal but its productivity is very low. It might be due to late sowing & improper weed management factors.

In India, rice is generally grown by transplanting in puddled soils. Although, the conditions for higher productivity are more conducive in transplanted rice but, it is labour intensive and requires huge amount of water for raising seedlings, puddling of field, followed by transplanting involve high labour cost and fossil fuels. Transplanting of rice is associated with various constraints like late transplanting due to non-availability of water and labours at peak time which causes low plant population and ultimately reduction in yield. Land preparation by puddling results in alteration of soil physical properties, which is adversely affect the succeeding crop. Thus, relatively aerobic systems (unpuddled) are being tried over timely sowing and early maturity (7-10 days) of crop and reduced production cost, improves soil physical conditions for the succeeding crops with less methane emission (Mohanty *et al.*, 2001)^[7]. Therefore the direct seeded rice may solve the problems of existing practices. The condition for higher productivity is more conducive in direct seeded and transplanting in puddled beds, but they are labour intensive, energy demanding and cumbersome. Among the various factors for low productivity of paddy proper weed management particular in direct seeded rice is more important. Direct seeding is a good alternative of transplanting and yield potential of direct seeded rice is equivalent to transplanting rice under proper water management and weed control (Awan *et al.*, 1989)^[1]. Weeds pose a serious threat to the direct seeded rice crop by competing for nutrients, light, space and moisture throughout the growing season. Ramzan (2003)^[9], Reported that yield reduction up to 48%, 53% and 74% in transplanted, direct seeded in flooded conditions and direct seeded in dry soils, respectively. Therefore, an effective and economical weed control strategy is to be required to meet the demand of staple food for increasing population.

Heavy weed infestation is one of the major constraints in direct seeded rice causing severe yield losses. Weeds emerge simultaneously with germination rice seedling resulting in severe competition for nutrients, light, moisture and space. The traditional methods of weed control in rice include hand-weeding by hoe or hand pulling, are effective but this is becoming less common because of labour scarcity at critical time of weeding and increasing labour costs (Chauhan, 2012 and Kumar and Ladha, 2011) [3, 4, 5]. Weed management in direct seeded rice can be accomplished by mechanical, cultural and chemical methods. The mechanical method of weed control consisted of repeated weeding and hoeing using "Khurpi" is though effective but labour intensive and reduce the benefit: cost ratio. Hence, for direct seeded rice, the chemical method of weed management is best suited as can take care of weeds right from beginning of crop growth and is cost effective.

Farmer's generally apply herbicides by mixing them in sand for easy operation and prefer to use either single application of pre or post herbicides which fails to control diverse weed flora observed in DSR (Chauhan, 2012 and Chauhan and Opeña, 2012) [3, 4]. However, it is important to use a broad-spectrum herbicide program including pre and post herbicides for season-long effective weed control and to avoid shifts toward problematic weed species and evolution of herbicide-resistant weed biotypes.

Materials and Methods

The experiment was laid out during *khariif*, 2015-16 and 2016-17 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (Uttar Pradesh), India. The field was well levelled having good soil condition. Geographically, Faizabad (Kumarganj) falls in sub-tropical climate and it is situated at 26.47 °N latitude and 82.12 °E longitude with an altitude of 113 meters above mean sea level. The experiment site is situated in main campus of the university, about 42 km away from Faizabad district. The soil of the experimental field was silt loam, having pH 8.31 in 2015-16 & 8.62 in 2016-17; organic carbon (%) 0.382 in 2015-16 & 0.391 in 2016-17; available N, P and K values to the tune of 132.62, 14.25 and 240.37 kg ha⁻¹ in 2015-16 and 137.5, 15.65 and 246.25 kg ha⁻¹ in 2016-17 respectively. The soil of experimental field was low in available nitrogen and phosphorus, medium in potassium and slightly alkaline in reaction. The field experiment was laid out in RBD with three replications, having 12 number of treatments *viz.* Bispyribac-Na 25 g, Pendimethaline fb Bispyribac-Na 1000 fb 25 g, Pyrazosulfuron fb Bispyribac-Na 20 fb 25 g, Bispyribac-Na + almix 25 g + 4 g, Pendimethaline fb Bispyribac-Na + HW 40 DAS, Oxadiragyl fb Pretilachlor 100 fb 1000g, Pendimethaline fb Pretilachlor 100 fb 1000 g, Pendimethaline fb HW 20 DAS, along with Hand Weeding, Weed Free and Weedy Check. The herbicide treatments were applied at 1 DAS and 20 DAS as pre & Post emergence to weeds, respectively. The crop was direct seeded on 2 July, 2015-16 and 5 July, 2016-17 of rice variety NDR-97. A recommended dose of nutrients of N, P, K and Zn at 60:30:30:15 kg/ha, respectively were applied in the crop. Herbicides (Pre-emergence and post-emergence) were applied with the help of a hand-operated knapsack sprayer fitted with flat-fan nozzle using water 500 L ha⁻¹. Data of weed were subjected to square root transformation ($\sqrt{x + 0.5}$) before statistical analysis to normalize their distribution. To determine the effect of crop

