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Research Article

Effect of Herbicides Combinations for Control of Weed Complex Growth and Yields in Direct Seeded Rice (*Oryza sativa*)

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ABSTRACT

The field experiment was conducted during kharif season of the year 2013-2014 on red lateritic soil of the Education-cum-experimental Farm, Department of Agronomy, College of Agriculture, Dapoli, Ratnagiri (M.S.) to study Effect of herbicides combinations for control of complex weed flora in direct seeded Rice (Oryza sativa). There have 10 treatments combination, Bispyribac-Na @ 25g/ha, Pendimethalin fb ispyribac-Na @ 1000 fb 25 g/ha, Oxadiargyl fb bispyribac-Na @ 100/25 g/ha, Pyrazosulfuron fb bispyribac -Na @ 20/25 g/ha, Pendimethalin fb bispyribac-Na fb manual weeding @ 1000 fb 25 g/ha, Pendimethalin fb manual weeding (Pendistar) @ 1000g/ha, Bispyribac -Na + (chlorimuron + metsulfuron) @ 20+4g/ha, Three mechanical weedings (cono / rotary weeder), Weed free check (HW at 20,40, and 60 DAS) and Weedy check. The present study revealed that as Various weed control measures tried significantly influenced growth of monocots during all the years of experimentation and in pooled results. During 1st year use of Pendimethalin fb manual weeding significantly reduced growth of monocots as compared to use of Bispyriback-Na, Pendimethalin fb Bispyriback-Na,Pyrazosulfuron fb Bispyribac-Na and weedy check and remained at par with rest of the treatments, while, during the year 2013, 2014 and in pooled results, use of pendimethaline fb manual weeding recorded significantly lowest weed growth than rest of the treatment except Pendimethalin fb manual weeding and weed free check and weed free check produced significantly higher grain and straw yield (40.56 and 48.96 qha^{-1}) respectively over rest of the treatments except the use of pendimethaline fb manual weeding (38.34 and 45.50 qha^{-1}) and Pendimethalin fb Bispyriback-Na fb manual weeding (37.08 and 45.74 qha^{-1}) which were at par with weed free check. Thus compared to best treatment of weed free check the percent reduction in the grain yield, (WCI) was found to be least in case of pendimethalin fb manual weeding (5.47%) followed by Pendimethalin fb Bispyriback-Na fb manual weeding (8.58 %) in 2013 & 2014.

Key words: *Direct seeded Rice, Different herbicides, weed growth, yield attributing characters and chemical composition.*

INTRODUCTION

Herbicides flowed by Intercultural operation play an important role in integrated weed management in rice. In early season weed competition significantly reduces rice grain yield and pre-emergence herbicides application are widely used.

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But most weeds seed germinate over long time and pre-emergence herbicides having short residual life so that used combinations of herbicides and approach integrated weed managements. It is estimated that weeds cause 10 to 20 % losses in crop production in developed, developing and under -developed countries respectively (yaduraju & Moorthy 2002).

MATERIALS AND METHODS

The field experiment was conducted during *kharif* season of the year 2013-2014 on red lateritic soil of the Education-cum-experimental Farm, Department of Agronomy, College of Agriculture, Dapoli, Ratnagiri (M.S.) to study Effect of herbicides combinations for control of complex weed flora in direct seeded Rice (*Oryza sativa*). There have 10 treatments combination with RBD designed. The different treatments included weed control measure such as hand weeding at 20 40 and 60 DAS, Weedy check, and different herbicides Bispyribac-Na 25g/ha 20 DAS (3-4 leaf stage), Pendimethalin fb bispyribac-Na 1000 fb 25 0-2 fb 25, Oxadiargyl fb bispyribac-Na 100/25 0-2 fb. 25, Pyrazosulfuron fb bispyribac –Na 20/25 0-3 fb. 25 Pendimethalin fb bispyribac-Na fb manual weeding 1000 fb 25 0-2 fb. 20 DAS (3-4 leaf stage) fb 45d. Pendimethalin fb manual weeding (Pendistar) 1000 0-2 fb. 25-30d Bispyribac -Na + (chlorimuron + metsulfuron) 20+4 20 DAS Three mechanical weedings (cono / rotary weeder) 20, 40, 60 DAS Weed free check (HW at 20, 40, and 60 DAS) Weedy check. The experimental data were subjected to analysis of variance (ANOVA) and treatment means were compared, significant differences were tested at p=0.05 usin split plot design (SPD) as given by Panse and Sukhatme (1985) using computer design.

