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Influence of Chemical Weed Management on Yield Attributes, Yield and Economics of Soybean (*Glycine max* (L.) Merill.)

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ABSTRACT: *A field experiment conducted at Dept. of Agronomy, Vasantrao Naik Krishi Vidyapeeth, Parbhani during Kharif Season 2011-12. The experiment was laid out in Randomized Block Design (R.B.D.) with three replications and eight treatments. Use of Pendimethalin-PE @ 750 g a.i. ha^{-1} and Imazethapyr POE @ 75 g a.i. was also found beneficial in comparison with the treatment weed free check i.e. 2 HW + 2 Hoeing at 3rd and 5th WAS; thus chemical weed control with their chemicals is good option where labour availability is severe problem.*

Key words: *Economics Soybean, Weed management, Yield attributes.*

INTRODUCTION

Soybean has been accredited as a principal food crop since long time. That produces 2-3 times more high quality protein yield per hectare than other pulses and cholesterol free oil. It is preferred especially by vegetarians on account of its richness in protein, fat, carbohydrates, mineral salts and vitamins. The protein of the meat, fish, eggs and pulses are acid producing while that of soybean are alkalizing in their effects which makes it a desirable constituent of human diet (Kale, 1985). Soybean protein is rich in lycine about 5 per cent which is deficient in most of the cereals. Soybean is generally processed for its oil, protein and lecithin as a whole bean or partially/fully defatted cakemeal. Enriching cereal flour with soybean improves its nutritive quality and soya flour can also be used in making baked products (chapattis, bread, biscuits, bun, runk and caked), thus it is a multipurpose crop used for making soya-milk, soya-paneer, Soya-yogurt, soya-icecream etc. Soya flour, soya fortified food staffs and biscuits have good acceptability among the people because of economical and nutritional advantages. Moreover, it is widely used in oil production in India. Out of the total soybean produced, about 85 per cent is utilized for oil extraction, 10 per cent for seed and 5 per cent for food purposes.

In the world, the total area under soybean is 77.85 million ha with production of 154.32 million tonnes, (Annon., 2006). India is the fifth largest producer of soybean in the world after USA, Brazil, China and Argentina. In India, the total area under soybean cultivation is 7.67 million ha with the production and productivity of 7.38 million tonnes and 1039 kg ha^{-1}, respectively (Anon., 2006). In India, Madhya Pradesh, Maharashtra, Rajasthan, Gujarat and Uttar Pradesh are the leading producers of soybean. In Maharashtra, the total area under cultivation is 22.46 lakh ha with production of 21.26 lakh tonnes and average productivity of 778 kg. (Anonymous, 2006).

Among the various factors responsible for the low yield of soybean, weeds have been considered to be of prime importance. The losses caused by weeds exceed the losses from any other category of biotic factors like insects, nematodes, diseases, rodents etc. In *kharif* soybean, the weed competition is one of the most important causes of yield loss and estimated to be 30–80 per cent (Yaduraju, 2002). A large number of weed species infest the crop during *Kharif* season, which results in declined production. Thus, intense weed competition is one of the main constraints for increasing soybean productivity. Reduction in the yield due to weeds varies from 35 to 50 per cent, depending upon the type of weeds, their intensity and time of crop weed competition (Chandel *et al*., 1995). Presence of weeds in the crop lowers the yield by competing with them for space, moisture, light and nutrients. Therefore, the weed management is the

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most important agronomic aspect that plays an important role in exploiting the yield potential of soybean, provided other inputs are not limiting.

In monsoon season weed infestation is one of the major factors which limits productivity level of soybean crop. Manual weeding is one of the oldest and most efficient methods of weed control. But unavailability of adequate labourers, their increased wages and declining efficiency under uncongenial conditions (like continuous spell of monsoon) make the tasks more difficult under these circumstances, the information of integration of effective and workable weed management practices which can be used ecologically and economically by the farmers is necessary.

