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Effect of weed management practices on rhizobium nodules, their dry weight and bio-chemical parameter of soybean

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Abstract

A field experiment was conducted during Kharif season of 2014 at Instructional Farm of Rajasthan College of Agriculture, Udaipur to study the effect of weed management practices on number of nodule, their dry weight and biochemical parameters of soybean. Under various treatment of weed management experiment pre-emergence application of pendimethalin along with hand weeding 30 DAS recorded maximum number of rhizobium nodule, their dry weight and other biochemical parameters of soybean under sub-humid southern plain and Aravalli hills zone of Rajasthan.

Keywords: Soybean, pendimethalin, metribuzin, imazethapyr, fenoxaprop, pre-emergence and post-emergence

Introduction

Soybean (*Glycine max* L. Merrill) is an important oilseed crop that is widely grown as a valuable source of protein and oil for human nutrition in the world. It has outstanding nutritive value with 43% biological protein, 20% oil and is also very rich in vitamins, iron, mineral, salts and amino acids. Weed infestation is considered a persistent and complex constraint in soybean, as it influences soybean growth and development through competition for nutrients, water, light and space as well as through production of allelopathic compounds (Vollmann *et al.* 2010). Thus, weed control is considered a key factor for successful soybean production. Weed management through manual weeding or hoeing although effective in reducing weed competition but it is not free from several limitations such as non-availability of sufficient manpower during peak periods, high labour cost, time consuming and not feasible under heavy soils and high rainfall areas. Hence, the present investigation was undertaken to evaluate the effect of weed management treatments on the biochemical parameters of soybean.

Key words - Pendimethalin, Metribuzin, Fenoxaprop-p-ethyl, Imazethapyr, Hand weeding

Methodology

A field experiment was carried out at Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* 2014. The soil of the experiment plot was clay loam, alkaline in reaction (pH 8.1), medium in nitrogen (285 kg ha⁻¹) and phosphorus (20.42 kg ha⁻¹) and high in potassium (230.90 kg ha⁻¹). The experiment was laid out in randomized block design comprising of 14 treatments *viz* T₁ - weedy check, T₂ - pendimethalin 0.750 kg ha⁻¹ PE, T₃ - metribuzin 0.350 kg ha⁻¹ PE, T₄ - fenoxaprop-p-ethyl 0.075 kg ha⁻¹ 20 DAS, T₅ - imazethapyr 0.100 kg ha⁻¹ 20 DAS, T₆ - pendimethalin 0.750 kg ha⁻¹ PE + one hand weeding 30 DAS, T₇ - metribuzin 0.350 kg ha⁻¹ PE + one hand weeding 30 DAS, T₈ - pendimethalin 0.750 kg ha⁻¹ PE followed by fenoxaprop-p-ethyl 0.075 kg ha⁻¹ 20 DAS, T₉ - pendimethalin 0.750 kg ha⁻¹ PE followed by imazethapyr 0.100 kg ha⁻¹ 20 DAS, T₁₀ - metribuzin 0.350 kg ha⁻¹ PE followed by fenoxaprop-p-ethyl 0.075 kg ha⁻¹ 20 DAS, T₁₁ - metribuzin 0.350 kg ha⁻¹ PE followed by imazethapyr 0.100 kg ha⁻¹ 20 DAS, T₁₂ - one hand weeding 20 DAS, T₁₃ - two hand weeding 15 and 30 DAS and T₁₄ - weed free up to 50 days and replicated thrice. Soybean variety JS-9560 was sown on 16 July 2014 by drilling the seed 80 kg ha⁻¹ at 30 cm row spacing. Oil, protein and percentage in seeds and chlorophyll content in plant leaves was estimated following by standard procedure. Dominant weed flora of the experiment field was *Amaranthus viridis*, *Commelina benghalensis*, *Parthenium hysterophorus*, *Trianthema portulacastrum*, *Digera arvensis*, *Cynodon dactylon*, *Echinochloa colona* and *Cyperus rotundus*.