RESULTS AND DISCUSSION

I) Effect of herbicide combinations on weed growth-

Various weed control measures tried significantly influenced growth of monocots during all the years of experimentation and in pooled results. During 1st year use of Pendimethalin fb manual weeding significantly reduced growth of monocots as compared to use of Bispyriback-Na, Pendimethalin fb Bispyriback-Na, Pyrazosulfuron fb Bispyribac-Na and weedy check and remained at par with rest of the treatments, while, during the year 2013, 2014 and in pooled results, use of pendimethaline fb manual weeding recorded significantly lowest weed growth than rest of the treatment except Pendimethalin fb manual weeding and weed free check. Various weed control measures tried did not significantly influenced growth of BLWS during individual years as well as in pooled results at 60 DAS. Application of Pendimethalin fb Bispyriback-Nafb manual weeding, Pendimethalin fbmanual weeding and weed free check remain at par with each other and reduced significantly the weed growth of monocots during 1st, 3rd years and in pooled results at 90 DAS. However, weed free check (3HW) reduced significantly the weed growth of monocots during the year 2013 over all other weed control measures tried except use of Pendimethalin fbmanual weeding. In respect of weed growth of BLWS was reduced significantly due to various weed control measures tried over weedy check during the year 2012-2013 and in pooled results. However, weed free check (3HW) reduced significantly the growth of BLWS during the year 2014 over all other treatments except use of Pendimethalin fb Bispyriback-Nafb manual weeding and Pyrazosulfuron fb Bispyribac-Na which was at par with weed free check.The pooled data indicated that the highest weed control efficiency was recorded under weed free check followed by Pendimethalin fbmanual weeding and Pendimethalin fb Bispyriback-Nafb manual weeding at all the stages of observations. This shows that the total weed growth of monocots and BLWs was conspicuously suppressed by the application of Pendimethalin fb manual weeding exhibiting the WCE of 83.94 and 94.29 percent at 60 and 90DAS respectively. These results are in conformity with the findings of Simerjeet kaur

and Surjeet singh who reported that hand weeding and pendimethline suppress the weed growth as compared to other herbicide treatments.

Table 1: Effects of herbicide combinations on weed growth at 60 DAS (No. 0.25 m^2) (Three year pooled mean)