MATERIALS AND METHODS

The field experiment was conducted during *Kharif* season of the year 2011 at the Agronomy Farm, College of Agriculture, Parbhani. Agronomy farm, College of Agriculture, Parbhani, Dist. Parbhani is situated in subtropical region at $19^0 16'$ North latitude and $76^0 47'$ East longitude having elevation of 408.5 meters above the mean sea level. The climate is subtropical and dry which is favourable for a crop like soybean during *Kharif* season. The average annual precipitation of Parbhani is 942 mm distributed from the beginning of June to September end. The present experiment was laid out in Randomized Block Design (RBD) with eight treatments replicated three times. Allocation of treatment at each plot in each replication was done by randomization. The details of different treatments with their symbol used are given below. W_1 - Chlorimuron POE @ 12 g a.i. ha^{-1} at 10-12 DAS, W_2 -Imazethapyr POE @ 75 g a.i. ha^{-1} at 10-12 DAS, W_3 - Pendimethalin PE @ 750 g a.i. ha^{-1}, W_4 -Quizalofop-ethyl POE @ 40 g a.i. ha^{-1} at 10-12 DAS, W_5 - Fenoxaprop-p-ethyl POE @ 75 g a.i. ha^{-1} at 20 DAS, W_6 -Tank mix Quizalofop ethyl POE @ 20 g a.i. ha^{-1} + Chlorimuron @ 6 g a.i. ha^{-1} at 10-12 DAS, W_7 -Weed free check (2 HW + 2 hoeing at 3^{rd} and 5^{th} WAS), W_8 - Weedy check. The soybean crop was fertilized with 30 : 60 : 30 NPK kg ha^{-1} by using fertilizers Urea, single super phosphate and muriate of potash. Fertilizers were mixed thoroughly in required and placed in the soil at 3-5 cm deep and away from seed before dibbling. The important weed species associated with soybean crop in the experimental area were grouped according to nature of cotyledons as monocots, dicot and sedges weeds at 20, 40 DAS and at harvest. Weed counts were taken at 20, 40 DAS and at harvest using quadrant 1.0 m^2. The number of monocot, dicot and sedge weeds falling within the quadrate were counted separately and recorded.

Cost of cultivation of the crop of individual treatment was worked out taking into consideration the cost of all the cultural operations starting from preparatory tillage to harvesting of the crop including the cost of all the inputs. The gross realization in term of Rs ha^{-1} was worked out for each treatment taking the present market value of soybean seed and straw. The net profit was worked out by deducting the total expenditure from gross realization from each of the treatments and recorded accordingly. The cost : benefit ratio (CBR) was worked out from the grain and straw yields of soybean obtained under different weed control treatments, considering the market prices.

RESULTS

Data presented in Table 1 showed the significant effect of weed management treatments on number of pods per plant recorded at harvest. Data presented in Table 1 revealed that the treatment (W_7) weed free check recorded highest number of pods per plant which was at par with (W_3) pendimethalin PE @ 750 g a.i. ha^{-1}, (W_2) Imazethapyr POE @ 75 g a.i. ha^{-1} at 10-12 DAS and (W_6) tank mix Quizalofop ethyl (POE) 20 g + Chlorimuron 6 g a.i. ha^{-1} at 10-12 DAS and significantly superior over rest of the treatments.

Data on seed weight per plant (g $plant^{-1}$) as affected by different weed control treatments revealed that treatments differed significantly in respect of seed yield per plant. The treatment (W_7) weed free check recorded more seed yield per plant (8.98 g $plant^{-1}$) over all other treatments and it was at par with (W_3) pendimethalin PE @ 750 g a.i. ha^{-1}, (W_2) Imazethapyr POE @ 75 g a.i. ha^{-1} at 10-12 DAS and (W_6) tank mix Quizalofop ethyl (POE) 20 g + Chlorimuron 6 g a.i. ha^{-1} at 10-12 DAS. Significantly lowest seed yield per plant recorded by treatment T_8 (weedy check).

The relevant data recorded on 100 seed weight of various weed control treatments revealed that the effect of different weed control treatments on 100 seed weight was non-significant. However, 100 seed weight was observed higher in treatment (W_7) weed free check (2 HW + 2 hoeing at 3^{rd} and 5^{th} WAS) and lowest in treatment control (W_8).

