Crop-Weed Competition on Growth and Yield of Soybean (*Glycine max* L.)

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Abstract

The present investigation was conducted to determine the effect of weed competition on growth and yield of soybean. Field experiment was conducted during *kharif* season, 2005 at the experimental farm of Nagaland University, School of Agricultural Sciences and Rural development, Medziphema. Nagaland. Dominant weed species observed in the experimental field were *Amaranthus viridis*, *Ageratum conyzoides*, *Cassia tora*, *Chromalaena odorata*, *Mimosa pudica* (among broad leaved), *Cynodon dactylon*, *Digitaria sanguinalis*, *Eleusine indica*, *Imperata cylindrica* (among grasses) and *Cyperus rotundus*, *Cyperus iria* (among sedges). Soybean yield was adversely affected by the weeds due to their competition for nutrients and moisture during early growth stages. The critical period of weed competition was between 14-54 days after sowing. Weed free and weedy period exhibited significant effects on No. of pods per plant, test weight, seed yield and stover yield.

1. Introduction

Soybean (*Glycine max* (L.) Merrill) with its 40-42% protein and 20-22% oil has already emerged as one of the major oilseed crop in India. Among the legumes, soybean (*Glycine max* L. Merrill) occupies an important position belonging to the family leguminosae and is grown commercially in almost all parts of India. It is an excellent source of protein and vegetable oil and helps supply a balanced, nutritive diet to India's predominantly vegetarian population. Weeds compete with soybean for solar radiation, nutrients and soil moisture when they are limited and the early season competition is the most critical. Weeds in soybean have been found to deplete soil fertility by taking 53.24 kg N ha^{-1} and 9.30 kg P ha^{-1} under unweeded conditions (Chhokar et al.,1997). Yield loss due to weeds ranges from 20% to 85% depending on the crop cultivar, nature and intensity of weeds, spacing, duration of weed infestation and environmental condition (Tiwari and Kurchania, 1990; Singh and Singh, 1992; Tiwari et al., 1960). It is also a potential oilseed crop in Nagaland, grows well in slopes and terraces and is grown as a pure crop as well as intercrop with maize. Conversely the full potential of this crop cannot be realized because of many factors, out of which weed competition is one of the main reason affecting the yield of soybean. The yield reduction is due to high rainfall, humidity and considerable proportion of labour has to be invested in weeding. Every farmer working with soil is faced with this harrowing menace of weed which in turn eats away a mammoth proportion of the output. The low productivity of soybean in Nagaland can be ascribed due to lack of improved agronomic practices. Among this, lack of knowledge about weeds is the most important one. In view of the above mentioned points, the present investigation was undertaken with the objective to study the effect of weed competition on growth and yield of soybean.

2. Materials and Methods

A Field experiment was conducted during *kharif* season of 2005 at the experimental farm of Nagaland University, School of Agricultural Sciences and Rural Development, Medziphema, Nagaland, situated at 310 m above msl. The soil of the experimental field was sandy loam in texture and well drained having 5.0 pH, 2.17% organic carbon, low in available 125.4 kg ha^{-1} nitrogen and 7 kg ha^{-1} P_2O_5, and medium (132 kg ha^{-1}) K_2O status. The experiment was laid out in a randomized block design with ten treatments and three replications. The treatments consisted of weedy condition for the initial 15, 30, 45, 60 days after sowing (DAS) and up to harvest and weed free maintenance for the first 15, 30, 45, 60 DAS and up to harvest. Soybean variety JS-335 was inoculated with Rhizobium culture and sown during the first week of June at 40 x15 cm^{-2} spacing. Repeated hand weeding was done in weed free plots to keep the plots

weed free for the whole season. Other recommended cultural practices were followed as per requirement of the crop. Data were recorded for plant height, fresh weight plant^{-1}, dry weight plant^{-1}, number of nodules plant^{-1}, number of pods plant^{-1} , pod weight plant^{-1}, test weight, seed and straw yield, weed density and weed dry matter. The secondary data were generated for weed control efficiency.

3. Result adn Discussion

3.1. Effect on weeds

The major weed flora observed in the experimental field were *Amaranthus viridis, Ageratum conyzoides, Cassia tora, Chromalaena odorata, Mimosa pudica* (among broad leaved), *Cynodon dactylon, Digitaria sanguinalis, Eleusine indica, Imperata cylindrica* (among grasses) and *Cyperus rotundus, Cyperus iria* (among sedges)

The data on dry weight of weeds revealed that weed free check had significantly lowest dry weight of weeds (0)0.7 g m^{-2}. At harvest, weed free up to 60 days after sowing (DAS) resulted in reduction of weed dry weight (21.6) 4.48 g m^{-2}. Weed emergence was significantly reduced in these plots where weed free period was up to 60 days and onwards were maintained (0)0.7.