growth, data on initial plant population/m row at 20 DAS, plant height (cm), tillers (m/row), plant dry matter accumulation (g/m row) were recorded at harvest and leaf area index was recorded at 75 days after sowing. Weed control efficiency was calculated using following formula. Where, WDC is the weed density (number m⁻²) in control plot; WDT is the weed density (number/m⁻²) in treated plot; in both WDC and WDT.

$$WCE = \frac{WDC - WDT}{WDC} \times 100$$

Results and Discussion

Effect on Weed

Different weed management practices were influenced on various weed flora. Among narrow leaved, *Echinochloa crusgalli* was the most dominant weed in the weedy check while in broad leaved weeds; *C. auxillaris* was one of the most dominant weed species during crop growing period. However, some other BLWs e.g. *Phyllanthus niruri* and Sedges like *Cyperus rotundus* and *Cyperus iria* were also present. By and large, dominance of BLWs was more over narrow leaved weeds.

Effect of weed management practices decreased the density of weed flora and weed biomass per unit area over weedy check during both the years (Table-1). Among the herbicide, Application of Pendimethalin (Pre) fb Bispyribac @ (1000 fb 25 g a.i. ha⁻¹) (PoE) was recorded significantly least density and dry weight of weeds over weedy check, which was being *at par* with Pendimethalin (Pre) fb Bispyribac + HW (40 DAS) and Oxadiragyl (Pre) fb Bispyribac @ (100 fb 25 g a.i. ha⁻¹) (PoE). However, minimum weed flora and weed biomass was obtained with weed free, which was significantly superior over rest of the treatments. Reducing of density of weed flora and dry weight of weed was mainly due to more effective control of grassy and broad leaf weeds through weed management practices, also reported was Madhavi *et al* 2016 [6] and Yadav *et al.* (2009) [12]. As far as the weed control efficiency (W.C.E.%) was concerned; it was also affected due to various weed control treatments. The maximum weed control efficiency (81.92 and 84.50%) was recorded with Pendimethalin (Pre) fb Bispyribac @ (1000 fb 25g a.i. ha⁻¹) + HW (40 DAS) followed by Pendimethalin (Pre) fb Bispyribac (1000 fb 25g ha⁻¹) (PoE) (77.99 and 80.49%) and Oxadiragyl (Pre) fb Bispyribac (100 fb 25 g ha⁻¹) (PoE) (75.97 and 78.48%) as compare to other herbicide treatment during both the year. However, highest weed control efficiency was weed free plot (100%). It was much effective to control the both type of weeds and resultant to this gave higher value of W.C.E. Application of Pendimethalin (Pre) fb Bispyribac @ (1000 fb 25g a.i. ha⁻¹) + HW (40 DAS) increased its bio efficacy to control the grassy and BLWs also and recorded the lowest value of weed index (1.82 and 3.88%) followed by Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) (6.36 and 8.33%). It means minimum reduction in grain yield was recorded with Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) + HW (40 DAS) followed by Pendimethalin (Pre) fb Bispyribac (PoE) (1000 fb 25g ha⁻¹).

