RESEARCH ARTICLE

Effect of different herbicides on weed control and yield in Soybean (Glucine max L.)

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ABSTRACT

A field survey was carried out in medium type of soil to evaluate the efficacy of herbicides for the control of weed. Dry matter accumulation of weed significantly reduced with application of Imezethapyr @ 75g ha^{-1} and Quizalofop ethyl @ 50g ha^{-1} with 1H and 1HW at 35 DAS followed by the treatment Imezethapyr 90 g ha^{-1} and Quizalofop ethyl 62.5 g ha^{-1} combined with 1 H and 1 HW at 35 DAS. Highest weed control efficiency and lowest weed index was recorded with treatment Imezethapyr @ 75g ha^{-1} +1H +1H +1HW. The treatment Imezethapyr @75 g ha^{-1}+1H+1HW found more effective on weed control and favours yield.

Keywords: Weed, Soybean, Yield attributes.

INTRODUCTION

Soybean in India at present has acquired a covered position by surpassing all the major oilseed crop. The unabated growth of soybean in area and production over short span of about 38 years has touched all time high covering more than 9.62 million hectares and produce more than 9.0 million ton of soybean since the average productivity round around 1 ton which is much more below than the world productivity viz., 2200 kg ha^{-1}. It needs to enhance production and productivity of soybean with continuous support of R & D.

Since the poor weed control is the major factor to reduce yield in soybean to the major extent up to 80%, further mechanical weed control is not feasible and enable in timely weed control so far. Hence it needs to evaluate efficient chemical herbicides favoring yield. Therefore, the present investigation was undertaken with objective to study the effect of different herbicides viz. imezethapyr, quizalofop ethyl on weed control and yield in soybean.

MATERIAL AND METHODS

The field experiment was conducted using randomized block design on medium soil type for 2011-2012. Fourteen treatments were given in three replicates.

T_1 -Unwedded control
T_2-2H + 2HW at 20 and 35 DAS
T_3-Imezethapyr 60 g ha^{-1} at 10 DAS

T_4-Imezethapyr 75 g ha^{-1} at 10 DAS
T_5-Imezethapyr 90 g ha^{-1} at 10 DAS
T_6-Quizalofop ethyl 37.5 g ha^{-1} at 10 DAS
T_7-Quizalofop ethyl 50 g ha^{-1} at 10 DAS
T_8-Quizalofop ethyl 62.5 g ha^{-1} at 10 DAS
T_9-Imezethapyr 60 g ha^{-1} 1H + 1HW at 10 and 35 DAS
T_{10}-Imezethapyr 75 g ha^{-1} 1H + 1HW at 10 and 35 DAS
T_{11}-Imezethapyr 90 g ha^{-1} 1H + 1HW at 10 and 35 DAS
T_{12}-Quizalofop ethyl 37.5g ha^{-1} 1H + 1HW at 10 and 35 DAS
T_{13}-Quizalofop ethyl 50 g ha^{-1} 1H + 1HW at 10 and 35 DAS
T_{14}-Quizalofop ethyl 62.5 g ha^{-1} 1H + 1HW at 10 and 35 DAS

Soybean variety JS-335 was sown on total 42 plots of size 4.8 x 3.6m^2 (gross) and 3.6 x 2.7m^2 (net) on dated 26.06.2011 with recommend seed rate i.e. 75 kg/ha and spacing i.e. 45 cm x 5 cm. All recommend package of practices were adapted appropriately in the experiment. Data was recorded for weed control efficiency, dry matter of weed, weed index, seed yield per hectare, straw yield per hectare. Weed dry matter was recorded by using a quadrate of one square meter from a random data recorded for the above five parameters was subjected to statistical analysis as suggested by Panse and Sukhatme (1954).