Data presented in (Table 1) indicated that the treatment (W_7) weed free check (2HW + 2 Hoeing at 3^{rd} and 5^{th} WAS) produced maximum straw yield ha^{-1} which was at par with (W_3) pendimethalin PE@ 750 gm a.i. ha^{-1}, (W_2) Imazethapyr PoE @ 75 gm a.i. ha^{-1} at 10-12 DAS and (W_6) tank mix quizalofop ethyl (PoE) 20 gm a.i. ha^{-1} + chlorimuron 6 gm a.i. ha^{-1} at 10-12

DAS and significantly superior over rest of the treatments. (W_8) weedy check recorded lowest straw yield ha^{-1}. These result are in conformity with the results of the Chhokar *et al.*,(1997), Jain *et al.*,(1985), Reddy *et al.,* (2003), Rammoorthy *et al.,* (1995), Balyan *et al.,* (2003).

Table 1
Yield attributes and yield of soybean influenced by different treatment

Treatment	Mean numberof pods/plant	Seed weight per plant (g)	100 seed weight (g)	Straw yield (kg/ha)	Seed yield (kg/ha)
W_1	32.12	7.10	14.70	2037	2141
W_2	34.25	8.66	15.70	2240	2538
W_3	34.66	8.83	15.44	2254	2558
W_4	32.98	7.02	14.65	1970	2148
W_5	30.97	7.12	14.05	1865	2090
W_6	33.13	8.06	15.14	2247	2528
W_7	36.62	8.98	16.40	2416	2642
W_8	23.62	5.10	10.28	1382	1585
SE ±	1.17	0.60	0.69	28	40
CD at 5 %	3.55	1.84	NS	86	123
G. Mean	32.29	7.60	14.54	2051	2278

Table 2
Economics of weed control treatments in soybean

Treatment	Yield (Kg ha^{-1})	Gross income (Rs ha^{-1})	Relative income (Rs ha^{-1})	Additional returns over weedy check (Rs ha^{-1})	Treatment cost (Rs ha^{-1})	B:C ratio
W_1	2141	48120	39593	11545	8527	1.35
W_2	2538	56956	47956	19908	9000	2.21
W_3	2558	57403	48280	20232	9123	2.21
W_4	2148	48241	39248	11200	8993	1.24
W_5	2090	46912	36974	8926	9938	0.89
W_6	2498	56079	47319	19271	8760	2.19
W_7	2642	59332	48919	20871	10413	2.00
W_8	1585	35561	28048	–	7513	–
SE ±	49	–	577	322	–	–
CD at 5 %	149	–	1728	977	–	–

Treatment (W_7) weed free check recorded highest seed yield over all other treatments. However, it was at par with pendimethalin PE @ 750 g a.i. ha^{-1}, Imazethapyr POE @ 75 g a.i. ha^{-1} at 10-12 DAS and Tank mix Quizalofop ethyl (POE) 20 g + Chlorimuron 6 g a.i. ha^{-1} at 10-12 DAS and significantly superior over rest of the treatments. Significantly lowest seed yield was recorded in weedy check as compared to all other treatments.

Higher relative income was recorded in (Table 2) (W_7) weed free check (2HW+2 Hoeing at 3rd and 5th WAS) i.e. Rs. 48919 per ha which was at par with (W_3) pendimethalin PE@ 750 gm a.i. ha^{-1} (Rs.48280 ha^{-1}), Imazethapyr PoE @ 75 gm a.i. ha^{-1} at 10-12 DAS (Rs. 47956 ha^{-1}), (W_6) tank mix quizalofop ethyl (PoE) 20 gm a.i. ha^{-1} + chlorimuron 6 gm a.i. ha^{-1} at 10-12 DAS (Rs. 47319 ha^{-1}). The higher relative income was due to higher yield and weed control efficiency recorded in these treatments, These results are in conformity of those Singh and Sharma (1990), Chhokar *et al.,* (1995) and Reddy *et al.,* (2003).

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