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COMPARATIVE STUDY OF BENTAZONE NA SALT AND SOME PROMISING HERBICIDES AGAINST WEED FLORA OF TRANSPLANTED RICE (*ORYZA SATIVA* L.)

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Abstract: An experiment was conducted at the instructional farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, during kharif season of 2013 & 2014 to evaluate the efficacy of different doses of Bentazone Na Salt 48 % SL in conjunction with other recommended herbicides for control of different weed flora in transplanted rice. The major weeds found were *Echinochloa spp., Cyperus irria, Alternanthera sessilis, Ammania baccifera, Monochoria vaginalis, Ludwigia purviflora.* Results revealed that Basagran 48% SL w/v @1200 g *a. i.* ha^{-1} as early post-emergence proved superiority in reducing the weed count (7.00 m^{-2}) and dry matter production (6.69 g m^{-2}) and increased the weed control efficiency (80.13 %) at 30 DAA as compared to its lower doses followed by pre-emergence application of Pretilachlor 50% EC and early post-emergence application of Oxadiargyl 80 % WP. Basagran 48% SL w/v @1200 g *a. i.* ha^{-1} recorded higher yield of rice irrespective of their dose of application. Unweeded control registered the highest weed count per m^2 and weed DMP and lowest yield among the treatments.
Keywords: Herbicide, Transplanted Rice, Weed control efficiency, Yield.

Introduction

Rice (*Oryza sativa* L.) is the vital food for more than two billion people in Asia and four hundreds of millions of people in Africa and Latin America (IRRI, 2006). India is the leading rice producing country in terms of area and is the second largest producer next to China. Rice is grown in 45 million ha annually with a production of 90 million tonnes, contributing 45% to the total food grain production of the country. Weed competition is one of the prime yield-limiting biotic constraints in rice.

Accordingly, an efficient and economic weed management program is necessary to control different types of weeds throughout the cropping period. Hand weeding is expensive, time consuming, difficult and often limited by scarcity of laborers in time. On the other hand, herbicides offer economic and efficient weed control if applied at proper dose and stage

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(Kumar and Sharma 2005). However, the continuous use of single herbicide or herbicides having the same mode of action may lead to the resistance problem in weeds. Hence it is necessary to test some high efficacy herbicides and sequential application of herbicides to control mixed weed flora in transplanted rice. Keeping these in view, a field experiment was carried out to evaluate the comparative performance of Bentazone Na Salt 48 % SL against some promising herbicide in controlling weeds of transplanted rice which will ensure an economic rice production.

Materials and methods

The experiment was conducted during *kharif* season of 2013 & 2014 at the "Instructional Farm" (latitude: 22°93'E, longitude: 88°53'N and altitude: 9.75 m) of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal. The experimental soil was well drained, alluvial in nature and sandy loam in texture, having pH 6.87, organic carbon 0.573 %, available nitrogen 241.57 kg ha^{-1}, available phosphorus 22.90 kg ha^{-1} and available potassium 111.22 kg ha^{-1}, respectively. The variety used in this experiment was Triguna. A set of 7 treatments was laid out in randomized block design with three replications. Treatments comprises of W_1 = Basagran 48% SL w/v @720 g a. i. ha^{-1}, W_2 = Basagran 48% SL w/v @960 g a. i. ha^{-1}, W_3 = Basagran 48% SL w/v @1200 g a. i. ha^{-1}, W_4= Ethoxysulfuron 15% WDG @15 g a. i. ha^{-1}, W_5 = Oxadiargyl 80% WP @80 g a. i. ha^{-1}, W_6 = Pretilachlor 50% EC @500 g a. i. ha^{-1} and W_7 = unweeded control . The test herbicide Basagran, standards like Ethoxysulfuron and Oxydiargyl were sprayed as early post-emergence (2-3 leaf stage), whereas Pretilachlor sprayed as pre emergence with the spray volume of 500 l ha^{-1} using knapsack sprayer with Flood jet deflector WFN 040 nozzle under few cm standing water. Treated plots were maintained water level static as far as possible. Twenty-three days old seedlings of Triguna rice variety were transplanted at a spacing of 20 × 15 cm. Plot size of 5m x 4m was maintained in the experiment. Half the recommended dose of N (40 kg/ha) and full dose of P_2O_5 and K_2O (40 kg/ha) were applied before transplanting at final land preparation, and the remaining N (40 kg/ha) was top-dressed in two equal splits, half at active tillering and the rest half at panicle-initiation stage. All the other recommended agronomic and plant protection measures were adopted to raise the crop and the intercultural practices were taken as need based. The data on weed counts and dry matter production (DMP) were recorded at 30 and 60 DAA and weed control efficiency (WCE) of different treatments was computed using data on weed DMP. The observations recorded on rice were number of grains panicle $^{-1}$, 1000-grainweight (g), grain and straw yield. The data were analysed following Analysis of Variance (ANOVA) technique and mean differences were adjusted by the Multiple Comparison test (Gomez and Gomez, 1984).