RESULTS AND DISCUSSION

The data of total weed count is presented in table 1. At 30 DAS, highest total weed count m^2 was observed with unweed control and all other treatments were significantly superior over unweeded control. Treatment comprising of two hoeing and two hand weedings was found significantly superior over other treatments except T_{10} – imezethapyr @ 75 g ha^{-1} + 1H and 1HW at 35 DAS, T_4 – imezethapyr @ 75 g ha^{-1} + 1H, T_{11} – imezethapyr @ 90 g ha^{-1} + 1H and 1HW at 35 DAS, T_7 – quizalofop ethyl @ 50 g ha^{-1}, T_{13} – quizalofop ethyl @ 50 g ha^{-1} + 1H and 1HW at 35 DAS and T_{14} – quizalofop ethyl @ 62.5 g ha^{-1} + 1H and 1HW at 35 DAS, which were at par with T_2 treatment comprising of two hoeing and two hand weedings at 20 and 35 DAS showed significantly lower total weed population m^{-2} over all treatments except for T_{10} – imezethapyr @ 75 g ha^{-1} + 1H and 1HW at 35 DAS, T_{13} – quizalofop ethyl @ 50 g ha^{-1} + 1H and 1HW at 35 DAS, T_{11} – imezethapyr @ 90 g ha^{-1} + 1H and 1HW at 35 DAS, T_{14} – quizalofop ethyl @ 62.5 g ha^{-1} + 1H and 1HW at 35 DAS, T_7 – quizalofop ethyl @ 50 g ha^{-1}, T_4 – imezethapyr @ 75 g ha^{-1} and T_5 - Imezethapyr 90 g ha^{-1} which were at par with T_2 treatment comprising of two hoeing and two hand weedings at 20 and 35 DAS. Similar trend was observed at 60 DAS and 75 DAS. At harvest, the total weed count m^{-2} was significantly lower with the treatment comprising of two hoeing and two hand weedings at 20 and 35 DAS. However, application of imezethapyr @ 75 & 90 g ha^{-1} along with 1H and 1HW at 35 DAS, Imezethapyr @ 75 g ha^{-1} and Quizalofop ethyl @ 50 g ha^{-1} were at par with treatment comprising of two hoeing and two hand weedings at 20 and 35 DAS. Similar results were reported by Kushwah and Vyas (2005) and Bhattacharya (2005).

Highest weed dry matter production was recorded with unweeded control and lowest weed dry matter production in weed free check (Table 2). Weed biomass showed progressive increase in unweeded control till 75 DAS. At 30 DAS highest weed dry matter was observed with unweeded control and all other treatments were significantly superior over unweeded control. Treatment comprising of two hoeing and two hand weedings at 20 DAS and 35 DAS was significantly superior over other treatments except for T_{10} – Imezethapyr @ 75 g ha^{-1} + 1H + 1HW at 35 DAS and T_{13} – quizalofop ethyl @ 50 g ha^{-1} + 1H and 1HW at 35 DAS which were at par with T2 treatment comprising of two hoeing and two hand weedings at 20 DAS and 35 DAS. At 45 DAS, significantly lower dry matter of weeds was observed with treatment comprising of two hoeings and two hand weedings at 20 DAS and 35 DAS except for treatments T_{10} – imezethapyr @ 75 g ha^{-1} + 1H and 1HW at 35 DAS, T_{13} – quizalofop ethyl @ 50 g ha^{-1} + 1H and 1HW at 35 DAS, T_{11} – imezethapyr @ 90 g ha^{-1} + 1H and 1HW at 35 DAS and T_{14} – quizalofop ethyl @ 62.5 g ha^{-1} + 1H and 1HW at 35 DAS which were at par with T_2 treatment comprising of two hoeing and two hand weedings at 20 and 35 DAS. Similar trend was observed at 60 DAS and 75 DAS. At harvest treatment comprising of two hoeing and two hand weedings exhibited significantly lower dry matter of weeds. However, application of imezethapyr @ 75 and 90 g ha-1 alogn with one hoeing and one hand weeding at 35 DAS and quizalofop ethyl @ 50 and 62.5 g ha-1 along with 1H and 1HW at 35 DAS were at par with treatment comprising of two hoeing and hand weedings at 20 and 35 DAS. These findings correlate with findings of Vyas and Jain (2005); Bhandiwaddar *et al* (2001). High weed dry matter production was recorded with unweeded control (T_1) and lowest was recorded with weed free check (T_2) however application of imezethapyr @ 75 and 62.5 g

ha^{-1} along with one hoeing and one hand weeding at 35 DAS was at par with the treatment of weed free check (T_2). Treatment consisting of two hoeings and two weedings recorded highest weed control efficiency over all other treatments at all periodical observations, followed by T_{10} -imezethapyr @ 75 g ha^{-1} +1H + 1HW at 30 DAS, T_{13} - quizalofop ethyl @ 50 g ha^{-1} +1H+1HW at 30 DAS, T_{11} - imezethapyr @ 90 g ha^{-1} + 1H & 1HW at 35 DAS and T_{14} - quizalofop ethyl @ 62.5 g ha^{-1} + 1H & 1HW at 35 DAS. This could be due to better control of weeds by hoeing combined with weeding. This result was in agreement to that of Vyas *et al.* (2000), Bhandiwaddar *et al* (2001), Singh (2002) and Bhattacharya *et at.* (2004)

Table 1: Total weed count m^{-2} as influenced by different weed control treatments.