Treatments	Grasses & Sedges				Broad leaved weeds				Total				Weed control efficiency			
	2012	2013	2014	Pooled	2012	2013	2014	Pooled	2012	2013	2014	Pooled	2012	2013	2014	Pooled
T1: Bispyribac-Na	24.67 **(4.74)**	3.84 **(1.97)**	14.67 **(3.88)**	14.39 (3.53)	00.00 **(0.71)**	00.00 **(0.71)**	12.50 **(3.59)**	4.17 (1.67)	24.67	3.84	27.17	18.56	30.19	65.7	12.83	28.34
T2: Pendimethalin fb Bispyribac-Na	19.67 **(4.34)**	2.75 **(1.79)**	12.33 **(3.56)**	11.58 (3.23)	0.33 **(0.88)**	0.27 **(0.87)**	6.33 **(2.61)**	2.31 (1.45)	20.00	3.02	18.66	13.89	43.41	73.0	40.13	46.37
T3: Oxadiargyl fb Bispyribac-Na	15.00 **(3.40)**	3.53 **(2.00)**	14.00 **(3.80)**	10.84 (3.07)	0.33 **(0.88)**	0.00 **(0.71)**	5.17 **(2.37)**	1.83 (1.32)	15.33	3.53	19.17	12.67	56.62	68.5	38.50	51.08
T4: Pyrazosulfuron fb Bispyribac-Na	27.33 (**4.83**)	4.09 **(2.13)**	10.00 **(3.30)**	16.48 (3.75)	0.00 **(0.71)**	0.00 **(0.71)**	3.23 **(1.92)**	1.08 (1.11)	27.33	4.09	13.23	17.56	77.33	63.5	57.56	32.20
T5: Pendimethalin fb Bispyribac-Na fb manual weeding	10.67 **(2.79)**	0.44 **(0.96)**	5.00 **(2.34)**	5.37 (2.03)	0.33 **(0.88)**	0.09 **(0.77)**	2.33 **(1.66)**	0.92 (1.10)	11.00	0.53	7.33	6.29	68.87	95.3	76.48	75.71
T6: Pendimethalin fb manual weeding	1.00 **(1.22)**	0.12 **(0.78)**	6.50 **(2.64)**	2.54 (1.55)	0.33 **(0.88)**	0.36 **(0.91)**	4.17 **(2.14)**	1.62 (1.31)	1.33	0.48	10.67	4.16	96.24	95.7	65.77	83.94
T7: Bispyribac-Na + (chlorimuron+metsulfuron)	10.33 **(3.18)**	2.42 **(1.57)**	13.83 **(3.78)**	8.86 (2.84)	3.33 **(1.53)**	0.00 **(0.71)**	7.00 **(2.73)**	3.44 (1.66)	13.66	2.42	20.88	12.33	61.35	78.4	33.01	52.39
T8: Three mechanical weedings (cono / rotary weeder)	4.33 **(2.09)**	4.37 **(2.00)**	12.67 **(3.61)**	7.12 (2.57)	1.33 **(1.34)**	0.44 **(0.96)**	4.17 **(2.13)**	1.98 (1.48)	5.66	4.81	16.84	9.10	83.98	57.0	45.97	64.86
T9: Weed free check (HW at 20,40, & 60DAS)	2.00 **(1.52)**	0.42 **(1.03)**	6.83 **(2.70)**	3.09 (1.75)	0.33 **(0.88)**	0.00 **(0.71)**	2.12 **(2.26)**	0.82 (1.28)	2.33	0.42	8.95	3.91	93.41	96.3	71.29	84.90
T10: Weedy check	32.67 **(5.70)**	10.80 **(3.25)**	17.50 **(4.22)**	20.32 (4.39)	2.67 **(1.45)**	0.40 **(0.98)**	13.67 **(6.87)**	5.58 (3.10)	35.34	11.20	31.17	25.90	-	-	00.00	
S.Em ±	- **(0.86)**	- **(0.38)**	- **(0.16)**	- (0.47)	- **(0.67)**	- **(0.13)**	- **(1.03)**	- (0.56)	-	-	-		-	-	-	
C.D.at 5%	- **(2.39)**	- **(1.05)**	- **(0.45)**	- (0.94)	- **(N.S.)**	- **(N.S.)**	- **(N.S)**	- (1.11)	-	-	-		-	-	-	

Figures in parentheses indicate square root transformations $\sqrt{x + 0.5}$

Table 2: Effects of herbicide combinations on weed growth at 90 DAS (No. 0.25 m^2) (Three year pooled mean)

