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RESEARCH ARTICLE :

Effect of pre and early post emergence herbicides in soybean and its residual effect on sunflower and pearl millet in western zone of Tamil Nadu

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BACKGROUND AND OBJECTIVES

Herbicide is the furthermost successful technology forever developed. The period of time that a herbicide remains active or persists in the soil as well as crop is extremely important as it relates to the length of time that weed control can be expected. Due to the critical period of crop weed completion at early stage of soybean, there is need for pre emergence herbicides for prolonged effective weed control (Reddy *et al.*, 1998).

There is a need to identify newer molecules for selective management of weeds and to overcome the problem of acquiring resistance by certain weeds against recommended herbicides. In view of this, an attempt has been made to find the effectiveness of flumioxazine, a contact herbicide to broad spectrum weed control in soybean.

Flumioxazine (N-phenylphthalimide) is a new molecule which acts on weeds by inhibiting protoporphyrinogen oxidase, an enzyme important in the synthesis of chlorophyll. Keeping these points in view, the experiment was taken with new herbicide molecule of PE Flumioxazine 50% SC in germination and growth of soybean and its residual effect sunflower and pearl millet.

RESOURCES AND METHODS

The experiment was conducted at Aigrculture Research Station, TNAU, Bhavanisagar during 2013-14. The experiment was laid out in a randomized block design with three replications and eleven treatments. The soil of the experimental field was red sandy clay loam in texture belonging to *Typic Paleustalfs*.

The nutrient status of soil during start of the experiment was low in available nitrogen (215 kg/ha), medium in available phosphorus

(17.5 kg/ha) and high in available potassium (260 kg/ha). Soybean variety CO (Soy) 3 with duration of 85-90 days released by TNAU was selected for this study.

After herbicide application, the plants were observed to find out the phytotoxicity effects. The observations taken on 7, 15, 30 and 45 days after herbicide application. The signs of herbicide injury were rated using 0 to 10 scale where 0= No injury and 10= complete destruction. This rating suggested by Patil and chauhan (1972) was followed.

OBSERVATIONS AND ANALYSIS

Effect of Treatments on Total weed density and dry weight: Weed density at different stages showed significant variation among the weed management practices and showed increasing trend from 25 DAS. Higher density of weeds was observed upto 60 DAS. Results are in corroboration with the finding of Nagaraju and Mohankumar (2009) who have recorded maximum density of weeds upto 60 DAS compared to other stages of the soybean crop covering greater portion of the soil at this stage.

At 25 and 45 DAS, PE application of flumioxazine at 250 g ha^{-1} (T_6) registered lower weed density (12.7 m^{-2}) (23.3 m^{-2}), which was on par with PE flumioxazine at 150 g ha^{-1} (T_5). This might be due to broad spectrum weed control at germination phase by the pre emergence application of herbicides (Table 1.).

At 60 DAS, there was remarkable reduction in total weed density (28.3 m^{-2}) with PE application of flumioxazine at 250 g ha^{-1} (T_6) which was on par with PE flumioxazine at 150 g ha^{-1} (T_5) (Table 1).

Effect of treatments on crop growth attributes: Germination and phytotoxicity in soybean: Germination of soybean was significantly influenced by different herbicide treatment. Highest germination percentage was recorded in PE application of flumioxazine at 75 g ha^{-1} (Table 2.).

Effect treatments on Plant height, and Dry matter production: At 45 DAS, higher plant height was recorded with PE flumioxazine at 112.5 g ha^{-1} (T_3) which was on par with PE pendimethalin at 1.0 kg ha^{-1} (T_7), hand weeding twice (T_{10}) and PE application of oxyflourfen at 125 g ha^{-1} (T_8) (Fig. 1.).

At 45 DAS, PE flumioxazine at 112.5 g ha^{-1} (T_3) recorded significantly higher dry matter production which was on par with PE flumioxazine at 100 g ha^{-1} (T_2), PE pendimethalin at 1.0 kg ha^{-1} (T_7) and PE flumioxazine at 75 kg ha^{-1} (T_1) (Fig. 1.).

Better weed control with no phytotoxity might have resulted in reduced crop weed competition for growth factors such as light, space and nutrients which in turn helped in efficient photosynthetic activity. Parker and Riches (1993) reported that the weed control with various herbicides increased the plant height markedly.

