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EFFICACY OF BENSULFURON METHYL + PRETILACHLOR AGAINST WEEDS IN TRANSPLANTED RICE

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ABSTRACT
The present investigation was conducted at the Krishi Nagar Farm, Department of Agronomy, JNKVV, Jabalpur during *kharif* 2015, The soil of the experimental field was sandy clay loam in texture, medium in organic carbon and available nitrogen, Phosphorus and potassium content and neutral in soil reaction. The experiment was laid out in randomized block design with seven weed control treatments comprising of Bensulfuron methyl + Pretilachlor @ (48+480), (60+600) and (72+720) g a.i./ha as pre-emergence, Pendimethalin @1300 g a.i./ha, Butachlor @1500 g a.i./ha, hand weeding twice at 20 and 40 DAT and weedy check replicated four times There *was* predominance of *Cyperus difformis* (47.83%) ,*Cyperus irria* (22.43%) and *Echinochloa colona* (5.2%) in transplanted rice. However, dicot weeds like *Ludwigia perennis* (10.90%), *Monochoria vaginalis* (8.54%) and *Eclipta alba* (5.10%) also marked their presence in less numbersApplication of Bensulfuron methyl + Pretilachlor @ (60+600) g ha-1 was found suitable for effective control of weeds followed by Bensulfuron methyl + Pretilachlor @ (72+720) g ha-1in transplanted rice

KEYWORDS: sandy clay loam, weed control, soil reaction, transplanted rice.

INTRODUCTION

Rice (*Oryza sativa* L.) is a plant belonging to the family of Gramineae (Poaceae) is one of the predominated food crop of the world, a grain of life more than 70% of the Asian population as the staple food crop for world poorest and densely population region and More than half of the human race depend on rice for their daily sustenance (Chauhan and Johnson, 2011). It is the leading cereal of the world (Ashraf et al., 2006). It is the primary source of income and employment for more than 100 million households in Asia and Africa, World's rice demand is projected to increase by 25% from 2001 to 2025 to keep pace with population growth (Anonymous, 2001). Rice is an important staple food crop of India and grown on nearly 43.95 million hectare with the production of 106.54 million tones triggering productivity of 2424 kg/ha, respectively. In Madhya Pradesh, rice covers 1.93 million ha area, with an annual production 2.78 million tones but average productivity is quite low (1438 kg/ha) as compared to national productivity of rice (2424 kg/ha) (Anonymous, 2015). The problem of extensive weed incidence during early stages of rice crop growth can not be determined which competes with crop plants for moisture, nutrients, light, space and other growth factors. This crop competition leads to significant yield losses to the tune of 35-55% in transplanted rice (Gautam and Mishra, 1995). Traditionally weed control in rice is done by manual and mechanical means which are most effective and common methods but they are tedious, costly, time taking and are difficult due to continuous rains during *kharif* season. Besides, adequate laborious are also not available during critical period of crop weed competition. Ramzan, 2003 reported yield reduction up to 48, 53 and 74% in transplanted, direct seeded flooded and direct seeded aerobic rice, respectively. Manual weeding although effective and most common practice of weed control in transplanted rice, these have several limitations particularly scarcity of labour at peak season, difficult to differentiate and remove the grassy weeds especially *Echinochloa colona* and *Echinochloa crus-galli*, due to phenotypical similarities between weeds and rice seedlings in the early stages. Raising cost of labour and their non-availability also lead to the search for alternative methods such as herbicide (Rao et al, 2007).

METHODOLOGY

The present investigation was conducted at the Krishi Nagar Farm, Department of Agronomy, JNKVV, Jabalpur during *kharif* 2015. The soil of the experimental field was sandy clay loam in texture, medium in organic carbon and available nitrogen, Phosphorus and potassium content and neutral in soil reaction. The experiment was laid out in randomized block design with seven weed control treatments comprising of Bensulfuron methyl + Pretilachlor @ (48+480), (60+600) and (72+720) g a.i./ha as pre-emergence, Pendimethalin @1300 g a.i./ha, Butachlor @1500 g a.i./ha, hand weeding twice at 20 and 40 DAT and weedy check replicated four times.Seedlings of rice variety JRH-5 were raised in nursery and transplanted in main field on 14rd July 2015 after its thorough puddling and leveling.

