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Evaluation of post emergence herbicides on weed spectrum in rice wet nursery

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Abstract
A field experiment was conducted at College of Agriculture, V. C Farm, Mandya for the evaluation of post emergence herbicides on weed spectrum in rice wet nursery during kharif, 2016. The results indicated that post emergence application of Bispyribac-sodium 12 SC @ 20.0 g *a.i.* ha^{-1} at15 DAS showed lower phyotoxicity on rice seedlings. It also resulted in significantly lower number of weed count, weed dry weight (grasses, sedges, broad leaved weeds) and their dry weight as comparable with rest of all the treatments.

Keywords: Agriculture, spectrum, comparable

Introduction
Rice (*Oryza sativa* L.), the staple food of over half world's population and in Asia 1.3 billion populations depend on it for their diet. In India 13.211 m ha is cultivated with rice contributing to 8.37 per cent to the the total area occupied with rice with production of 90.6 million tonnes. In Karnataka rice is been cultivated in an acerage of 1.39 m ha with 3.45 million tonnes. Majorly the crop is cultivated in lowland condition by transplanting 20-30 days old seedlings grown in nurseries. Thus the management of the crop starts from nursery establishment and its management.

Yield losses of 48-71 % due to the transplanting of *E. crus-galli* seedlings have been reported (Jiang, 1983) [2] and weed seedlings that are transplanted with rice seedlings to the main field are difficult to control by hand weeding and cannot be controlled by selective herbicides (Quadranti and Guyer, 1985) [3]. Thus indicating that high quality seedlings are prerequisite for high quality and quantity yields to avoid yield loss in the main field as given by Gautham and Mishra, 1995 that in transplanted rice, weed infestation reduces the grain yield by 35 - 55 per cent.

Among different weed management method , hand weeding is labourious and costlier, biological methods are crop specific and use of pre- emergence application of herbicides results in weed shift and herbicides resistance therefore the investigation was carried to evaluate post emergence herbicides on weed spectrum of rice seedlings in wet nursery with the following objectives:

1. To evaluate the phytotoxicity of post emergence herbicides application on rice seedlings.
2. To know the effectiveness of post emergence herbicides in controlling weeds in rice wet nursery.

Methodology
The field experiment was conducted at College of agriculture, V. C Farm, Mandya which falls under the region III of Southern Dry Zone of Karnataka (Zone-VI). Geographically located at 12^0 45′ and 30^0 57′ North latitude and 76^0 45′ and 78^0 24′ East longitude at an altitude of 695 meter above mean sea level in red sandy loam soil. The field experiment was laid out in a Randomised Complete Block Design (RCBD) in three replications with following 10 treatments.

T_1 : Fenoxaprop-p-ethyl 9 EC @ 56.25 ml *a.i.* ha^{-1} at15 DAS
T_2 : Ethoxysulfuron 15 WG @ 18.50 g *a.i.* ha^{-1} at15 DAS
T_3 : Bispyribac-sodium 12 SC @ 20.0 ml *a.i.* ha^{-1} at15 DAS
T_4 : Penoxsulam 24 SC @ 22.5 ml *a.i.* ha^{-1} at15 DAS
T_5 : Chlorimuron-ethyl+metsulfuronmethyl 20 WP @ 4.00 g *a.i.* ha^{-1} at15 DAS
T_6 : 2, 4 D sodium salt 80 WP @ 2.0 kg *a.i.* ha^{-1} at15 DAS

T_7 : Oxadiargyl 80 WP @ 120 g *a.i.* ha^{-1} at 3 DAS
T_8 : Bensulfuron methyl+pretilachlor 6.6 G @ 660 g *a.i.* ha^{-1} at 3 DAS
T_9 : Hand weeding at 20 DAS
T_{10} : Control (unweedy check).

Puddled (wet) nursery of plot size 4 m x 5 m was demarcted with bund of 0.5 m^2 size. Rice variety MTU 1001, pre germinated seeds were broadcasted in the plot at rate of 62 kg per 750 m^2, seedling requried for one hectare. For recording phytotoxicity visual ratings were taken at 1, 3, 7 and 14 days after spraying (DASp) of pre-emergence and post-emergence herbicides to know the extent of toxicity caused by different herbicides and the ratings were expressed in the scale of 0-10.
The total number of weeds present in area of 0.25 m^2 of each plot were recorded at 20 and 25 DAT. They were further classified into grasses, sedges, and broad leaved weeds and recorded as number of weeds 0.25 m^{-2} and density of weeds per m^2 is uprooted and counted according classes, sun dried for 1 day and oven dried to a constant weight at 65°C and dry weight of weeds in each treatment was recorded and expressed as g m^{-2}.
The data collected from the experiment at different growth stages were subjected to statistical analysis The level of significance used in 'F' and 'T' test was 0.05 and the data on weed count, density and dry weight of weeds were transformed using $(x+0.5)^{1/2}$ transformation and critical difference values were calculated wherever 'F' test was significant.