Effect on growth

Data recorded to plant height, no. of tiller, dry matter accumulation and leaf area index had significant influenced by weed management practices during experimental years (Table-3). Tallest plant height was recorded with application of Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g

a.i. ha⁻¹) + HW (40 DAS) and being at par with Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) and Oxadirygyl (Pre) fb Pretilachlor (PoE) @ (100 fb 1000 g a.i. ha⁻¹). Consequently, weed free treatment was recorded significantly highest plant height over rest of the treatment. Hence, same trend was also observed in no. of tillers, dry matter accumulation and leaf area index. Increasing of plant height was mainly causes to the fact that both type of weed that is broad leaf and narrow leaf weed controlled to a regional absent, resulting very less competition of various weed species with crop plants, very less crop –weed competition due to optimum availability of nutrient, moisture and space causes ultimately found more plant height over weedy check. These results are in conformity with the work done at Jena *et al.* (2002) and Punia *et al.* (2004)

Effect on Yield

All the herbicidal treatments either applied in sequential combination with herbicides or as sole application, significantly increased yield of rice as compared to weedy check during both the years of investigation. Among the herbicide, the application of Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) + HW (40 DAS)

was recorded significantly highest values (44.08 and 45.84 q/ha) of grain and straw yield (57.61 and 59.79 q ha⁻¹) and which was being *at par* with Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) and Oxadirygyl (Pre) fb Pretilachlor (PoE) @ (100 fb 1000g a.i. ha⁻¹), however, maximum values (44.90 and 46.69 q ha⁻¹) of grain and straw yield values (58.32 and 60.53 q/ha) was recorded under weed free treatment, which was found significantly superior over rest of the treatments respectively, during both the years. Enhancing grain and straw yield was mainly due to control of all types weed owing to increase growth characters resulted increase grain and straw yield. Also reported was Singh and Sharma (1994) [10]. Weed management practices under direct seeded rice did not significant influenced harvest index during both the years, respectively.

It is concluded that significantly effect of different weed management practices on weed flora, density and biomass of weed, growth and yield under direct seeded rice condition. Application of Pendimethalin (Pre) fb Bispyribac (PoE) @ (1000 fb 25g a.i. ha⁻¹) + HW (40 DAS) proved best treatment for control of weed flora, and enhanced yield of direct seeded rice.

Table 1: Effect of weed management practices on density of weed flora under direct- seeded rice.

Treatment	<i>Echinochloa colonum</i>		<i>Echinochloa crusgallis</i>		<i>Cyprus rotundas</i>		<i>Phylenthus niruri</i>		Other		Total	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	4.38 (18.70)	4.48 (19.60)	4.21 (17.30)	4.32 (18.20)	5.34 (28.10)	5.47 (29.50)	5.02 (24.80)	5.14 (26.00)	3.79 (13.90)	3.88 (14.60)	10.15 (102.80)	10.40 (107.90)
T2	3.71 (13.30)	3.80 (14.00)	3.57 (12.30)	3.66 (12.90)	4.51 (19.90)	4.62 (20.90)	4.25 (17.60)	4.35 (18.50)	3.22 (9.90)	3.30 (10.40)	8.56 (73.00)	8.78 (76.70)
T3	3.87 (14.50)	3.96 (15.20)	3.74 (13.50)	3.83 (14.20)	4.71 (21.70)	4.82 (22.80)	4.43 (19.20)	4.54 (20.20)	3.36 (10.80)	3.43 (11.30)	8.94 (79.70)	9.16 (83.70)
T4	4.17 (16.90)	4.26 (17.70)	4.02 (15.70)	4.12 (16.50)	5.08 (25.35)	5.20 (26.60)	4.79 (22.50)	4.90 (23.60)	3.62 (12.60)	3.70 (13.20)	9.66 (93.05)	9.90 (97.60)
T5	4.30 (18.00)	4.40 (18.90)	4.15 (16.80)	4.25 (17.60)	5.25 (27.10)	5.37 (28.40)	4.95 (24.10)	5.07 (25.30)	3.74 (13.50)	3.83 (14.20)	9.99 (99.50)	10.23 (104.40)
T6	3.36 (10.80)	3.43 (11.30)	3.25 (10.10)	3.33 (10.60)	4.09 (16.30)	4.19 (17.10)	3.87 (14.50)	3.96 (15.20)	2.93 (8.10)	3.00 (8.50)	7.75 (59.80)	7.95 (62.70)
T7	4.02 (15.65)	4.11 (16.40)	3.87 (14.55)	3.93 (15.00)	4.89 (23.50)	5.01 (24.70)	4.61 (20.80)	4.72 (21.80)	3.49 (11.70)	3.57 (12.30)	9.31 (86.20)	9.52 (90.20)
T8	4.58 (20.50)	4.68 (21.50)	4.41 (19.00)	4.53 (20.00)	5.59 (30.80)	5.72 (32.30)	5.26 (27.20)	5.39 (28.60)	3.97 (15.30)	4.06 (16.00)	10.64 (112.80)	10.89 (118.40)
T9	4.83 (22.90)	4.95 (24.00)	4.66 (21.30)	4.78 (22.40)	5.90 (34.40)	6.04 (36.10)	5.56 (30.50)	5.70 (32.00)	4.19 (17.10)	4.30 (18.00)	11.24 (126.20)	11.52 (132.50)
T10	4.96 (24.10)	5.07 (25.30)	4.78 (22.40)	4.89 (23.50)	6.05 (36.20)	6.20 (38.00)	5.70 (32.10)	5.84 (33.70)	4.29 (18.00)	4.40 (18.90)	11.53 (132.80)	11.81 (139.40)
T11	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
T12	7.79 (60.30)	7.99 (63.40)	7.50 (55.90)	7.68 (58.70)	9.53 (90.50)	9.77 (95.00)	8.96 (80.00)	9.18 (84.00)	6.74 (45.00)	6.90 (47.30)	18.20 (331.70)	18.66 (384.40)
SEm ±	0.14	0.14	0.14	0.14	0.19	0.17	0.17	0.18	0.12	0.13	0.34	0.36
CD 5%	0.41	0.41	0.41	0.41	0.54	0.49	0.50	0.51	0.35	0.39	0.99	1.06

