The Bioscan 9(4): 1549-1551, 2014
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

BIO-EFFICACY OF NEW HERBICIDE MOLECULES FOR BROAD SPECTRUM WEED CONTROL IN TRANSPLANTED RICE (*ORYZA SATIVA* L.)

J. P. BHIMWAL* AND P. C. PANDEY
Department of Agronomy,
G. B. Pant University of Agriculture & Technology, Pantnagar - 263 145. U.S. Nagar. Uttarakhand. INDIA
e-mail: jaibhimwal@gmail.com

KEYWORDS
Flucetosulfuron10 WG
Weeds
Transplanted rice
Yield

Received on :
26.05.2014

Accepted on :
15.10.2014

***Corresponding author**

ABSTRACT
Comparative efficacy of different new herbicides and their dose against weeds in transplanted *Kharif* rice was studied at N.E. Borlaug crop research center of G.B. Pant University of Agriculture and Technology Pantnagar Uttarakhand. Nine weed control treatments viz. Flucetosulfuron 20 g ha^{-1} and 25 g ha^{-1}, Penoxsulam + Cyhalofop-butyl 120 g ha^{-1} and 135 g ha^{-1}, Bispyribac-sodium 35 g ha^{-1}, Anilofos 500 g ha^{-1}, two hand weeding weed free and weedy check were tested in a Randomized Block Design with three replications. The results revealed that the major weed flora associated with the transplanted rice during *Kharif* season was mainly comprised of *Echinochloa spp.* (32.48%), *Leptochloa chinensis L.* (22.49%), *Commelina benghalenensis L.* (15.48%), *Caesulia axillaris* Roxb. (15.21%), *Cyperus spp.* (12.63%) and other weeds (1.67%). Flucetosulfuron10 WG at 25 g ha^{-1} applied at 2-3 days after transplanting was found most effective to check all types of weed population and their growth. These herbicide treatments also gave the maximum grain yield (4.45 t ha^{-1}) and straw yield (5.76 t ha^{-1}) of rice resulting in lowest weed index (9.99%) Flucetosulfuron10 WG at 25 g ha^{-1} applied at 2 days after transplanting can be used safely achieve broad spectrum weed control in transplanted rice.

INTRODUCTION

Rice is the most important staple food crop of millions of mankind from down of civilization (Chakravarti *et al.,* 2012). Among the cereal crops, it serves as the principal source of nourishment for over half of the global population (Davla et al., 2013). In Indian agriculture, rice is the main source of livelihood for more than 150 million rural households. The total area of rice crop in India is 43.97 m ha, production is 100.00 m t and average productivity is 2.37 t/ha (Anonymous, 2013a). Over 90% of the world rice is grown and consumed here, where 60% of the world population lives. Rice occupies an area of 3.77 m ha with the production of 8.53 m t and productivity of 1.60 t/ha, but its average yield is rather low. (Anonymous, 2013b). Rice yields are affected by pests and also by management practices. Among pests, weeds are one of the major constraints which affect rice productivity. The various crop stand establishment practices and land type influence the intensity and nature of weed problem. Weeds compete with crop plants for nutrients, water, light and space and pose a major problem in rice production by affecting quality. Infestation of weeds in transplanted rice not only results in yield reduction but quality of produce is also impaired. Uncontrolled weeds cause reduction in grain yield up to 76% under transplanted conditions (Singh *et al.,* 2004). The weed flora under transplanted condition is very much diverse and consists of grasses, sedges and broad-leaf weeds causing yield reduction of rice crop up to 76% (Singh *et al.,* 2004). The effective control of weeds at initial stages (0-40 DAT) can help in improving the productivity of this crop. Hand weeding is very easiest method but very expensive and at early stages it is very difficult due to morphological similarity between grassy weeds and rice seedlings (Rahman *et al.,* 2012). Due to cost effectiveness and timely control of weeds the use herbicides is in practice for last several years. However a number of problems have been encountered even with the use of herbicides. In India, for transplanted rice crop widely used herbicide are Butachlor, Anilofos, Thiobencarb and Pretilachlor recommended as pre-emergence for weed control. These herbicides provide effective control of annual grasses when applied as pre-emergence 1-3 days after transplanting. But effective control of annual sedges and non-grassy weeds is not obtained by these herbicides. Due to continuous use of such herbicides a shift of weed flora from grassy to non-grassy and annual sedges is being observed in transplanted rice fields (Rajkhowa *et al.,* 2006).

Therefore, evaluation of new herbicides for control of wide spectrum of weed flora is imperative. Recent trend of herbicide use is to find out an effective weed control measure by using low dose high efficiency herbicides which will not only reduce the total volume of herbicide use but also the application become easier and economic (Kathiresan, 2001). In view of the above facts, the present study was undertaken to evaluate the performance of new herbicide molecules for wide spectrum control of the weeds along with better efficacy for transplanted rice.