RESULTS & DISCUSSION

Dominant weed flora

Species wise weed data at 30 DAT in weedy check plot (Table 1). exhibited that there was predominance of monocot (*Cyperus difformis, Cyperus iria* and *Echinochloa colona)* and broad leaved (*Ludwigia perennis* , *Eclipta alba* and *Monochoria vaginalis*) weeds in the experimental field. Among the weeds *Cyperus*

difformis followed by *Cyperus iria* were more rampant (47.83 and 22.43 % at 30 DAT and 29.50 and 26.65 at harvest) due to their continuous regrowth during the crop season. Similar weed flora in rice has also been reported by Mahajan et al. (2003), Duary et al. (2015) and Punia et al. (2016).

TABLE 1: Species wise weed density (m^{-2}) and Relative density (%) in weedy check plots at 30 DAT and harvest

Weed species	Density (m^{-2})		Relative density (%)	
	30 DAT	Harvest	30 DAT	Harvest
Grasses				
Echinochloa colona	11.57	22.64	5.2	12.9
Cyperus difformis	106.5	51.76	47.83	29.5
Cyperus iria	49.94	46.75	22.43	26.65
Broad leaved weeds				
Ludwigia perennis	24.28	22.54	10.9	12.85
Eclipta alba	11.35	19.1	5.1	10.89
Monochoria vaginalis	19.01	12.65	8.54	7.21
Total	222.64	175.44	100	100

Density and dry weight of weeds

Significant variations in the density and dry weight of *Cyperus difformis*, *Cyperus iria*, *Echinochloa colona*, *Ludwigia perennis* , *Eclipta alba* and *Monochoria vaginalis* under different weed control treatments were observed (Table 3 and 4). It was noticed that the density and dry weight of all these weeds were maximum under weedy check plots at all the growth intervals. This was attributed to non adoption of weed control measure in the weedy check plots. The density and dry weight of these weeds were reduced when the weeds were controlled through the herbicide and hand weeding. The reduction in the density and dry weight of all the weeds was marginal with the application of Bensulfuron methyl + Pretilachlor as pre-emergence @ (48+480) g a.i./ha and check herbicides, Butachlor at 1500 ml/ha and Pendimethalin 1300 ml/ha. All these weeds were controlled effectively with the application of Bensulfuron methyl + Pretilachlor as pre-emergence @ (72+720) g a.i./ha. Similar results were also reported by Rajkhowa et al. (2007), Kumar et al. (2013) and Kumar et al (2014).

Weed index

The index (Table 4) was maximum (51.15%) in weedy check plots due to presence of more weeds while it was minimum (12.50%) with Bensulfuron methyl + Pretilachlor @ (60+600) g a.i./ha The minimum weed index noted under later treatment (i.e. Bensulfuron methyl + Pretilachlor @ 729 g a.i./ha) was owing to effective control of weeds.

Weed control efficiency

Weed control efficiency (Table 4) under a treatment had strongly reverse relationship with weed biomass. Maximum (92.56%) weed control efficiency was noted under hand weeding twice. It was closely followed by Bensulfuron methyl + Pretilachlor @ (72+720) and (60+600) g a.i./ha (90.27% and 86.06%). This was attributed to removal of weeds which reduced the biomass production under these treatments. These results are in collaboration with the findings of Prakash et al (2013) and Ramachandra et al. (2014).

