Effect of Low Dose Herbicides on Growth and Yield of Rice (*Oryza sativa.* L)

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***Abstract*:** Field experiment were carried out at the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, during *Samba* season 2014-2015 to evaluate the growth, yield and economics of bio-efficacy of bispyribac acid 40% SC against weed flora in paddy. The result revealed that the application of bispyribac acid 40% SC @ 70 g a.i ha^{-1} 10 DAT followed by the hand weeding (HW) twice at 20 and 40 DAT significantly registered the plant height,LAI, DMP and also registered higher grain yield(5467,5389 $kgha^{-1}$) and straw yield (9258,9228 $kgha^{-1}$),respectively. The lower growth and yield attributes was recorded in unweeded control treatment.

***Keywords*: Rice, low dose herbicide, growth and yield.**

INTRODUCTION

'Rice is Life', the slogan of the International Year of Rice – 2004 (IYR) has been declared by the United Nations General Assembly (Jacques Diouf, 2003). Rice (*Oryza sativa* L.) is one of the most predominant food crop that is being extensively cultivated in India. More than 90 per cent of the world's rice is grown and consumed in Asia. Rice is grown in 114 countries across the world with an area of 164 million hectares and with the production of 741.4 million tonnes and productivity of 4.4 t ha^{-1} (FAO, 2013). In India rice is grown in an area of 43.95 million hectares with a production of 106.54 million tonnes with productivity of 2.42 t ha^{-1}. In Tamil Nadu, rice is grown in an area of 1.79 million hectares with a production of 5.54 million tonnes with a productivity of 3.1 t ha^{-1} (Agricultural Statistics at a Glance 2014).Rice crop suffers from various biotic and abiotic constraints. Weed competition is one of the prime yield limiting biotic constraint which compete with crops for water, light, nutrients and space. Weeds are the competitors in their early growth stages than at later stages and hence the growth of crops has suffered and finally reduced the grain yield (Jacob and Syriac, 2005). Greater yield losses can occur at times when weed competition coincides with the critical period of rice growth. Critical period of weed completion at 30 and 60 days after transplanting (DAT) and reduction in grain yield due to unchecked weed infestation in transplanted rice varied between 29 and 63 per cent (Bhuvaneswari*et al.,* 2009).Weeds grow profusely in the rice field and reduce crop yields drastically and the yield loss ranges between 15 to 20 per cent yet and in severe cases the yield losses can be more than 50 per cent, depending upon the species and intensity of weeds (MirzaHasanuzzama*et al*.,2009).The hand weeding is expensive, time consuming, difficult and other limitations such as by scarcity of labourers in time.In India, the manual method of weed control is quite popular and effective. Of late, labour has become non-availability and costly due to intensification, diversification of agriculture and urbanization (Uma *et al*., 2014). Chemical method of weed control is effective to control the weeds economically. Now-a-days use of herbicides is gaining popularity in rice culture due to their rapid effect and less cost involvement compared to traditional methods. In India, for transplanted rice crop the widely used herbicide are butachlor, anilofos, thoibencarb and pretilachlor which are applied as pre-emergence for weed control. These herbicides provide effective control of annual grasses when applied as pre-emergence 1-3 days after transplanting (Bhimwal and Pandey, 2014). Recent trend of herbicide use is to find out an effective weed control measure by using low dose high efficiency herbicides (LDHE) which will not only reduce the total volume of herbicide use but also the application become easier and economic.Use of early post emergence herbicides has greater potential for effective weed management and higher yield.