MATERIALS AND METHODS

A field study was conducted during *kharif* 2012 to evaluate the new herbicides for transplanted rice at N.E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar(29ºN latitude,79º.29'E longitude and at an altitude of 243.94 meters above mean sea level). The land is topographically known as medium land and the soil was alluvial origin, silt loam in texture having pH 7.7, CEC 20 m.e. per 100g soil, organic carbon 1.02%, available N 206.08 kg ha^{-1}, available P 17.00 kg ha^{-1} and available K 219.00 kg ha^{-1}. The experiment was laid out in a randomized block design with 9 treatments (Table 1) and 3 replications. 21 days old seedlings of rice var. Pant Dhan-12 was transplanted with 3-4 seedlings $hill^{-1}$ during 2nd week of July in both the years of experimentation at a spacing of 20 cm × 20 cm. Herbicides were sprayed using knapsack sprayer fitted with a flat fan nozzle at a spray volume of 500 l ha^{-1}. Recommended dose of fertilizers *i.e.* 120: 60: 40 kg N, P_2O_5 and K_2O ha^{-1} were applied. Half dose of N in the form of Urea, and full amount of P_2O_5 (Single Super Phosphate) and K_2O (Muriate of Potash) were applied as basal during final land preparation. Rest half of N was topdressed in two equal splits; one at active tillering and the other at panicle initiation stage. Need-based irrigation was given to the crop. The rice plant was harvested on 27.10.2012 and 28.10.2012. The performance of different treatments was studied in terms of all types of flora, weed density, weed biomass and their subsequent effect on growth and yield of rice.

RESULTS AND DISCUSSION

Effect on weeds

The most important weed species found in the experiment field were. *Echinochloa spp.*, *Leptochloa chinensis* L., *Cyperus spp.*, *Caesulia axillaris* Roxb. and *Commelina benghalensis* L.. Density and biomass of weeds were significantly higher in non-weeded control treatment. In contrast, weed free (15, 30,

Table 1: Details of treatments

Sr. No	Treatments	Concentration	Dose (kg a.i. ha^{-1})	Time of Application (DAT)
T_1	Flucetosulfuron	10 WG	20	2
T_2	Flucetosulfuron	10 WG	25	2
T_3	Penoxsulam + Cyhalofop-butyl	6 OD	120	17
T_4	Penoxsulam + Cyhalofop-butyl	6 OD	135	17
T_5	Bispyribac-sodium	10 SC	35	17
T_6	Anilofos	33 EC	500	3
T_7	Two hand weeding	-	-	20 & 40
T_8	Weed free	-	-	15,30,45 & 60
T_9	Weedy	-	-	

DAT- Days after transplanting

Table 2: Effect of different treatment on weed density, weed biomass, and weed control efficiency

Treatment	Weed Density (no. m^{-2})			Weed Biomass (g m^{-2})			Weed Control Efficiency (%) at 60 DAT
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
T_1	3.99	3.88	3.91	3.48	4.04	4.77	77.93
T_2	3.62	3.60	3.38	2.95	3.79	4.85	82.89
T_3	3.57	3.47	3.23	2.94	3.73	4.67	83.76
T_4	4.18	4.11	3.91	3.55	3.68	4.85	84.46
T_5	3.80	3.72	3.71	3.21	3.84	4.60	82.06
T_6	4.34	4.15	4.07	3.86	4.03	4.83	78.05
T_7	3.06	3.23	3.61	2.50	2.70	4.14	94.44
T_8	0.00	0.00	0.00	0.00	0.00	0.00	100
T_9	4.89	5.39	5.10	4.50	5.54	5.51	0
SEm (±)	0.09	0.07	0.10	0.13	0.07	0.10	-
CD (p=0.05)	0.29	0.22	0.32	0.40	0.21	0.30	-

DAT- Days after transplanting

Table 3: Effect of different treatments on yield of rice

Treatment	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	% increase of grain yieldover control	Weed index (%)
T_1	3.98	4.68	115.13	19.71
T_2	4.45	5.12	140.54	9.99
T_3	4.31	4.95	132.97	12.76
T_4	3.93	4.43	112.43	20.70
T_5	3.99	4.31	115.67	19.29
T_6	4.04	4.52	118.37	18.60
T_7	4.75	5.44	156.75	4.21
T_8	4.95	5.76	167.56	0
T_9	1.85	2.58	0	62.26
S.m (±)	0.26	0.35	-	-
CD (p=0.05)	0.79	1.06	-	-

45 and 60 DAT) treatment recorded lowest weed density and biomass of weeds followed by two hand weeding (Twice at 20 and 40 DAT) treatment than rest of the weed management practices (Table 2).