Residual effect treatments on growth and germination of succeeding crops: Residual effect of herbicide is one of the important factors for recommending it to the farmers in order to avoid the residual phytotoxity in the succeeding crops. Germination percentage at 10 DAS, plant height and dry matter production at 30 DAS of succeeding crops such as sunflower and pearlmillet was recorded to study the

Table 1 : Effect of treatments on total weed density (No.m^{-2}) and total weed dry weight in soybean

Treatment	25 DAS	45 DAS	60 DAS	25 DAS	45 DAS	60 DAS
T_1- PE Flumioxazine 50% SC 75 g a.i. /ha	8.57 (71.7)	10.4 (106)	11.6 (133)	5.60 (29.5)	6.82 (44.5)	7.58 (55.5)
T_2- PE Flumioxazine 50% SC 100 g a.i. /ha	7.23 (50.3)	8.70 (73.7)	9.89 (96.3)	5.22 (25.4)	6.44 (39.5)	7.05 (47.7)
T_3- PE Flumioxazine 50% SC 112.5 g a.i. /ha	5.84 (32.3)	7.31 (51.7)	8.30 (67.0)	4.67 (19.9)	5.54(28.7)	6.14 (35.9)
T_4- PE Flumioxazine 50% SC 125 g a.i. /ha	5.29 (26.0)	6.43 (39.3)	7.28 (51.1)	4.08 (14.6)	5.07 (24.0)	5.54 (28.7)
T_5- PE Flumioxazine 50% SC 150 g a.i. /ha	4.51 (18.3)	5.80 (31.7)	6.56 (41.3)	3.45 (9.95)	4.69 (20.0)	5.35 (26.7)
T_6- PE Flumioxazine 50% SC 250 g a.i. /ha	3.83 (12.7)	5.03(23.3)	5.50 (28.3)	3.03 (7.24)	4.30 (15.6)	4.85 (21.5)
T_7- PE Pendimethalin 30% EC 1.0 kg a.i. /ha	5.94 (33.3)	7.01 (47.3)	8.25 (66.7)	4.98 (22.8)	6.43 (35.7)	6.66 (42.5)
T_8- PE Oxyflourfen 23.5% EC 125 g a.i. /ha	7.94 (61.3)	9.04 (80.0)	10.5 (109)	5.65 (29.9)	6.87 (45.3)	7.59 (55.9)
T_9- EPOE Chlorimuron ethyl 25% WP 9 g a.i. /ha	10.2 (103)	11.1 (122)	11.7 (136)	6.85 (45.3)	7.43 (53.3)	8.21 (65.6)
T_{10}- Hand weeding on 25 & 45 DAS	16.3 (265)	8.48 (70.0)	7.95 (61.3)	11.0 (120)	6.16 (36.1)	6.39 (38.9)
T_{11}- Unweeded check	16.6 (273)	19.4 (374)	21.6 (467)	11.1 (122)	12.0 (141)	12.9 (165)
S.E. ±	0.44	0.51	0.60	0.32	0.35	0.39
C.D. (P=0.05)	0.93	1.05	1.25	0.67	0.73	0.82

Table 2 : Effect of treatments on phytotoxicity rating and germination % of soybean

Treatments	Phytotoxicity rating				Germination (%)	
	7 DAHS	15 DAHS	30 DAHS	45 DAHS	7 DAS	15 DAS
T_1- PE Flumioxazine 50% SC 75 g a.i. /ha	0	0	0	0	82.3	96.4
T_2- PE Flumioxazine 50% SC 100 g a.i. /ha	0	0	0	0	80.8	93.1
T_3- PE Flumioxazine 50% SC 112.5 g a.i. /ha	1	0	0	0	79.6	92.3
T_4- PE Flumioxazine 50% SC 125 g a.i. /ha	2	1	1	0	65.3	72.3
T_5- PE Flumioxazine 50% SC 150 g a.i. /ha	3	2	1	0	61.2	70.1
T_6- PE Flumioxazine 50% SC 250 g a.i. /ha	4	3	2	1	55.6	65.3
T_7- PE Pendimethalin 30% EC 1.0 kg a.i. /ha	0	0	0	0	81.3	94.5
T_8- PE Oxyflourfen 23.5% EC 125 g a.i. /ha	0	0	0	0	80.4	92.4
T_9- EPOE Chlorimuron ethyl 25% WP 9 g a.i. /ha	0	0	0	0	78.9	93.8
T_{10}- Hand weeding on 25 & 45 DAS	0	0	0	0	81.1	95.8
T_{11}- Unweeded check	0	0	0	0	80.3	94.8
S.E. ±	-	-	-	-	26	28
CD (P=0.05)	-	-	-	-	NS	NS