Grain and straw yield

In the present study the lowest grain and straw yields (Table 4) were noted under weedy check plots in which weeds were allowed to grow throughout the crop season. This resulted in severe crop-weed competition for available growth resources which resulted in the inferior growth and yield attributing characters as well as partitioning of dry matter in leaves, stem and panicle, which resulted in lowest yields. Significant increase in yields (grain and straw) were observed with the different doses of Bensulfuron methyl + Pretilachlor when applied as pre-emergence @ ((48+480), (60+600) and (72+720) g a.i./ha) being highest (5153 and 9302 kg/ha) at (60+600) g a.i./ha. The grain and straw yields noted under hand weeding twice were appreciably more (5889 and 9964 kg/ha) over all the treatments. The enhanced yields under these treatments was because of elimination of weeds which helped in enhancing the availability of nutrients, space, sunlight and water resulting in better growth and development of crop plants. This caused better yield attributing characters and accumulation of more dry matter ultimately the highest yields. These results are in collaboration with the findings of Mukherjee and Maity (2011), Chauha and Opena (2013) and Kumar et al (2014).

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TABLE 4: rice as influenced by different weed control treatments

T.No.	Treatments	WCE (%)		Weed index	Grain yield (kg ha^{-1})	Straw yield (kg ha-1)
		30 DAT	Harvest			
T_1	Weedy check (Control)	-	-	51.15	2877	6254
T_2	Bensulfuron methyl + Pretilachlor (48+480) g/ha	63.97	75.94	26.30	4340	7952
T_3	Bensulfuron methyl + Pretilachlor (60+600) g/ha	78.70	86.06	12.50	5153	9302
T_4	Bensulfuron methyl + Pretilachlor (72+720) g/ha	85.23	90.27	14.93	5010	9072
T_5	Pendimethalin 1300 g/ha	48.88	62.43	38.76	3606	7499
T_6	Butachlor 1500 g/ha	41.33	75.38	39.35	3571	7560
T_7	Hand Weeding 20 and 40 DAT	90.43	92.56	0.00	5889	9964
SEm±				-	36.02	76.83
CD(P=0.05)				-	107.85	230.05

TABLE 2: Effect of different treatments on density/m^2 of *Echinochloa colona*, *Cyperus difformis* and *Cyperus iria*

Treatments		*Echinochloa colona*		*Cyperus difformis*		*Cyperus iria*		*Ludwigia perennis*		*Eclipta alba*		*Monochoria vaginalis*	
		30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest
T_1	Weedy check (Control)	3.47 (11.57)	4.81 (22.64)	10.34 (106.50)	7.23 (51.76)	7.10 (49.93)	6.87 (46.75)	4.98 (24.8)	4.80 (22.54)	3.44 (11.3)	4.43 (19.10)	4.42 (19.0)	3.63 (12.6)
T_2	Bensulfuron methyl + Pretilachlor (48+480) g/ha	2.43 (5.38)	2.74 (7.00)	5.90 (34.26)	3.04 (8.77)	4.04 (15.84)	3.19 (9.68)	3.00 (8.51)	2.59 (6.23)	2.09 (3.85)	3.41 (11.10)	2.69 (6.75)	2.10 (3.91)
T_3	Bensulfuron methyl + Pretilachlor (60+600) g/ha	2.24 (4.50)	2.35 (5.00)	3.82 (14.10)	2.40 (5.26)	2.94 (8.12)	2.59 (6.18)	1.70 (2.39)	2.06 (3.75)	1.60 (2.06)	2.83 (7.51)	1.72 (2.46)	1.49 (1.73)
T_4	Bensulfuron methyl + Pretilachlor (72+720) g/ha	1.73 (2.50)	1.62 (2.13)	3.67 (13.00)	1.92 (3.19)	2.80 (7.32)	2.40 (5.25)	1.61 (2.10)	1.76 (2.61)	1.47 (1.66)	2.40 (5.25)	1.25 (1.07)	1.34 (1.31)
T_5	Pendimethalin 1300 g/ha	2.69 (6.75)	3.67 (12.95)	5.70 (31.97)	3.55 (12.14)	4.37 (18.59)	4.39 (18.74)	3.16 (9.48)	2.84 (7.58)	2.73 (6.97)	(3.81 14.04)	3.04 (8.75)	2.27 (4.63)
T_6	Butachlor 1500 g/ha	2.92 (8.00)	2.69 (6.71)	7.17 (50.97)	3.19 (9.71)	5.11 (25.58)	3.78 (13.75)	3.41 (11.12	2.78 (7.25	2.41 (5.31)	2.95 (8.18)	2.65 (6.50)	2.81 (7.38)
T_7	Hand Weeding 20 and 40 DAT	1.57 (1.95)	1.58 (2.00)	2.63 (6.43)	1.72 (2.47)	2.24 (4.50)	2.35 (5.00)	1.20 (0.95)	(1.59 2.02)	1.21 (0.97)	1.97 (3.39)	0.71 0.00	1.11 (0.73)
SEm±		0.25	0.37	0.49	0.32	0.24	0.42	0.33	0.44	0.35	0.41	0.59	0.23
CD (P=0.05)		0.77	1.10	1.45	0.96	0.73	1.25	1.01	1.33	1.04	1.24	1.78	0.70