Result and discussion

Weed infestation

In this study the rice field was infested with different types of weeds. The relative density of these weed species was also different (Table-1). 14 different weed species were observed in control (unweeded) plot where most dominating weeds were broadleaves. Among the different categories of weeds, five were grasses, two sedges and seven broadleaves. Among the weed species maximum relative weed density was observed for *Monochoria vaginalis* (19.04 %) at 30DAA which was followed by *Cyperus irria* (11.90 %) and *Echinochloa crusgalli* (9.53 %). *Paspalum distichum* was emerged at 60 DAA, which might be due to their seasonal preferences and favorable condition of growth. Relative weed species of many several weeds decreased at later stages (60 DAA) due to their completion of life cycle. In this study it was also observed that grasses were less dominating weed species.

Effect on weeds

All the treatments registered significantly lower number of weeds and total dry matter production than weedy check (Table 2). All the three doses of Basagran were found effective in arresting the weed population and their growth compared with the traditional recommended herbicides, viz. Ethoxysulfuron, Oxadiargyl and Pretilachlor. Among the treatments, higher dose of Basagran i.e. treatment W_3 reduced the weed population most effectively at every growth stages than the lower doses (W_2 and W_1). Application of Basagran @1200 g *a. i.* ha^{-1} as early post-emergence treatment has been found most effective in reducing the weed count (7.00 m^{-2}) and weed DMP (6.69 $g.m^{-2}$) and increased the WCE (80.13 %) at 30 DAA followed by pre-emergence application of Pretilachlor @500 g *a. i.* ha^{-1} (with the weed count of 10.00 m^{-2}, weed DMP of 8.86 $g.m^{-2}$ and WCE of 73.69 %) and early post-emergence application of Oxadiargyl @80 g a. i. ha^{-1} (with the weed count of 12.00 m^{-2}, weed DMP of $g.m^{-2}$ and WCE of 70.36 %). Similar trend were observed at 60 DAA. While treatment W_4 (Ethoxysulfuron 15 % WDG) was most effective in minimizing the population and biomass of sedges appeared in rice field. Unweeded control registered the highest weed count of 76.00 m^{-2} and weed DMP of 107.04 g m^{-2} at 60 DAA. Herbicide application drastically reduced the weed population but different pre/post emergence herbicides showed identical result in relation to weed density at 60 DAA. Hasanuzzaman *et al.* 2008 reported that all herbicidal treatments reduced weed population significantly compared with weedy check. Hence, the dry weight of weeds increased with the age of the crop in the control plot and it is mainly due to the fact that with the age of the crop the number as well as the size of individual weed species increased which gave more dry weight (Yadav *et al.,* 2008). The experimental field was dominated by mainly broad leaf weeds and sedges. Basagran controlled broadleaf weed effectively upto 60 DAA but not the sedges at that stage. It was expected that Basagran would control sedges but it did not probably due to that aged sedges are not sensitive to Bentazon at the recommended dose (Vidotto *et al*., 2007). Juraimi *et al.* (2010) found that sequential application of Bentazon provided 100 % control of all sedges and broadleaf weeds in direct wet seeded rice.