Among all the weed control treatments, weed free treatment recorded the maximum weed control efficiency (100%) resulting in the highest seed yield

3.1.1. Effect on the growth and yield of crop

Soybean height was not significantly affected due to different treatments (Table 2). Weed free check resulted in the highest number of pods plant^{-1}, number of seeds pod^{-1} and weedy check recorded the greatest height of soybean plant. Higher

Table 1: Effect of weedy and weed free periods on weed density, dry weight of weeds and weed control efficiency

Treatments	WD m^{-2} (at harvest)		WDW (g m^{-2})	WCE (%)
	BL	GS		
Weed free upto 15 DAS	(8.33) 2.94	(9.66) 2.93	(25.33) 5.04	44.55
Weed free upto 30 DAS	(15.33) 3.83	(13) 3.63	(39) 6.26	42.95
Weed free upto 45 DAS	(11) 3.38	(7) 2.44	(36) 5.75	54.10
Weed free upto 60 DAS	(16.66) 4.02	(5.66) 2.16	(21.6) 4.48	79.34
Weed free upto harvest	(0) 0.7	(0) 0.7	(0) 0.7	100.0
Weedy upto 15 DAS	(0) 0.7	(0) 0.7	(0) 0.7	98.58
Weedy upto 30 DAS	(0) 0.7	(0) 0.7	(0) 0.7	82.47
Weedy upto 45 DAS	(0) 0.7	(0) 0.7	(0) 0.7	69.79
Weedy upto 60 DAS	(0) 0.7	(0) 0.7	(0) 0.7	46.21
Weedy upto harvest	(6) 2.53	(2.33) 1.37	(43.66) 5.47	0
SEM±	(6.14) 0.33	(2.51) 0.53	(6.14) 0.62	
CD (p=0.05)	0.96	1.23	1.84	

WD: Weed density; WDW: Weed dry weight; WCE: Weed control efficiency; BL: Broad leaf; GS: Grasses and sedges; figures in parentheses are original values

Table 2: Effect of weedy and weed free periods on yield attributes and yield of soybean

Treatment (Days)	Plant height (cm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed Yield (q ha^{-1})	Stover yield (q ha^{-1})
Weed free upto 15 DAS	78.4	43.6	0.6	100	0.01	5.16
Weed free upto 30 DAS	83.73	114.3	1.16	133.3	2.54	6.91
Weed free upto 45 DAS	71.13	67.06	2.20	136.6	3.14	6.72
Weed free upto 60 DAS	72.06	139.6	2.90	136.6	8.38	14.21
Weed free upto harvest	65.46	132.3	3.16	143.3	10.17	16.76
Weedy upto 15 DAS	70.26	120.4	2.59	140	5.72	12.39
Weedy upto 30 DAS	65.8	97.06	2.69	130	5.40	11.94
Weedy upto 45 DAS	64.53	118.46	2.28	126.6	5.29	10.16
Weedy upto 60 DAS	67.53	129.9	1.83	126.6	5.22	9.69
Weedy upto harvest	84	39.53	0.6	100	0.01	4.53
SEM±	12.82	16.44	1.50	5.36	1.35	2.52
CD (p=0.05)	NS	48.86	NS	15.92	4.01	7.50

plant height but lower number of pods plant^{-1}, number of seeds pod^{-1} in weedy check were mainly due to stiff competition from weeds for space as was evidenced by lanky tall plants with few branches. The data on seed yield and yield parameters, weed dry weight, weed control efficiency, test weight gave maximum seed yield (10.17 q ha^{-1}). Maximum values regarding all the above attributes were recorded in plots kept weed free up to harvest except number of pods per plant which was found to be at weed free up to 60 DAS (139.6) but was found to be at par with weed free up to harvest (132.3) which may be due to least crop weed competition for nutrients, moisture, space and sunlight. The minimum values however were recorded in the weedy up to harvest (39.53). This was because of emergence of large number of weeds.

The seed yield of soybean exhibited significant difference due to different methods of weed control. Significantly maximum yield was obtained from weed free up to harvest (10.17 q ha^{-1}) and minimum grain yield was noticed in the plots kept weedy up to harvest (0.01 q ha^{-1}) and weed free up to 15 days after sowing (0.01 q ha^{-1}).

4. Conclusion

Significantly highest seed yield (10.17 q ha^{-1}) was found to be at par with weed free up to 60 days after sowing (8.38 q ha^{-1}). There was progressive increase in seed yield when the weed free conditions were prolonged up to 60 days after sowing. The data further revealed that maintaining weed free conditions beyond 60 days after sowing failed to give significant increase in grain yield.

From this study, it can be concluded that the critical period of weed competition was between 14 to 54 days after sowing during which the crop should be kept free of weeds to prevent the potential loss in soybean grain yield.

5. References

Chhokar, R.S., Balyan, R.S., Pahuja, S.S., 1997. Nutrient Removal by weeds in soybean (*Glycine max*) under integrated weed management. Indian Journal of Agronomy 42, 138-141.

Mishra, O.P., Tiwari, S., Ram, K., 1990. Study on the effects of butachlor and thiobencarb on soybean and associated weeds under two dates of planting. In: Proceeding of Indian Society of Weed Science Annual Meeting, Jabalpur, India, 80.

Singh, G., Singh, D., 1992. Weed control efficacy of oxyfluorfen, acifluorfen, metribuzen and linuron in soybean(*Glycine max*. L.). Indian Journal of weed science 24, 97-99.

Tiwari, J.P., Kurchania, S.P., 1990. Survey and management of weeds in soybean ecosystem in Madhya Pradesh. Indian Journal of Agricultural Sciences 60, 672- 676.

Tiwari, J.P., Kurchania, S.P., Paradka, N.R., Bhalla, C.S., 1996. Bioefficacy of chlorimuron ethyl for weed control in soybean (*Glycine max*). Indian journal of Agricultural Sciences 66, 583-588.