*Data subjected to square root ($\sqrt{x + 0.5}$) transformation and original data presented in parenthesis

Table 2: Effect of weed management practices on weed dry matter (g m^{-1}), WCE (%), WI (%) and growth characters of rice under direct seeded situation .

Treatments	Weed biomass (gm^{-1}) at 50 DAS		Weed Control Efficiency (%)		Weed Index (%)		Plant height (cm) at harvest stage		No. of tillers at harvest stage		Dry matter accumulation (g m^{-1})		Leaf area Index at 50 DAS	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	6.44 (41.12)	6.60 (43.16)	69.01	71.53	12.50	14.33	92.40	96.10	381.63	392.89	915.75	951.27	3.81	3.96
T2	5.45 (29.20)	5.58 (30.68)	77.99	80.49	6.36	8.33	98.88	102.84	401.38	413.43	973.17	1010.92	4.08	4.24
T3	5.68 (31.88)	5.82 (33.48)	75.97	78.48	9.09	11.00	96.00	99.84	392.60	404.30	943.51	980.12	3.96	4.12
T4	6.14 (37.22)	6.28 (39.04)	71.95	74.49	11.14	13.00	93.84	97.59	386.02	397.46	927.86	963.85	3.87	4.03
T5	6.35 (39.80)	6.49 (41.76)	70.00	72.53	14.32	16.11	90.48	94.10	375.78	386.81	900.92	935.86	3.73	3.88
T6	4.93 (23.92)	5.05 (25.08)	81.97	84.50	1.82	3.88	103.68	107.83	416.01	428.65	1016.88	1056.33	4.28	4.45
T7	5.91 (34.48)	6.04 (36.08)	74.01	76.61	10.00	11.89	95.04	98.84	389.67	401.26	941.92	978.45	3.92	4.08
T8	6.75 (45.12)	6.91 (47.36)	65.99	68.52	19.32	21.01	85.20	88.61	359.68	370.07	760.06	789.63	3.51	3.66
T9	7.13 (50.48)	7.31 (53.00)	61.95	64.47	17.73	19.45	86.88	90.36	364.80	375.40	864.06	897.58	3.58	3.73
T10	7.31 (53.12)	7.50 (55.76)	59.96	62.49	17.05	18.78	87.60	91.10	367.00	377.68	870.21	903.96	3.61	3.76
T11	0.71 (0.00)	0.71 (0.00)	100.00	100.00	0.00	0.00	105.60	109.82	421.86	434.73	1032.14	1072.19	4.36	4.53
T12	11.52 (132.68)	11.81 (139.36)	0.00	2.50	30.00	31.47	73.92	76.88	325.30	334.31	746.52	775.46	3.05	3.17
SEm \pm	0.23	0.22	-	-	-	-	3.31	3.96	15.40	15.45	35.00	38.90	0.15	0.18
CD 5%	0.67	0.63	-	-	-	-	9.65	11.57	44.96	45.09	102.17	113.53	0.43	0.54