Effect on crop

Except the grain weight all the crop characters and yield components were significantly influenced by different treatments used in this experiment (Table 3). In this study, greater weed infestation in the control plot (W_7), resulted in the lowest number of grain panicle^{-1} (70.07). The treatment W_3 produced the maximum number of grain panicle^{-1} (91.55) which was statistically superior to any other treatment (Table 3) mainly due to weed-free conditions in this treatment. Single application of any pre/post emergence herbicides produced identical numbers of grains per panicle. These results corroborated with the results of Ahmed *et al.* [2005] and Hasanuzzaman *et al.* [2007]. In this study 1000-grain weight was not significantly affected by weeding treatments. However, the highest grain weight observed with W_3 and the lowest with W_7. It was also concluded by many workers that control of weeds promoted the yield and yield attributes including number of filled grains per panicle and 1000 grain weight in rice [Raju *et al*., 2002]. On an average, there was more than 43% reduction in the grain yield of rice due to competition with weeds in weedy plots (Table 3). All the herbicide-treated plots gave grain yields significantly more than the weedy plots. The highest grain yield of rice (3.96 t ha^{-1}) was obtained in W_3 treatment followed by W_6, W_2 and W_4 (3.63, 3.46, and 3.43 t ha^{-1} respectively). Straw yield also significantly affected by weeding treatments (Table 3). The highest straw yield (4.95 t ha^{-1}) was observed with W_3 which was statistically identical with W_4 (4.62 t ha^{-1}). In this study herbicide application did not show any extra benefit to produce higher straw yield. Numerically the control treatment showed the lowest straw yield. However, there was significant yield increase in Basagran 48% SL w/v at respective higher doses of application over lower doses as well as with the recommended traditional herbicides, viz. Ethoxysulfuron 15% WDG, Oxadiargyl 80% WP and Pretilachlor

50% EC. There was no phytotoxic effect of any herbicides at any of the doses applied on transplanted rice crop.

Conclusion: Hand weeding is time consuming, expensive and tedious though much effective. Under the present situation of unavailability of laborers and high wages, manual weed control is not possible. Hence, chemical weed control appears to hold a great promise in dealing with effective, timely and economic weed suppression. Thus the application of Basagran (Bentazone Na Salt) 48% SL w/v herbicide at higher dose proved superior for wide-spectrum weed control especially of broad leaves weeds as compared to lower doses, in transplanted rice field.

References

[1] Ahmed, G.J.U., M.K.A. Bhuiyan, C.R. Riches, M. Mortimer and D. Jhonson, 2005. Farmer's participatory studies of integrated weed management system for intensified lowland. Proceeding of the 8th Biennial Agronomy Convention, Bangladesh Agron. Soc., Dhaka.

[2] Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedures for Agriculture Research. Int. Rice Res. Inst. Jhon Wiley and Sons. New York, pp: 139-240.

[3] Hasanuzzaman, M., Kamrun Nahar and M.R. Karim, 2007. Effectiveness of different weed control methods on the performance of transplanted rice. Pakistan J. Weed Sci. Res., **13**(1-2): 17-25.

[4] Hasanuzzaman, M., M.O. Islam and M.S. Bapari, 2008. Efficacy of different herbicides over manual weeding in controlling weeds in transplanted rice. Aus. J. Crop Sci., **2**(1): 18-24.

[5] IRRI (International Rice Research Institute), 2006.*World Rice Statistics*. Intl. Rice Res. Inst. http://www.irri.org/science/wrs. Accessed on July, 2006.

[6] Juraimi AS, Begum M, Najib MMY, Azmi M (2010). Efficacy of herbicides on the control of weeds and productivity of direct seeded rice under minimal water conditions. Plant Protect. Quart., **25**(1): 19-25.

[7] Kumar M and Sharma G. 2005. Effect of herbicides alone and in combination on direct seeded rice. *Indian Journal of Weed Sciences* **37**(3/4): 197-201.

[8] Raju, A., B.J. Pandian, P. Thukkaiyannan and N. Thavaprakash, 2002. Effect of weed management practices on the yield attributes and yields of wet-seeded rice. Acta Agron. Hungarica, **51**: 461-464.

[9] Singh V P, Govindra S and Mahendra S. 2004. Effect of fenoxaprop-p-ethyl on transplanted rice and associated weeds. *Indian Journal of Weed Science* **36**(1/2): 190-192.

[10] Vidotto F, Tesio F, Tabacchi M, Ferrero A (2007). Herbicide sensitivity of *Echinochloa* spp. accessions in Italian rice fields. Crop Protection.**26**: 285-293.

[11] Yadav D B, Singh S and Yadav A. 2008. Evaluation of Azimsulfuron and metsulfuron methyl alone and in combination for weed control in transplanted rice. *Indian Journal of Weed Science* **40**(1/2): 14-18.