MATERIALS AND METHODS

Field experiment was conducted to evaluate the bio-efficacy of Bispyribac acid 40 % SC against weed flora in paddy during Samba season (2014-2015) at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalainagar(TN).The soil of experimental field was clayey loam with low in available nitrogen (234 kg ha^{-1}), medium in available phosphorus (21.8 kg ha^{-1}) and high in available potassium (310 kg ha^{-1}). The pH and E.C were 7.5 and 0.45 dsm^{-1} respectively. The experiment was laid out in a randomized block design with three replications. The details of the treatment is T_1- Unweeded Check, T_2- Weed Free check T_3- Hand weeding twice at 20 and 40 DAT, T_4- Bispyribac acid 40% SC @ 17.5 g a.iha^{-1} 10 DAT, T_5- Bispyribac acid 40% SC @ 35 g a.iha^{-1}10 DAT, T_6- Bispyribac acid 40% SC @ 52.5 g a.iha^{-1} 10 DAT, T_7- Bispyribac acid 40% SC @ 70 g a.iha^{-1} 10 DAT, T_8- Bispyribac sodium 10% SC @ 20 g a.iha^{-1} 10 DAT, T_9- Azimsulfuron 50% D.F @35 g a.i ha^{-1} 10 DAT. The recommended dose of fertilizer 150 kg of N, 50 kg P_2O_5 and 50 kg of K_2O was followed for medium duration variety Co 43 in the Samba. N was applied in the form of Urea,while phosphorus and potassium were applied in the form of SSP and MOP respectively. The entire dose of P_2O_5 and half of K_2O were applied as basal along with half dose of N. The remaining half dose of N and the balance of K_2O were applied in two equal splits at 20 DAT and 40 DAT. Weed management practices were carried out as per treatment schedule. The calculated quantity of herbicides was sprayed uniformly at 10 DAT as early post emergence application as per the treatment schedule.

RESULTS AND DISCUSSION

STUDIES ON GROWTH CHARACTERISTICS

The weed management treatments significantly influenced growth characteristics in rice. Among the weed management practices tried. The plant height was significantly influenced by various treatments on 30 and 60 DAT and at harvest. Weed free check recorded highest plant height of 59.58, 91.06, 117.06 cm at 30, 60 DAT, harvest. This was followed by early post emergence herbicide application of Bispyribac acid 40% SC @ 70 g ha^{-1} on 10 DAT and this was on par with hand weeding twice at 20 and 40 DAT which significantly registered the plant height of 55.20,81.93,109.53 cm and 54.43,80.46,108.10 cm during

Samba season, respectively.This might be due to better weed control throughout the growth stages of rice and better availability of all resources this *viz.*, light, moisture, space and nutrients to rice. This is in consonance with the reports of Ramesh (1999). The least values of plant height was recorded in unweeded control at all the stages of crop growth.

The treatments altered the leaf area index at flowering of crop significantly during crop growth season. Weed free check significantly registered the highest leaf area index of 6.06 followed by application of early post emergence herbicide Bispyribac acid 40 % SC @ 70 g ha^{-1} on 10 DAT and this was on par with hand weeding twice at 20 and 40 DAT with the leaf area index of 5.66 and 5.63, respectively. This could be attributed to the effective suppression of weed, which favoured congenial environment to the crop to utilize all available resources efficiently. The least LAI was noticed in unweeded control plot with LAI of 3.26 at flowering stage. Umapathi (1998) and Suganthi (2002) also stated that leaf area index was higher in less weed competition treatments.

The crop dry matter production increased with the age of crop and reached its maximum at maturity. The dry matter production was significantly influenced by all the treatments at different growth stages. Weed free check registered the highest crop dry matter production of 5.99, 8.85, 16.38 t ha^{-1} at 30, 60 DAT and at harvest stages. This was followed by the application of early post emergence herbicide Bispyribac acid 40 % SC @ 70 g ha^{-1} on 10 DAT and this was on par with hand weeding twice at 20 and 40 DAT which significantly recorded the highest crop dry matter production of 5.50, 8.39, 15.54 t ha^{-1} and 5.43,8.30, 15.44 t ha^{-1}, respectively.This might be due to crop canopy and effective utilization of available nutrients which ultimately resulted in increased dry matter production, Karuppiah (1995) and SubhashBabu*et al.* (2008).. The lowest dry matter production of 2.82, 4.42, and 8.71 t ha^{-1} on 30, 60 DAT and at harvest was recorded in unweeded control treatment.

Table 1. Effect of weed management practiceson growth attributes in rice

Treatments	Plant height			Leaf area index	Dry matter production (t/ha)		
	30 DAT	60 DAT	Harvest	At flowering	30 DAT	60 DAT	Harvest
T_1- Unweeded control	29.33	47.1	65.10	3.26	2.82	4.42	8.71
T_2- Weed free check	59.58	91.06	117.06	6.06	5.99	8.85	16.38
T_3- Hand weeding (HW) twice at 20 and 40 DAT (farmer's practice)	54.43	80.46	108.10	5.63	5.43	8.30	15.44
T_4- Bispyribac acid 40% SC @ 17.5 g a.i ha^{-1}	40.96	66.06	84.73	4.51	4.17	6.31	13.38
T_5 - Bispyribac acid 40% SC @ 35 g a.i ha^{-1}	41.16	64.80	86.30	4.52	4.18	6.35	13.55
T_6- Bispyribac acid 40% SC @ 52.5 g a.i ha^{-1}	49.26	73.46	96.78	5.13	4.79	7.33	14.47
T_7 - Bispyribac acid 40% SC @ 70 g a.i ha^{-1}	55.20	81.93	109.53	5.66	5.50	8.39	15.54
T_8-Bispyribac sodium 10 SC @ 20 g a.i ha^{-1}	41.76	62.53	88.56	4.61	4.22	6.35	13.62
T_9 - Azimsulfuron 50% DF @ 35 g a.i ha^{-1}	34.43	53.33	75.69	3.76	3.63	5.40	11.26
S.Ed	1.98	2.19	2.34	0.10	0.12	0.20	0.31
CD (P=0.05)	4.21	4.64	4.98	0.21	0.27	0.43	0.66