Note: DAHS-Days after herbicide spraying, DAS-Days after sowing NS=Non-significant

Table 3 : Residual effect of treatments on Plant height (cm) the dry matter production (kg ha^{-1}) of succeeding crops at 30 DAS

Treatment	Plant height		DMP	
	Sunflower	Pearl millet	Sunflower	Pearl millet
T_1- PE Flumioxazine 50% SC 75 g a.i. /ha	23.2	82.0	83	154
T_2- PE Flumioxazine 50% SC 100 g a.i. /ha	25.9	81.6	98	170
T_3- PE Flumioxazine 50% SC 112.5 g a.i. /ha	23.8	80.3	108	136
T_4- PE Flumioxazine 50% SC 125 g a.i. /ha	22.5	79.2	98	131
T_5- PE Flumioxazine 50% SC 150 g a.i. /ha	21.1	78.8	98	158
T_6- PE Flumioxazine 50% SC 250 g a.i. /ha	22.8	79.7	93	133
T_7- PE Pendimethalin 30% EC 1.0 kg a.i. /ha	25.3	82.3	86	157
T_8- PE Oxyflourfen 23.5% EC 125 g a.i. /ha	23.7	81.0	102	153
T_9- EPOE Chlorimuron ethyl 25% WP 9 g a.i. /ha	22.8	80.7	103	163
T_{10}- Hand weeding on 25 & 45 DAS	24.5	81.6	98	131
T_{11}- Unweeded check	21.6	79.4	99	160
S.E. ±	3.32	1.63	13	19
CD(P=0.05)	NS	NS	NS	NS

NS=Non-significant

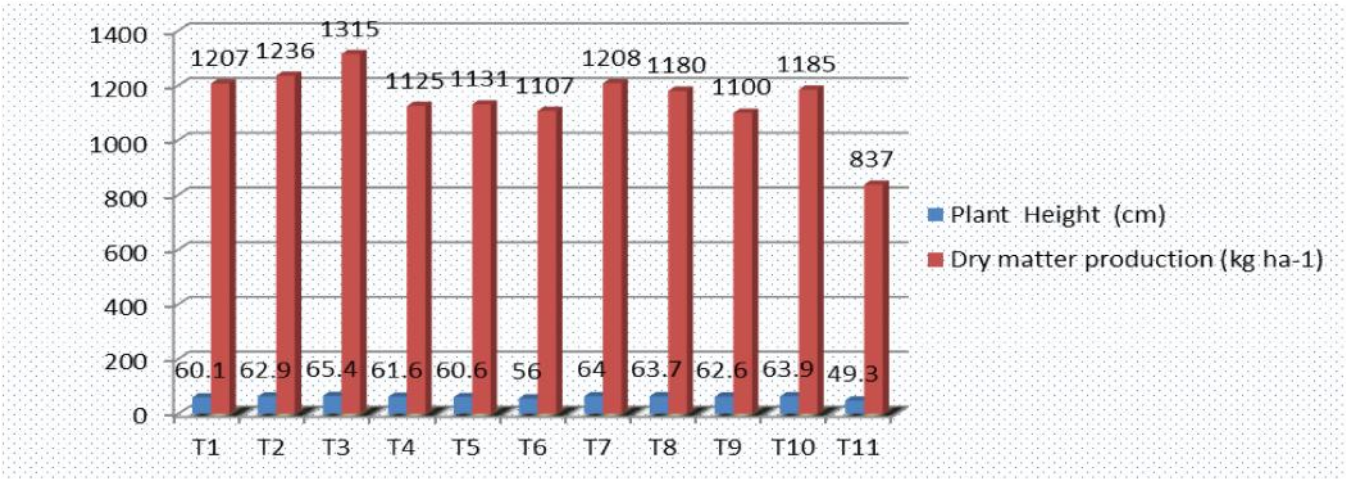

Fig. 1 : Effect of treatments on Plant height (cm) and dry matter production (kg ha^{-1}) of soybean at 45 days after aowing

residual effect of flumioxazine. Results indicated that there was no significant difference among the treatments and it was evident that there is no residual toxicity due to the application of flumioxazine at all doses in the succeeding crops (Table 3.). It is in conformity with the results by Raskar and Bhoi (2002) who reported no carry over effect of soybean PE application of various herbicides on succeeding crop of potato.

Conclusion :

Hence, it could be concluded that, PE flumioxazine at 112.5 g ha^{-1}were recorded significant improvement in plant growth attributes (*viz.*, plant height, Dry matter production and Leaf area index) without residual effect on succeeding crops.

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