Results and Discussion

Phytotoxicity: Among the treatments during investigation, higher phytotoxicity on rice seedlings were recorded in T_2 (8.00, 7.33, 7.33 and 7.33), T_7 (7.00, 6.67, 7.00 and 5.67) and T_1 (5.67, 5.33, 4 and 5.33) all other remaining treatments showed phytotoxicity at the initial days and recovered from the toxicity within few days this may be due to high activity of the herbicides resulting in incompatibility of the herbicides with the younger seedlings of rice (Fig. I)

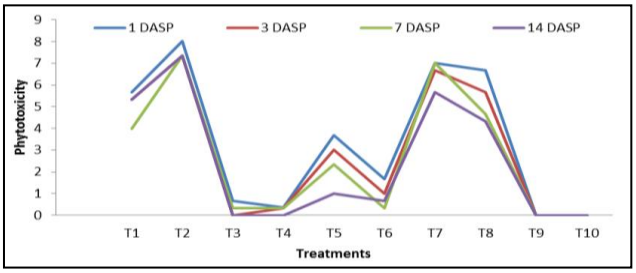

Fig 1

Total weed count (0.25 m^{-2}): At 5 DASp post emergence application of ethoxysulfuron 15 WG @ 18.50 g *a.i.* ha^{-1} at15 DAT recorded lower weed count (1.0, 0.7 and 0.0 of grassy, sedges and broad leaved weeds, respectively) and it was at par with rest of the treatments except T_9 and T_{10} which may be so since weeding was carried, because hand weeding was planned at 20 DAS (Table I). This is in accordance with the findings of Dhillon and Makhan (2016) [1].

Table 1: Weed count in 0.25 m^{-2} of area in wet nursery under treatment effects.

Treatments	Grasses		Sedges		BLW	
	5DASp	10DASp	5DASp	10DASp	5DASp	10DASp
T_1	0.7 (1.0)	2.7 (1.8)	0.3 (0.9)	0.0 (0.7)	1.3 (1.3)	1.3 (1.2)
T_2	1.0 (1.2)	2.7 (1.7)	0.7 (1.1)	1.7 (1.4)	0.0 (0.7)	2.0 (1.5)
T_3	0.7 (1.0)	3.7 (3.0)	1.3 (2.0)	1.3 (2.0)	2.3 (2.5)	2.0 (2.2)
T_4	1.0 (1.2)	1.3 (1.3)	1.0 (1.2)	1.0 (1.2)	0.3 (0.9)	1.7 (1.4)
T_5	1.0 (1.2)	1.3 (1.3)	0.7 (1.0)	2.0 (1.3)	1.7 (1.4)	3.3 (1.9)
T_6	1.3 (1.3)	2.3 (1.6)	0.8 (1.2)	2.4 (1.6)	0.7 (1.0)	2.7 (1.6)
T_7	1.0 (1.1)	1.0 (1.2)	2.0 (1.5)	0.7 (1.1)	3.0 (1.9)	4.3 (2.1)
T_8	1.3 (1.3)	1.3 (1.3)	1.0 (1.2)	1.3 (1.2)	1.7 (1.4)	2.0 (1.5)
T_9	1.7 (1.4)	2.0 (1.5)	0.3 (0.9)	0.3 (0.9)	2.7 (1.6)	0.7 (1.0)
T_{10}	2.3 (1.6)	4.3 (2.2)	2.3 (1.6)	3.0 (1.9)	3.3 (1.9)	5.6 (2.5)
S.Em±	0.63	0.70	0.27	0.37	0.25	0.82
CD @ 5% @ 5%	0.75	2.08	0.79	1.10	0.75	2.44

Weed density and weed dry weight
Grasses: T_1 recorded significantly lower weed density (0.1 no. m^{-2}) and dry weight (0.00 g m^{-2}) of grassy weeds at 5 DASp over rest of the treatments. At 10 DASp hand weeding at 20 DAS recorded lower weed dry weight (0.4 no. m^{-2}) and density (0.5 g m^{-2}) since broad spectrum of weed were removed from the plot and it was on par with T_3 (Table II).