STUDIES ON YIELD ATTRIBUTES-

Among the weed management practices tried,with exception of test weight, the yield components *viz.*, number of panicle m^{-2} and number of filled grains $panicle^{-1}$ were significantly higher in the application of early post emergence herbicide Bispyribac acid 40% SC @ 70 g ha^{-1}10 DAT and this was on par with hand weeding twice at 20 and 40 DAT. The next best treatment was Bispyribac acid 40% SC @ 52.5 g ha^{-1}10 DAT. This was mainly due to less interference of weeds with crop for natural resources during early crop growth period. The above finding are in line with the earlier reports of (RajibDass*etal.*, 2015).The least yield components were recorded in unweeded control.

Significant difference in grain yield was noticed among the weed management treatment. Among the treatments, weed free check significantly registered the maximum grain yield of 5987 kg ha^{-1} and this was followed by application of early post emergence herbicide Bispyribac acid 40 % SC @ 70 g ha^{-1} on 10 DAT and this was on par with hand weeding twice at 20 and 40 DAT that registered the grain yield of 5467 kg ha^{-1} and 5389 kg ha^{-1}, respectively. The above observations are in concomitance with the findings of Maduulika Singh and Paikra (2014). The lower grain yield of 2578 kg ha^{-1} was recorded in unweeded control treatment.

Straw yield was significantly influenced by various treatments. The weed free check significantly recorded higher straw yield of 9998 kg ha^{-1} during samba season and this was followed by application of early post emergence herbicide Bispyribac acid 40% SC @ 70 g ha^{-1} on 10 DAT and this was on par with hand weeding twice at 20 and 40 DAT which recorded the straw yield of 9258 kg ha^{-1} and 9228 kg ha^{-1}. The above observations are in concomitance with the findings of Madhulika Singh and Paikra (2014).The lowest straw yield of 5109 kg ha^{-1} was recorded in unweeded control treatment.

Table 2. Effect of weed management practiceson yield attributes in rice

Treatments	Number of Panicles m^{-2}	FilledGrains $panicle^{-1}$	Thousand grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1- Un weeded control	276	47.01	20.57	2578	5109
T_2- Weed free check	510	88.96	21.86	5987	9998
T_3- Hand weeding (HW) twice at 20 and 40 DAT (farmer's practice)	465	78.23	21.53	5389	9228
T_4 - Bispyribac acid 40% SC @ 17.5 g a.i ha^{-1}	364	61.00	21.05	4001	7421
T_5- Bispyribac acid 40% SC @ 35 g a.i ha^{-1}	370	62.14	21.19	4068	7456
T_6- Bispyribac acid 40% SC @ 52.5 g a.i ha^{-1}	428	71.06	21.42	4789	8432
T_7- Bispyribac acid 40% SC @ 70 g a.i ha^{-1}	469	80.54	21.59	5467	9258
T_8- Bispyribac sodium 10% SC @ 20 g a.i ha^{-1}	378	64.78	21.26	4164	7589
T_9 - Azimsulfuron 50% DF @ 35 g a.i ha^{-1}	321	53.1	20.78	3210	6231
S.Ed	16.43	2.77	1.40	185.19	325.64
CD (P=0.05)	34.83	5.88	NS	392.59	690.34

CONCLUSION

In the light of above said facts, it can be concluded that adoption of early post emergence application with Bispyribac acid 40% SC @70 g ha^{-1} was found to be on par with hand weeding (HW) twice at 20 and 40 DAT (farmers practice) holds promise as an agronomically sound , ecologically safe and economically viable technology for enhancing the growth and yield of rice in the deltaic zone of Cauvery region .

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