International Journal of Science, Environment and Technology, Vol. 7, No 4, 2018, 1236 – 1241

ISSN 2278-3687 (O)
2277-663X (P)

BIO-EFFICACY OF PENDIMETHALIN 30% EC + IMAZETHAPYR 2% SL PREMIX AGAINST WEEDS OF SOYBEAN

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Abstract: Experiment was conducted during *Kharif* 2016 and *kharif* 2017 to evaluate pre-emergence the bio-efficacy of Pendimethalin 30% EC + Imazethapyr 2% SL premix for weed control in soybean. The results accrued over two years revealed that the application of herbicides significantly control the weeds during the critical period of crop-weed competition. The yield reduction due to weeds was 69.68 %. Among herbicidal treatments, the maximum weed control efficiency and highest yield was with premix formulation of Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g a i/ha and statistically at par with Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI , Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI and Sulfentrazone + Clomazone (Pre-mix) @ 725 g a i/ha applied as pre emergence emergence and all these treatments significantly superior than pendimethalin 30% EC. The pre plant incorporation, pre emrgence and post emergence herbicides are equally effective to control the weeds in soybean.
Keywords: Soybean, weed, weed control efficiency.

INTRODUCTION

Soybean is a leading oilseed crop of the world and India. Soybean productivity is oscillating between 1.0 to 1.7 t per ha in last decade as compared to other productivity in major soybean growing countries (2.7 t/ha). Soybean (*Glycine max*) is an important rainy season crop grown more than 0.92 mh in south eastern parts of Rajasthan mainly in Kota, Bundi, Baran and Jhalawar districts producing 0.75 mt with average productivity of 811 kg/ha which is very low compared to national productivity of 1153 kg/ha (Anon 2017). One of the major reasons for lower productivity is abiotic and biotic factors encountered during crop season. Among the biotic factors, weed is most crucial and responsible for reduction in yield from 20-77 per cent depending on the type of soil, season and intensity of weed infestation (Billore *et al*., 1999; Kuruchania *et al*., 2001). Soybean suffers from heavy weed competition especially in the early stages of crop growth. The application of herbicide as pre plant incorporation (PPI), pre-emergence (PE) played a great role in controlling the weeds in earlier years of introduction of this crop in India. The introduction of post-emergence (PoE) effective

*Received June 4, 2018 * Published Aug 2, 2018 * www.ijset.net*

herbicides have changed whole scenario of herbicide use pattern. The availability of newer molecules of PoE offered options to farmers for efficient weed management. There is still a need to provide more optional pre-plant incorporation (PPI), PE or PoE herbicides for better management of weeds to achieve sustainable production of soybean. Therefore, the present investigation was initiated to study to find out the bio-efficacy of new molecule *i.e.* Pendimethalin 30% EC + Imazethapyr 2%, Pyroxasulfone 85% WG, Sulfentrazone + Clomazoneof herbicides when applied as PPI, PE or Pos for weed management in soybean.

MATERIAL AND METHODS

The experiment was conducted during *Kharif* 2016 and *Kharif* 2017 at research farm of Agricutural Research Station, Ummedganj Farm, Kota to evaluate the bio-efficacy of Pendimethalin 30% EC + Imazethapyr 2% SL premix against weeds of Soybean. The rainfall received during the kharif 2016 crop season was 1175.6 mm and the kharif 2017 crop season was 508 mm. Minimum and maximum mean temperature during the *kharif* 2016 ranged from 21.9 0C to 37.7 0C, respectively. The experiment consisted of six treatments involving , namely Sulfentrazone + Clomazone 58 % WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence, Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence, Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI, Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI, Pendimethalin 30% EC @ 1.0 kg ai/ha as pre-emergence and weedy check (Table 1). All the six treatments were replicated four times in randomized block design. Soybean "JS 95-60" was sown at 30 cm spaced row using 100 kg seed/ha on July 05th, 2016 and July 04th, 2017 and harvested on September 27th and 30th, 2016 and 2017, respectively. Both PPI herbicide applied before sowing, PE herbicides were applied just after sowing of soybean while the PoE herbicides were applied after 15-20 days after sowing (DAS) using 500 litres of water per ha. Soybean was cultivated by following the other recommended package of practices. Weed count and their dry biomass were recorded at 30, 45 and 60 days after sowing weed control efficiency of each treatment was determined by using the standard formula. Yield and yield attributes were recorded at the time of harvesting. The data were pooled over the years as per standard procedures.

RESULTS AND DISCUSSION

Among the different weeds grassy (51.6%), broadleaf (34.1%) and sedges (13.2%) weeds was observed in experimental field. The predominant weed flora in the weedy check plot at 30, 45 and 60 DAS was *Echinochloa* spp. *Cyperus rotundus (*L.), *Celosia argentea* (L.), *Commelina benghalensis* L, *Digera arvensis* Forsk, *Boerhavia diffusa* L, *Convolvulus*

*arvensis*L, *Cynodon dactylon* (L.) *etc*. All the weed control treatments showed significant reduction in weed density and dry matter accumulation as compared to weedy check (Table 1).