Table 2: Density (no. m^{-2}) and dry weight (g m^{-2}) of grassy weeds in wet nursery under treatment effects

Treatments	Weed density		Weed dry weight	
	5 DASp	10 DASp	5 DASp	10 DASp
T_1	0.1 (0.8)	1.2 (1.3)	0.00 (0.7)	1.6 (1.4)
T_2	0.8 (1.1)	1.1 (1.3)	0.4 (0.9)	1.1 (1.3)
T_3	0.4 (2.0)	0.4 (0.9)	0.1 (1.9)	0.7 (1.1)
T_4	0.7 (1.1)	0.8 (1.1)	0.4 (0.9)	0.8 (1.1)
T_5	0.3 (0.9)	1.0 (1.3)	0.1 (0.8)	1.6 (2.5)
T_6	0.8 (1.1)	1.3 (1.3)	1.4 (1.3)	1.6 (1.4)
T_7	0.5 (1.0)	0.7 (1.1)	0.2 (0.8)	0.7 (1.1)
T_8	0.3 (0.9)	0.7 (1.1)	0.4 (0.9)	1.1 (1.2)
T_9	0.6 (1.1)	0.4 (0.9)	0.4 (0.9)	0.5 (1.0)
T_{10}	1.2 (1.3)	1.6 (1.4)	1.3 (1.3)	2.8 (1.8)
S.Em±	0.19	0.22	0.30	0.40
CD @ 5%	0.55	0.65	0.89	1.20

The findings were in harmony with the results of Rao, 2005 [5] Sedges : A significantly lower weed density (0.2 no. m^{-2}) and weed dry weight (0.1 g m^{-2}) was recorded with T_1 over all other treatments at 5 DASp. At 10 DASp (DASp), significantly lower weed density (0.4 no. m^{-2}) and weed dry weight (0.2 g m^{-2}) with T_9 which was on par with T_1 and higher number and dry weight of weeds was recorded with control at 5 and 10 DASp, since no weed management practise was carried, and the results were in harmony with the findings of Rao and Moody, 1988 [4] (Table III).

Table 3. Density (no. m^{-2}) and dry weight (g m^{-2}) of sedges in wet nursery under treatment effects.

Treatments	Weed density		Weed dry weight	
	5 DASp	10 DASp	5 DASp	10 DASp
T_1	0.2 (0.8)	0.5 (1.0)	0.1 (0.8)	0.0 (0.7)
T_2	0.4 (1.0)	0.9 (1.2)	0.3 (0.9)	1.4 (1.3)
T_3	0.9 (2.1)	0.9 (2.1)	0.8 (1.9)	0.4 (1.9)
T_4	0.4 (0.9)	0.9 (1.2)	0.7 (1.1)	0.8 (1.1)
T_5	0.7 (1.1)	1.2 (1.3)	0.8 (1.1)	1.5 (1.4)
T_6	0.9 (1.1)	1.6 (1.4)	0.6 (1.0)	0.7 (1.0)
T_7	0.9 (1.2)	1.2 (1.2)	0.9 (1.2)	0.5 (1.0)
T_8	0.5 (1.0)	0.4 (0.9)	0.4 (0.9)	0.2 (0.8)
T_9	0.5 (1.0)	0.9 (1.2)	0.1 (0.8)	0.3 (0.8)
T_{10}	1.5 (1.4)	1.9 (1.5)	1.1 (1.3)	2.1(1.6)
S.Em±	0.18	0.18	0.15	0.32
CD @ 5%	0.54	0.52	0.44	0.94

Broad leaved weeds (BLW): At 5 and 10 DASp significantly lower weed density (0.5 and 0.6, respectively) was recorded with T_3 over rest of the treatments and since the herbicide is best against all class of herbicides. Dry weight of BLW varied significantly among the treatments, similar trend to that of weed density was followed where in lower dry weight was recorded with T_3 (0.0 and 0.7, respectively) at 5 and 10 DASp (Table IV) similarly with the findings of Rao and Moody, 1988 [4].

Table 4: Density (no. m^{-2}) and dry weight (g m^{-2}) of BLW in wet nursery under treatment effects

Treatments	Weed density		Weed dry weight	
	5 DASp	10 DASp	5 DASp	10 DASp
T_1	0.5 (1.0)	1.3 (1.3)	0.5 (1.0)	1.1 (1.1)
T_2	0.5 (1.0)	1.1 (1.2)	0.0 (0.7)	1.3 (1.3)
T_3	0.2 (0.8)	0.6 (0.9)	1.2 (2.3)	1.3 (2.0)
T_4	0.5 (1.0)	1.3 (1.5)	0.0 (0.7)	0.7 (1.0)
T_5	0.3 (0.9)	1.9 (1.5)	0.6 (1.1)	1.4 (1.4)
T_6	0.4 (0.9)	0.3 (0.9)	0.3 (0.9)	0.9 (1.1)
T_7	1.0 (1.2)	1.6 (1.1)	1.4 (1.3)	2.8 (1.8)
T_8	1.5 (1.4)	1.7 (1.4)	0.3 (0.9)	1.3 (1.3)
T_9	0.5 (1.0)	1.3 (1.5)	0.7 (1.0)	0.8 (1.2)
T_{10}	0.7 (1.1)	1.9 (1.5)	2.5 (1.6)	1.4 (1.4)
S.Em±	0.91	0.33	0.29	0.27
CD @ 5%	0.56	0.97	0.85	0.79

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