Treatment details	Time of application	30 DAS	45 DAS	60 DAS	75 DAS	AH
T_1 - Un weeded control		53.33 (7.34)	54.99 (10.24)	55.99 (10.36)	54.00 (10.16)	55.66 (10.34)
T_2 - (2H + 2HW)	20 & 35 DAS	19.00 (4.41)	18.00 (6.03)	18.99 (6.17)	18.00 (6.02)	19.93 (6.32)
T_3 - Imezethapyr @ 60 g ha^{-1}	10 DAS	34.00 (5.87)	34.99 (8.23)	36.32 (8.43)	35.99 (8.35)	37.66 (8.54)
T_4 - Imezethapyr @ 75 g ha^{-1}	10 DAS	27.00 (5.24)	26.33 (7.11)	27.99 (7.33)	27.33 (7.24)	29.33 (7.51)
T_5 - Imezethapyr @ 90 g ha^{-3}	10 DAS	30.00 (5.52)	32.32 (7.93)	34.99 (8.26)	34.00 (8.16)	36.33 (8.42)
T_6 - Quizalofop ethyl @ 37.5 g ha^{-1}	10 DAS	35.33 (6.00)	35.32 (8.28)	37.66 (8.54)	37.99 (8.60)	39.66 (8.73)
T_7 - Quizalofop ethyl @50 g ha^{-1}	10 DAS	27.66 (5.31)	27.99 (7.32)	28.99 (7.44)	27.99 (7.32)	29.66 (7.54)
T_8 - Quizalofop ethyl @ 62.5 g ha^{-1}	10 DAS	31.33 (5.64)	32.66 (7.98)	35.33 (8.30)	34.66 (8.20)	36.66 (8.46)
T_9 - lmazethapyr @ 60g ha^{-1} + 1H+1HW	10 & 35 DAS	31.33 (5.64)	32.99 (8.00)	35.32 (8.31)	34.66 (8.23)	36.00 (8.39)
T_{10} - Imazethapyr @ 75g ha^{-1} + 1H+1HW	10 & 35 DAS	26.00 (5.15)	21.66 (6.61)	24.33 (6.94)	23.33 (6.81)	24.66 (7.01)
T_{11} - lmazethapyr @ 90g ha^{-1} + 1H+1HW	10 & 35 DAS	27.00 (5.24)	25.33 (7.10)	27.32 (7.38)	25.32 (7.13)	27.33 (7.38)
T_{12} - Quizalofop ethyl @ 37.5 g ha^{-1} + 1H+1HW	10 & 35 DAS	32.66 (5.76)	33.33 (8.07)	34.99 (8.30)	33.99 (8.17)	34.99 (8.28)
Ti_3 - Quizalofop ethyl @ 50 g ha^{-1} + 1H +1HW	10 & 35 DAS	28 (5.34)	23.66 (6.88)	25.66 (7.14)	24.66 (7.01)	26.33 (7.21)
T_{14} - Quizalofop ethyl @ 62.5 g ha^{-1} + 1H + 1HW	10 &35 DAS	29 (5.43)	25,66 (7.17)	27.32 (7.38)	25.66 (7.19)	27.33 (7.39)
SE (m) ±		**0.36**	**0.5**	**0.53**	**0.52**	**0.52**
CD at 5%		**1.10**	**1.53**	**1.61**	**1.58**	**1.61**
QM		**5.56**	**7.64**	**7.88**	**7.76**	**7.97**

Upper values are original values; Figures in parentheses are transformed values $\sqrt{x + 0.}$

Table 2: Weed dry matter accumulation (g) as influenced by different treatments.