Among the tested herbicides, new herbicide Penoxsulam + Cyhalofop-butyl 6 OD at 120 g ha^{-1} applied at 17-20 DAT and Flucetosulfuron 10 WG at 25 g ha^{-1} applied at 2-3 DAT were found most effective to check all types of weed population and their growth resulting in lower biomass of weeds due to its higher weed control efficiency.

Effect on crop

Perusal of the Table 3 revealed that all the herbicide treated plots produced grain and straw yields significantly more than the non-weeded plots. The highest grain yield (4.95 t ha^{-1}) was in weed free treatment which was significantly higher than all the weed control treatments except two hand weeding (4.75 t ha^{-1}), Flucetosulfuron 10 WG at 25 g ha^{-1} applied at 2 DAT (4.45 t ha^{-1}) and Penoxsulam + Cyhalofop-butyl 6 OD at 120 g/ha applied at 17 DAT (4.31 t ha^{-1}) treatments. Similar trend of result was also found in case of straw yield of rice. Among different tested herbicides, lowest weed index (9.99 %) was recorded with the application of Flucetosulfuron 10 WG at 25 g ha^{-1} applied at 2 DAT resulting in 140.54 % increase in grain yield of rice over non-weeded control. The effective control of weeds starting from the early crop growth stage might have resulted in better growth and yield of rice. The variation in grain yield under different treatments was the result of variation in weed density and weed biomass. Application of herbicides under test did not show any phytotoxic symptom on rice plant.

Both Flucetosulfuron and Penoxsulam + Cyhalofop-butyl herbicides are very control weeds especially at early growth stages. The mode of action of both herbicide is enzyme acetolactate synthase (ALS) inhibitor, which is essential for the synthesis of branched-chain amino acids valine, leucine, and isoleucine. Inhibition of amino acid production subsequently inhibits cell division and causes death in susceptible plants. (Kim *et al.*, 2006 and pal *et al.*, 2009)

Based on the results of present investigation it can be concluded that Flucetosulfuron 10 WG at 25 g ha^{-1} applied at 2 DAT was most effective to check all types of weed population which may be recommended to replace the tedious, time consuming and expensive hand weeding practice of weed control in transplanted *kharif* rice.

REFERENCES

Anonymous 2013a. Directorate of Economics and Statistics. Department of Agriculture and Cooperation. Ministry of Agriculture, Government of India.

Anonymous 2013b. Report of Agriculture Department, Chhattisgarh Government. Krishi Diary, Directorate of Extension Services, IGKV, Raipur.

Chakrawarti, S. K., Kumar, H., Lal, J. P. and Vishwakarma, M. K. 2012. Induced mutation in traditional aromatic rice-frequency and spectrum of viable mutations and characterizations of economic values. *The Bioscan*. **7(4):** 739-742.

Davla, D., Sasidharan, N., Macwana, S., Chakraborty, S., Trivedi, R., Ravikiran, R. and Shah, G. 2013. Molecular characterization of rice (*Oryza sativa* L.) genotypes for salt tolerance using microsatellite markers. *The Bioscan*. **8(2):** 498-502.

Kathiresan, R. M. 2001. Sustainability of weed management practices in rice-blackgram cropping system. Lead paper and abstract of final biennial conference in the new millennium as eco-friendly weed management options for sustainable agriculture, University of Agricultural Sciences, Bangalore, India. p. 79

Kim, D. S., Hwang, K. H., Lee, J. N. and Koo, S. J. 2006. Herbicidal action mechanism of flucetosulfuron. *Korean J. Weed Science*. **26(3):** 316-322.

Pal, S., Banerjee, H. and Mandal, N. N. 2009. Efficacy of low dose of herbicides against weeds in transplanted *kharif* rice (*Oryza sativa* L.). *J. Plant Protection Sciences*. **1(1):** 31-33.

Rahman, M., Juraimi, A. S., Jaya Suria, A. S. M., Azmi, B.M. and Anwar, P. 2012. Response of weed flora to different herbicides in aerobic rice system. *Scientific Res. Ess.* **7(1):** 12-23.

Rajkhowa, D. J., Borah, N., Barua, I. C. and Dekha, N. C. 2006. Effect of pyrazosulfuron-ethyl on weeds and productivity of transplanted rice during rainy season. *Indian J. Weed Science*. **38:** 25-28.

Singh, V. P., Singh, Govindra and Singh, M. 2004. Effect of fenoxaprop-P-ethyl on transplanted rice and associated weed. *Indian J.Weed Sciences* **36:** 190-92.