*Data subjected to square root ($\sqrt{x + 0.5}$) transformation and original data presented in parenthesis of weed biomass at 50 DAS.

Table 3: Effect of weed management practices on grain and straw yield in direct seeded rice.

Treatment	Grain yield (q ha^{-1})		Straw yield (q ha^{-1})		Harvest index (%)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	39.29	40.86	52.29	54.27	42.90	42.95
T2	42.04	43.72	55.28	57.37	43.20	43.25
T3	40.82	42.45	53.53	55.56	43.26	43.31
T4	39.90	41.49	52.89	54.89	43.00	43.05
T5	38.47	40.01	51.62	53.58	42.70	42.75
T6	44.08	45.84	57.61	59.79	43.35	43.40
T7	40.41	42.02	53.78	55.82	42.90	42.95
T8	36.22	37.67	39.78	41.29	47.66	47.71
T9	36.94	38.42	49.47	51.34	42.75	42.80
T10	37.24	38.73	49.78	51.66	42.80	42.85
T11	44.90	46.69	58.32	60.53	43.50	43.55
T12	31.43	32.69	43.22	44.86	42.10	42.15
SEm \pm	1.55	1.74	2.19	1.89	1.77	1.64
CD 5%	4.53	5.07	6.39	5.53	NS	NS

References

- Anonymous. Fertilizer statistics, FAI, New Delhi 2015.
- Awan IU, Alizai HU, Chaudhry FM. Comparative study of direct seeding and transplanting methods on the grain yield of rice. *Sarhad J. Agric* 1989;5:119-124.
- Chauhan BS. Weed ecology and weed management strategies for dry-seeded rice. *Asia Weed Technol* 2012;26:1-13
- Chauhan BS, Opeña J. Effect of tillage systems and herbicides on weed emergence, weed growth, and grain yield in dry-seeded rice systems. *Field Crops Res* 2012;137:56-69.
- Kumar V, Ladha JK. Direct-seeding of rice: recent developments and future research needs. *Adv. Agron* 2011;111:297-413
- Madhavi M, Yakadri M, Leela Rani P, Ramprakash T. Herbicide combinations for weed control in direct-seeded rice. *Indian Journal of Weed Science* 2016;48(4):369-371.
- Mohanty SR, Bharti K, Moorthy BTS, Ramkrishna B, Rao VR, Sathunathan N, Adhya TK *et al.* Effect of herbicide butachlor and methane emission and ebullition flux from a direct seeded flooded rice field. *Biology and Fertility of Soils* 2001;33:175-180.
- Mukherjee D. Effect of low doses of herbicides on weeds, nutrient uptake and yield of transplanted rice

- (*Oryza sativa* L.). Indian J. of Agronomy 2005;50(3):194-196.
9. Ramzan M. Evaluation of various planting methods in rice-wheat cropping system, Punjab, Pakistan. Rice crop Report 2003;4:4-5.
 10. Singh KN, Sharma SN. Effect of fertility levels, spacing and weed control measures on upland direct seed rice growth, yield attributes and yield. Madras Agri 1994;81(12):660-662.
 11. Singh S, Ladha JK, Gupta RK, Bhushan L, Rao AN. Weed management in aerobic rice systems under varying establishment methods. Crop Protection 2008;27:660-671.
 12. Yadav DB, Yadav A, Punia SS. Evaluation of bispyribac-Na for weed control in transplanted rice. Indian J Weed Sci 2009;41:23-27.