Treatments	Grasses & Sedges				Broad leaved weeds				Total				Weed control efficiency			
	2012	2013	2014	Pooled	2012	2013	2014	Pooled	2012	2013	2014	Pooled	2012	2013	2014	Pooled
T1: Bispyribac-Na	33.50 **(5.76)**	102.00 **(9.87)**	25.38 **(5.08)**	51.75 (6.30)	00.00 **(0.71)**	00.00 **(0.71)**	18.70 **(4.36)**	1.45 (1.21)	33.50	102.00	42.08	53.20	70.31	16.4	23.95	30.91
T2: Pendimethalin fb Bispyribac-Na	20.00 **(4.30)**	23.67 **(4.00)**	18.04 **(4.29)**	15.99 (3.49)	1.33 **(1.39)**	1.00 **(1.17)**	9.10 **(3.06)**	2.13 (1.48)	21.33	24.67	27.14	18.12	81.10	79.8	53.60	76.47
T3: Oxadiargyl fb Bispyribac-Na	36.83 (**6.02**)	86.33 **(8.27)**	20.37 **(4.56)**	42.57 (5.51)	1.17 **(1.22)**	0.33 **(0.88)**	9.47 **(3.14)**	1.55 (1.34)	38.00	86.66	29.84	44.12	66.32	28.9	48.64	42.70
T4: Pyrazosulfuron fb Bispyribac-Na	28.83 **(5.13)**	66.33 **(7.98)**	29.78 **(5.50)**	33.55 (5.19)	0.00 **(0.71)**	0.33 **(0.71)**	6.18 **(2.56)**	0.97 (1.06)	28.83	66.66	35.96	34.52	74.45	45.4	37.80	55.17
T5: Pendimethalin fb Bispyribac-Na fb manual weeding	1.00 **(1.15)**	12.33 **(3.22)**	10.81 **(3.35)**	5.56 (2.11)	1.67 **(1.45)**	1.00 **(1.22)**	3.70 **(2.04)**	1.57 (1.42)	2.67	13.33	14.51	7.13	97.63	89.1	74.64	90.74
T6: Pendimethalin fb manual weeding	2.50 **(1.53)**	1.33 **(1.27)**	12.90 **(3.65)**	2.49 (1.61)	1.50 **(1.38)**	1.33 **(1.34)**	6.19 **(2.90)**	1.91 (1.52)	4.00	2.66	19.09	4.40	96.45	97.8	66.85	94.29
T7: Bispyribac-Na + (chlorimuron+metsulfuron)	17.50 (**4.16**)	112.67 **(10.43)**	21.61 **(4.68)**	48.38 (5.62)	0.00 **(0.71)**	0.33 **(0.88)**	13.16 **(3.64)**	1.32 (1.21)	17.50	113.0	34.77	49.70	84.49	7.4	40.96	35.45
T8: Three mechanical weedings (cono / rotary weeder)	10.50 **(3.24)**	53.00 **(6.51)**	18.26 **(4.31)**	22.60 (3.98)	15.17 **(3.36)**	0.67 **(1.05)**	7.20 **(2.75)**	6.19 (2.07)	25.67	53.67	25.46	28.79	77.25	56.0	56.18	62.61
T9: Weed free check (HW at 20,40, & 60DAS)	1.67 **(1.26)**	1.00 **(1.22)**	11.32 **(3.43)**	2.03 (1.49)	0.17 **(0.81)**	0.33 **(0.88)**	3.48 **(1.97)**	0.82 (1.09)	1.84	1.33	14.80	2.85	98.37	98.9	74.60	96.30
T10: Weedy check	74.50 **(8.47)**	116.67 **(10.78)**	32.90 **(5.77)**	60.76 (6.95)	38.33 **(5.28)**	5.33 **(2.12)**	25.32 **(5.07)**	16.24 (3.25)	112.83	122.00	58.22	77.00	-	-	-	-
S.Em ±	- **(0.58)**	- **(0.91)**	- **(0.15)**	- (0.99)	- **(1.24)**	- **(0.43)**	- **(0.24)**	- (0.50)	-	-	-		-	-	-	-
C.D.at 5%	- **(1.61.)**	- **(1.52)**	- **(0.45)**	- (1.98)	- **(3.42)**	- **(1.19)**	- **(0.70)**	- (0.99)	-	-	-		-	-	-	-

Figures in parentheses indicate square root transformations $\sqrt{x + 0.5}$

Table 3: Effects of herbicide combinations on yield of rice (Three year pooled mean)

Treatments	Grain Yield qu/ha				Straw Yield qu/ha				WCI%			
	(2012)	**(2013)**	**(2014)**	**Pooled**	**(2012)**	**(2013)**	**(2014)**	**Pooled**	**(2012)**	**(2013)**	**(2014)**	**Pooled**
T1: Bispyribac-Na	19.51	23.13	28.65	20.43	20.44	24.23	49.11	27.93	33.64	56.0	21.62	49.63
T2: Pendimethalin fb Bispyribac-Na	17.95	50.44	35.19	31.20	20.00	52.99	54.75	39.25	38.95	4.2	9.35	23.08
T3: Oxadiargyl fb Bispyribac-Na	17.96	40.56	36.76	31.76	19.11	43.00	52.87	38.32	38.91	22.9	9.66	21.70
T4: Pyrazosulfuron fb Bispyribac-Na	16.42	32.82	29.24	26.16	19.11	36.76	41.86	32.58	44.14	37.6	28.34	35.50
T5: Pendimethalin fb Bispyribac-Na fb manual weeding	25.71	46.38	39.19	37.08	28.89	50.09	58.24	45.74	12.55	11.9	1.80	8.58
T6: Pendimethalin fb manual weeding	23.22	52.33	39.45	38.34	24.15	56.49	55.55	45.50	21.02	0.59	4.25	5.47
T7: Bispyribac-Na + (chlorimuron+metsulfuron)	11.31	38.31	27.73	25.79	12.22	41.38	46.69	33.43	61.53	27.2	25.00	36.42
T8: Three mechanical weedings (cono / rotary weeder)	17.89	37.51	35.58	30.33	19.06	40.51	52.87	37.48	39.15	28.3	10.85	25.22
T9: Weed free check (HW at 20,40, & 60DAS)	29.40	52.64	39.64	40.56	30.44	56.85	59.58	48.96	-	-	-	0.00
T10: Weedy check	3.33	10.89	19.96	11.39	3.77	11.85	34.35	16.65	88.67	79.3	45.56	71.92
S.Em ±	0.60	0.75	0.27	2.56	0.41	0.78	0.54	2.84	-	-	-	-
C.D.at 5%	1.65	2.08	0.74	5.11	1.13	1.17	1.49	5.67	-	-	-	-