Table 1: Relative density (%) of different weed species in the untreated control plots at two different growth stages of transplanted rice

Weed species			**Relative density (%)**	
Botanical name	**Family**	**Types of weed**	**30 DAA**	**60 DAA**
Echinochloa colona	Gramineae	Grass	7.14	5.56
Leersia hexandra	Gramineae	Grass	2.38	2.78
Echinochloa crusgalli	Gramineae	Grass	9.53	8.33
Paspalum distichum	Gramineae	Grass	0	2.78
Echinochloa formosensis	Gramineae	Grass	4.76	5.56
Cyperus difformis	Cyperaceae	Sedge	7.14	11.11
Cyperus irria	Cyperaceae	Sedge	11.90	18.06
Alternanthera sessilis	Amaranthaceae	Broadleaf aquatic	4.76	5.56
Ammania baccifera	Lythraceae	Broadleaf	7.14	6.94
Eclipta alba	Asteraceae	Broadleaf	9.52	6.94
Stellaria media	Caryophyllaceae	Broadleaf	4.76	4.16
Marsilea quadrifolia	Marsileaceae	Broadleaf aquatic	4.76	5.55
Monochoria vaginalis	Pontederiaceae	Broadleaf aquatic	19.04	15.27
Ludwigia purviflora	Onagraceae	Broadleaf	7.14	6.94

Table 2: Weed dry matter and weed control efficiency as affected by different treatments

Treatments	*Weed density (no.m^{-2})		*Weed dry matter production(g.m^{-2})		WCE (%)	
	30 DAA	60 DAA	30 DAA	60 DAA	30 DAA	60 DAA
W_1	4.74 (22)	5.24 (27)	3.91 (14.77)	7.81 (60.51)	56.13	43.47
W_2	3.67 (13)	4.9 (24)	3.38 (10.93)	7.45 (55.08)	67.54	48.54
W_3	2.74 (7)	4.06 (16)	2.68 (6.69)	5.75 (32.58)	80.13	69.57
W_4	4.06 (16)	5.24 (27)	3.86 (14.44)	7.99 (63.37)	57.11	40.79
W_5	3.54 (12)	4.87 (23)	3.24 (9.98)	7.35 (53.03)	70.36	50.46
W_6	3.24 (10)	4.57 (20)	3.05 (8.86)	6.13 (37.11)	73.69	65.33
W_7	6.52 (42)	8.76 (76)	5.85 (33.67)	10.37 (107.04)	-	-
LSD $_{0.05}$	0.87	0.71	0.217	0.542	-	-

***Data subjected to square root transformation; values in parentheses are original**

[Treatments: W_1 = Basagran 48% SL w/v @720 g a. i. ha^{-1}, W_2 = Basagran 48% SL w/v @960 g a. i. ha^{-1}, W_3 = Basagran 48% SL w/v @1200 g a. i. ha^{-1}, W_4= Ethoxysulfuron 15% WDG @15 g a. i. ha^{-1}, W_5 = Oxadiargyl 80% WP @80 g a. i. ha^{-1}, W_6 = Pretilachlor 50% EC @500 g a. i. ha^{-1}, W_7 = Control (no weeding)]

Table 3 Yield and yield attributes of transplanted rice as affected by different treatments

Treatments	No. of grains panicle $^{-1}$	1000-grainweight (g)	Yield (t ha^{-1})	
			Grain	Straw
W_1	82.39	20.68	3.37	4.01
W_2	85.09	20.26	3.46	4.42
W_3	91.55	21.75	3.96	4.95
W_4	83.67	20.19	3.43	4.62
W_5	79.14	20.51	3.38	4.29
W_6	84.36	20.29	3.63	4.48
W_7	70.07	19.75	1.77	3.32
LSD $_{0.05}$	2.626	NS	0.536	0.493

[Treatments: W_1 = Basagran 48% SL w/v @720 g a. i. ha^{-1}, W_2 = Basagran 48% SL w/v @960 g a. i. ha^{-1}, W_3 = Basagran 48% SL w/v @1200 g a. i. ha^{-1}, W_4= Ethoxysulfuron 15% WDG @15 g a. i. ha^{-1}, W_5 = Oxadiargyl 80% WP @80 g a. i. ha^{-1}, W_6 = Pretilachlor 50% EC @500 g a. i. ha^{-1}, W_7 = Control (no weeding)]