The highest weed control efficiency was observed with Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) applied as pre-emergence at thrice the stages of observations (30, 45 and 60 DAS), 71.17 %, 62.27% and 56.36%, respectively. The weed control efficiency of herbicides declined as the crop age advanced. The weed control efficiency of the Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI at thrice (30, 45 and 60 DAS) the stages of observations were higher 68.99 %, 58.41% & 50.54 %, respectively than pendimethalin statistically at par with Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI and Sulfentrazone + Clomazone 58 % WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence (Table 1)

The variation in weed count, their dry matter and weed control efficiency might be due the differences in effectiveness of herbicides against different weeds in the field. The effectiveness of PPI, PE and PoE was found to be equally effective (Billore *et al*., 1999). Many researchers have reported lower weed densities in soybean with the use of herbicides like sulfentrazone (Vidrine *et al*., 1996; Niekamp *et al.,* 2001; Krausz *et al.,* 2003) and pendimethalin (Nayak *et al.,* 2000; Raskar and Bhoi, 2002, Chauhan *et al.,* 2002) and clomazone (Werling and Bhuler, 1988), integrated weed management (Meena *et al*., 2009), imazethapyr (Meena *et al.,*2011) and Clomazone and Sulfentrazone (Rawat *et al*., 2017).

Results revealed that soybean plant height significantly higher of weedy check as compared to rest of the treatments. Branches per plant significantly higher of Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence but at par with Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI, Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI, Pendimethalin 30% EC @ 1.0 kg ai/ha as pre-emergence as compared to weedy check (Table 2). The maximum pods per plant were observed with Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence and showed non-significant differences with Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI, Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI. The maximum seed index was also recorded with Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence and remained at par with all the treatments except control. The yield reduction was to the extent of 69.68 per cent, if weeds were not managed. All the treatments showed higher yield over weedy control as well as

Pendimethalin 30% EC @ 1.0 kg a i per ha. The yield enhancement due to weed control treatments was 64.04 to 96.58 per cent. The significantly higher seed yield was recorded with Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) applied as pre-emergence and remained at par with Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI, Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI and Sulfentrazone + Clomazone 58% WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence. Among the herbicides, however, the lower level of pendimethalin @ 1.0 kg a i per ha was less effective as compared to other herbicides. The more or less similar pattern was also recorded in straw yield. The harvest index remained unchanged due to different treatments.

The yield enhancement in weed control treatment might be due to the effective control of weeds which offers less competition between crop and weeds during the critical period of crop-weed competition. The similar results were also reported by Singh *et al.* (2004), Singh and Jolly (2004) and Mishra and Singh, (2009).

Conclusion

On the basis of two years results, it could be concluded that the application of Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g a i per ha as PE was found to be as effective but remained at par with Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI and better than pendimethalin and Sulfentrazone + Clomazone 58 % WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence.

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Table 1. Effect of herbicides on weed count, dry matter and weed control efficiency in soybean

Treatment	30 DAS			45 DAS			60 DAS		
	Count (m^2)	Dry matter (g/m^2)	WCE (%)	Count (m^2)	Dry matter (g/m^2)	WCE (%)	Count (m^2)	Dry matter (g/m^2)	WCE (%)
Sulfentrazone + Clomazone 58 % WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence	3.28 (9.79)	2.50 (5.27)	60.81	4.66 (20.67)	3.45 (10.87)	52.25	4.12 (15.98)	5.23 (26.32)	49.18
Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence	2.88 (7.30)	2.21 (3.89)	71.17	4.09 (15.71)	309 (8.56)	62.27	3.64 (12.25)	4.76 (21.66)	56.36
Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI	3.12 (8.74)	2.37 (4.64)	65.55	4.43 (18.66)	3.32 (10.02)	55.76	3.85 (13.82)	5.16 (25.58)	48.47
Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI	2.96 (7.79)	2.29 (4.25)	68.98	4.36 (17.98)	3.21 (9.32)	58.41	3.71 (12.80)	5.04 (24.43)	50.54
Pendimethalin 30% EC @ 1.0 kg ai/ha as pre-emergence	3.51 (11.33)	2.52 (5.35)	60.33	4.47 (19.00)	3.51 (11.35)	49.14	4.42 (18.58)	5.65 (30.95)	37.69
Weedy Check	5.00 (24.00)	3.80 (13.47)	-	6.23 (37.80)	4.81 (22.11)	-	5.56 (29.89)	7.20 (50.77)	-
CD (P = 0.05)	2.65	0.66		3.04	1.84		3.11	2.61	-

Square root transformed value (x+1) of weed count used for statistical analysis, Data in parenthesis are original values of weed counts and dry weight

Table 2. Effect of herbicides on soybean growth, yield attributes and yield

Treatment	Plant height (cm)	Branches (No/ plant)	Pods (No/ Plant)	Seed index	Seed yield (kg/ha)	Straw yield (kg/ha)	HI (%)
Sulfentrazone + Clomazone 58 % WP premix @ 725 g ai/ha (1250 ml/ha) as pre-emergence	45.56	1.83	28.75	10.61	1142	1949	36.97
Pendimethalin 30% EC + Imazethapyr 2% SL premix @ 960 g ai/ha (3000 ml/ha) as pre-emergence	44.00	2.14	33.40	10.90	1323	2234	37.15
Pyroxasulfone 85 % WG @ 102 g ai/ha (120 g/ha) as PPI	44.20	1.91	28.89	10.71	1190	2025	37.01
Pyroxasulfone 85% WG @ 127.5 g ai/ha (150 g/ha) as PPI	44.40	2.09	32.14	10.81	1276	2163	37.09
Pendimethalin 30% EC @ 1.0 kg ai/ha as pre-emergence	45.60	1.79	28.29	10.85	1104	1921	36.48
Weedy Check	50.00	1.31	17.39	10.18	673	1150	36.85
CD (P = 0.05)	3.56	0.33	4.65	NS	216.78	305.31	NS