Treatment details	Time of application	30 DAS	45 DAS	60 DAS	75 DAS	AH
T_1 - Un weeded control		217.33	226.33	235.33	244.66	239.00
T_2 - (2H + 2HW)	20 & 35 DAS	14.66	15.00	23.33	25.33	26.33
T_3 - Imezethapyr @ 60 g ha^{-1}	10 DAS	81.33	94.66	117.66	120.33	115.00
T_4 - Imezethapyr @ 75 g ha^{-1}	10 DAS	57.33	66.33	76.33	77.66	74.33
T_5 - Imezethapyr @ 90 g ha^{-3}	10 DAS	73.66	85.66	97.00	100.00	95.66
T_6 - Quizalofop ethyl @ 37.5 g ha^{-1}	10 DAS	90.33	M05.33	132.33	136.33	130.33
T_7 - Quizalofop ethyl @50 g ha^{-1}	10 DAS	70.32	81.66	96.22	98.33	94.00
T_8 - Quizalofop ethyl @ 62.5 g ha^{-1}	10 DAS	81.66	95.33	116.66	119.66	114.33
T_9 - lmazethapyr @ 60g ha^{-1} + 1H+1HW	10 & 35 DAS	79.66	38.66	52.33	53.66	51.00
T_{10} - Imazethapyr @ 75g ha^{-1} + 1H+1HW	10 &35 DAS	57.33	24.33	31.66	33.00	30.33
T_{11} - lmazethapyr @ 90g ha^{-1} + 1H+1HW	10 &35 DAS	73.66	28.66	38.00	38.66	35.33
T_{12} - Quizalofop ethyl @ 37.5 g ha^{-1} + 1H+1HW	10 & 35 DAS	88.67	40.33	54.33	55.66	53.00
Ti_3 - Quizalofop ethyl @ 50 g ha^{-1} + 1H +1HW	10 & 35 DAS	57.66	28.33	37.00	37.66	34.66
T_{14} - Quizalofop ethyl @ 62.5 g ha^{-1} + 1H + 1HW	10 & 35 DAS	79.66	32.66	43.33	44.33	40.66
SE (m) ±		**10.48**	**6.57**	**7.20**	**7.89**	**7.89**
CD at 5%		**32.02**	**20.09**	**22.01**	**24.10**	**24.10**
GM		**80.23**	**68.81**	**82.25**	**84.66**	**81.00**

Table 3: Weed control efficiency (%) and weed index (%) as influenced by different treatments

Treatment details	Time of application	Weed Index (%)	Weed control efficiency (%)				
			30 DAS	45 DAS	60 DAS	75 DAS	AH
T_1 - Un weeded control		41.58	-	-	-	-	-
T_2 - (2H + 2HW)	20 & 35 DAS	-	93.40	93.37	90.08	89.64	88.98
T_3 - Imezethapyr @ 60 g ha^{-1}	10 DAS	21.84	62.13	58.17	50.00	50.81	51.88
T_4 - Imezethapyr @ 75 g ha^{-1}	10 DAS	14.07	72.75	70.69	67.56	68.25	68.89
T_5 - Imezethapyr @ 90 g ha^{-3}	10 DAS	19.41	66.1	62.15	55.80	56.53	57.46
T_6 - Quizalofop ethyl @ 37.5 g ha^{-1}	10 DAS	23.62	57.49	53.46	43.76	44.27	45.46
T_7 - Quizalofop ethyl @50 g ha^{-1}	10 DAS	15.85	67.47	63.91	59.11	59.80	60.66
T_8 - Quizalofop ethyl @ 62.5 g ha^{-1}	10 DAS	20.87	62.91	57.88	50.42	51.09	52.16
T_9 - Imazethapyr @ 60g ha^{-1} + 1H+1HW	10 & 35 DAS	10.19	63.12	82.91	77.76	78.06	79.49
T_{10} - Imazethapyr @ 75g ha^{-1} + 1H+1HW	10 &35 DAS	1.45	73.61	89.25	86.54	86.51	87.30
T_{11} - Imazethapyr @ 90g ha^{-1} + 1H+1HW	10 & 35 DAS	4.36	65.15	87.33	83.85	84.19	85.21
T_{12} - Quizalofop ethyl @ 37.5 g ha^{-1} + 1H+1HW	10 & 35 DAS	13.91	58.25	82.18	76.91	77.25	78.66
Ti_3 - Quizalofop ethyl @ 50 g ha^{-1} + 1H +1HW	10 & 35 DAS	2.42	72.98	87.48	84.27	84.60	85.49
T_{14} - Quizalofop ethyl @ 62.5 g ha^{-1} + 1H + 1HW	10 &35 DAS	6.63	63.06	85.56	81.58	81.88	82.98