TABLE 3: Effect of different treatments on dry weight /m^2 of *Echinochloa colona*, *Cyperus difformis* and *Cyperus iria*

Treatments		*Echinochloa colona*		*Cyperus difformis*		*Cyperus iria*		*Ludwigia perennis*		*Eclipta alba*		*Monochoria vaginalis*	
		30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest	30 DAT	At Harvest
T_1	Weedy check (Control)	2.17 (4.20)	7.95 (62.75)	2.59 (6.19)	9.26 (85.30)	3.31 (10.43)	11.17 (124.38)	1.14 (0.81)	3.32 (10.50)	2.19 (4.28)	5.69 (31.83)	1.95 (3.30)	2.54 (5.96)
T_2	Bensulfuron methyl + Pretilachlor (48+480) g/ha	1.63 (2.15)	3.94 (15.00)	1.59 (2.04)	3.75 (13.54)	1.92 (3.18)	5.20 (26.50)	0.91 (0.33)	1.88 (3.05)	1.40 (1.45)	3.92 (14.85)	1.37 (1.39)	1.83 (2.87)
T_3	Bensulfuron methyl + Pretilachlor (60+600) g/ha	1.35 (1.31)	3.12 (9.25)	1.25 (1.08)	2.66 (6.58)	1.62 (2.13)	4.10 (16.28)	0.79 (0.13)	1.38 (1.40)	1.21 (0.98)	3.39 (10.98)	0.92 (0.34)	1.06 (0.63)
T_4	Bensulfuron methyl + Pretilachlor (72+720) g/ha	1.26 (1.09)	1.92 (3.20)	1.06 (0.62)	2.16 (4.17)	1.38 (1.40)	3.87 (14.50)	0.78 (0.10)	1.29 (1.17)	0.85 (0.23)	2.92 (8.02)	0.73 (0.04)	0.96 (0.43)
T_5	Pendimethalin 1300 g/ha	1.63 (2.16)	(4.80 22.50)	2.07 (3.80)	(4.12 16.45)	2.07 (3.80)	7.45 (55.00)	0.98 (0.47)	1.81 (2.79)	1.66 (2.25)	(4.48 19.58)	1.45 (1.59)	1.90 (3.10)
T_6	Butachlor 1500 g/ha	1.93 (3.24)	(4.03 15.78)	2.17 (4.23)	(3.65 12.86)	2.74 (7.00	5.92 (34.50)	0.99 (0.48)	1.81 (2.78)	1.63 (2.17)	3.00 (8.50)	1.45 (1.60)	1.89 (3.08)
T_7	Hand Weeding 20 and 40 DAT	1.01 (0.53)	1.62 (2.13)	0.84 (0.20)	1.82 (2.80)	1.08 (0.68)	3.60 (12.43)	0.77 (0.09)	0.99 (0.48)	0.84 (0.20)	2.54 (5.97)	0.71 0.00	0.89 (0.29)
SEm±		0.11	0.279	0.694	0.359	0.13	0.427	0.025	0.101	0.084	0.181	0.024	0.054
CD (P=0.05)		0.34	0.835	2.077	1.074	0.39	1.279	0.074	0.303	0.251	0.543	0.072	0.162