Table 4: Economics for Weed Control Measures Applied in Rice

Treatments	**Pooled (2012 to 2014)**				
	Grain yield q/ha	Straw yield q/h	Gross Expenditure (Rs./ Q/ha.)	Gross returns in Rs./Q/ha.	C: B ratio
T1: Bispyribac-Na	20.43	27.93	43408	36231	0.83
T2: Pendimethalin fb Bispyribac-Na	31.20	39.25	52546	54650	1.04
T3: Oxadiargyl fb Bispyribac-Na	31.76	38.32	52740	55304	1.05
T4: Pyrazosulfuron fb Bispyribac-Na	26.16	32.58	44694	45756	1.02
T5: Pendimethalin fb Bispyribac-Na fb manual weeding	37.08	45.74	52505	64768	1.23
T6: Pendimethalin fb manual weeding	38.34	45.50	50032	66610	1.33
T7: Bispyribac-Na +(chlorimuron+metsulfuron)	25.79	33.43	44329	45371	1.02
T8: Three mechanical weedings (cono / rotary weeder)	30.33	37.48	55225	52991	1.01
T9: Weed free check (HW at 20,40, & 60DAS)	40.56	48.96	56873	70632	1.24
T10: Weedy check	11.39	16.65	35935	20415	0.57

*** selling rate 1) Rice – 1500/- per qu. 2) Straw – 200/- per qu.**

*** Herbicide rate**

II) Effect of herbicide combinations on yield

The pooled data revealed that various weed control measures tried significantly influenced the yield attributes viz. plant height and weight of filled grains per panicle over weedy check. Weed free check (three hand weeding) recorded significantly higher plant height over other treatments except Pendimethalin fb Bispyriback-Na fb manual weeding, Pendimethalin fb manual weeding, Three mechanical weeding and Pendimethalin fb Bispyriback-Nawhich were at par with weed free check. In respect of filled grains per panicle pre-emergence application of pendimethalin fb manual weeding significantly showed higher response over Bispyriback-Na, Oxadiargyl fb Bispyriback-Na andweedy check and remain at par with rest of the treatments. As a result, weed free check produced significantly higher grain and straw yield (40.56 and 48.96 qha^{-1}) respectively over rest of the treatments except the use of pendimethaline fb manual weeding (38.34 and 45.50 qha^{-1}) and Pendimethalin fb Bispyriback-Na fb manual weeding (37.08 and 45.74 qha^{-1}) which were at par with weed free check. Thus compared to best treatment of weed free check the percent reduction in the grain yield, (WCI) was found to be least in case of pendimethalin fb manual weeding (5.47%) followed by Pendimethalin fb Bispyriback-Na fb manual weeding (8.58 %).The highest net returns of Rs. 16,578/ha were obtained with the application of pendimethalin (PE) fb manual weeding, followed by weed free check (HW at 20, 40

and 60 DAS) Rs. 13,759/ha with B:C ratio of 1.33 and 1.24 respectively. This clearly indicate that all weed control measures under study recorded significant increase in grain & straw yield over weedy check. The weed free check recorded significantly highest grain & straw yield of 40.56&48.96 q/ha. respectively over all other treatments, which were at par with Pendimethalin fb manual weeding for grain yield and Pendimethalin fb Bispyribac-Na fb manual weeding for straw yield. But the highest Benefit Cost Ratio was obtained from the application of Pendimethalin fb manual weeding (1.33). These results are in conformity with the findings of Simerjeet kaur and Surjeet singh 2015 who reported that handweeding and pendimethline increases the yield of rice crop as compared to other herbicide treatments Similar results were also obtained by Singh et al. (2009) that under dry seeding, higher grain yield was recorded with preemergence application of pendimethalin 1.50 kg/ha. The difference in yield might be due to differences in application mode and efficacy of herbicides against weed species.

CONCLUSION

On the basis three years pooled data it could be concluded that application of pendimethalin (PE) fb manual weeding was the most effective and economical treatment followed by weed free check (HW at 20, 40, and 60 DAS) to control weed growth effectively in direct seeded drilled rice during kharif season and thus obtain higher productivity and profit.

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