Table 4: Seed yield & straw yield as influenced by different treatments

Treatment details	Time of application	Seed yield kg ha^{-1}	Straw yield kg ha^{-1}
T_1 - Un weeded control		1213	2790
T_2 - (2H + 2HW)	20 and 35 DAS	2346	3800
T_3 - Imezethapyr @ 60 g ha^{-1}	10 DAS	1755	3213
T_4 - Imezethapyr @ 75 g ha^{-1}	10 DAS	1978	3779
T_5 - Imezethapyr @ 90 g ha^{-3}	10 DAS	1826	3347
T_6 - Quizalofop ethyl @ 37.5 g ha^{-1}	10 DAS	1714	2966
T_7 - Quizalofop ethyl @50 g ha^{-1}	10 DAS	1920	3499
T_8 - Quizalofop ethyl @ 62.5 g ha^{-1}	10 DAS	1779	3082
T_9 - Imazethapyr @ 60g ha^{-1} + 1H+1HW	10 and 35 DAS	2056	3333
T_{10} - Imazethapyr @ 75g ha^{-1} + 1H+1HW	10 and 35 DAS	2308	3764
T_{11} - Imazethapyr @ 90g ha^{-1} + 1H+1HW	10 and 35 DAS	2216	3618
T_{12} - Quizalofop ethyl @ 37.5 g ha^{-1} + 1H+1HW	10 and 35 DAS	1955	3150
Ti_3 - Quizalofop ethyl @ 50 g ha^{-1} + 1H +1HW	10 and 35 DAS	2282	3672
T_{14} - Quizalofop ethyl @ 62.5 g ha^{-1} + 1H + 1HW	10 and 35 DAS	2153	3500
SE (m) ±		**118.24**	**92.18**
CD at 5%		**361.2**	**281.6**
GM		**1964.51**	**3393.79**

Among the weed management practices lowest weed index was observed with T_{10}-imezethapyr @ 75 g ha^{-1} + 1H + 1HW at 30 DAS followed by T_{13} - quizalofop ethyl @ 50 g ha^{-1} +1H+1HW at 30 DAS, -T_{11} - imezethapyr @ 90 g ha^{-1} +1H & 1HW at 35 DAS and T_{14} quizalofop ethyl @ 62.5 g ha^{-1} +1H & 1HW at 35 DAS. Lower weed index in herbicidal treatments could be due to better weed control which provided favourable conditions for crop growth which ultimately increased the grain yield of soybean crop as compared to unweeded control treatment. Similar results were obtained by Chandel *et al* (2001). Treatment of two hoeing and two weeding (T_2) recorded highest weed control efficiency and lowest weed index percent followed by T_{10} - Imezethapyr @ 75 g ha^{-1} + 1H+1HW at 30 DAS.

Data pertaining to seed and straw yield of soybean as influenced by different weed control treatments was presented in Table 4. Highest seed yield ha^{-1} was recorded with treatment comprising of two hoeings and two hand weedings and significantly lowest seed yield was recorded with unweeded control. Seed yield ha^{-1} recorded with treatments T_{10} - imezethapyr @ 75 g ha^{-1}+ 1H & 1HW at 35 DAS, T_{13} - quizalofop ethyl @ 50 g ha^{-1} + 1H & 1HW at 35 DAS, T_{11} - imezethapyr @ 90 g ha^{-1} + 1H & 1HW at 35 DAS and T_{14} - quizalofop ethyl @ 62.5 g ha^{-1} + 1H & 1HW at 35 DAS were at par with T_2 treatment comprising of two hoeings and two hand weedings at 20 DAS and 35 DAS. These results

are also in agreement with the findings of Kushwah and Vyas (2001), Sharma (2001), Bhandiwaddar *et al.* (2001), Bhattacharya *et al.* (2004) and Singh (2002). Highest straw yield was recorded with treatment T_2 treatment comprising of two hoeings and two hand weedings at 20 DAS and 35 DAS and straw yield ha^{-1} recorded with treatments T_{10} - imezethapyr @ 75 g ha^{-1} + 1H & 1HW at 35 DAS, T_{13} - quizalofop ethyl @ 50 g ha^{-1} +1H & 1HW at 35 DAS, T_{11} - imezethapyr @ 90 g ha^{-1} + 1H & 1HW at 35 DAS and T_{14} - quizalofop ethyl @ 62.5 g ha^{-1} + 1H & 1HW at 35 DAS were at par with T_2. However, significantly lowest straw yield ha^{-1} was recorded in treatment unweeded control.

CONCLUSION

Study of effect of different weed control on yield revealed that treatments T_{10}, T_{11}, T_{13}, and T_{14}) were found promising in weed control which also showed superior effect on yield over unweeded control and found comparable to two hoeing and two hand weeding at 20 and 35 DAS. It shows that both Imezethapyr and Quizalofop ethyl are effective in weed control with the optimum doses of concentration i.e. 75g ha^{-1} and 50g ha^{-1} along with hoeing and weeding as they showed significant effect on yield.

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