Results and Discussion

All the weed control treatments were found significant in affecting the number of rhizobium nodules and their dry weight at 30 and 60 DAS. The maximum number of nodule and their dry

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weight was recorded under weed free treatments which was closely followed by pre-emergence application of pendimethalin 0.750 kg ha⁻¹ + hand weeding 30 DAS and two hand weeding treatment. More nodules count in above treatments might be due to greater infestation of *Rhizobium* in the growing roots. Low number of nodule and dry weight of nodule in unweeded check might be due to more crop weed competition. These results were in agreement with the finding of Nirala *et al.* (2016)^[3]. All the weed control treatments were found significant in affecting the total chlorophyll content at 50 and 75 DAS. At 50 DAS, The maximum chlorophyll (2.91 mg g⁻¹) was recorded under weed free treatments which was closely followed by pre-emergence application of pendimethalin 0.750 kg ha⁻¹ + hand weeding 30 DAS (2.80 mg g⁻¹). At 75 DAS, Amongst all weed management treatments weed free treatments recorded maximum total chlorophyll content in leaves 75 DAS (2.29 mg g⁻¹) which was significantly at par with pre emergence application of pendimethalin along with hand weeding combination as well as two hand weeding treatment. The increase in chlorophyll content of the crop under weed control treatments can be clearly attributed to the reduction in interference of the weeds as evident from the higher weed control efficiency which ultimately favoured better growth environment for the crop. Thus, under lesser crop weed competition, adequate

availability of lights, temperature and space along with moisture and nutrients, improved physiological and morphological characters of plant as well as photosynthesis with greater rate ultimately leads to more chlorophyll content in plants (Duncan, 1971)^[2] and these results are in close conformity with close reported by Dhaker *et al.* (2010)^[1]. All the weed control treatments failed to record significant influence on protein and oil content in seed. However, maximum protein content was recorded under weed free check (40.63 per cent) which was followed by pre-emergence application of pendimethalin along with hand weeding 30 DAS (40.44%) and two hand weeding 15 and 30 DAS (40.31%). The effective weed control owing to these treatments lead to higher nutrient uptake, consequently higher protein and oil content compared to unweeded control. These results are in close conformity with close reported by Zid (2006)^[6] and Sharma *et al.* (2015)^[4].

Conclusion

It can be concluded that maximum number of nodule, nodule dry weight, total chlorophyll content, oil and protein content in soybean could be realized with the pre-emergence application of pendimethalin along with hand weeding 30 DAS under sub-humid southern plain and Aravalli hills zone of Rajasthan.

Table 1: Effect of weed management practices on number of nodules and their dry weight

Treatments	No. of nodule and their dry weight			
	30 DAS	60 DAS	Dry weight at 30 DAS (gm plant ⁻¹)	Dry weight at 60 DAS (gm plant ⁻¹)
Weedy check	13.40	25.50	26.1	42.1
Pendimethalin 750 g ha ⁻¹ PE	15.40	32.00	31.0	52.1
Metribuzin 350 g ha ⁻¹ PE	15.00	34.00	32.4	56.4
Fenoxaprop-p-ethyl 75 g ha ⁻¹ POE	15.40	37.00	33.6	57.9
Imazethapyr 100 g ha ⁻¹ POE	16.00	39.58	35.9	58.5
Pendimethalin + HW 30 DAS	19.55	53.50	49.0	79.6
Metribuzin 350 g ha ⁻¹ + HW 30 DAS	19.00	50.00	47.5	68.7
Pendimethalin 750 g ha ⁻¹ + Fenoxaprop-p-ethyl POE	17.68	47.50	45.0	70.8
Pendimethalin 750 g ha ⁻¹ + Imazethapyr at POE	18.50	49.53	43.5	72.7
Metribuzin 350 g ha ⁻¹ + Fenoxaprop-p-ethyl POE	18.00	45.00	43.0	67.9
Metribuzin 350 g ha ⁻¹ + Imazethapyr POE	18.10	47.25	43.2	69.8
One hand weeding at 20 DAS	16.50	41.00	40.0	60.7
Two hand weeding 15 and 30 DAS	19.00	52.00	48.0	74.7
Weed free	20.40	58.00	51.0	84.8
SEm±	0.60	1.77	1.58	1.83
CD (P=0.05)	1.75	5.15	4.58	5.33

Table 2: Effect of weed management treatments on biochemical parameters of soybean

Treatments	Weed control efficiency	Seed oil content (%)	Seed protein content (%)	Chlorophyll content (mg g ⁻¹ fresh weight)		Seed Yield	Net return	BC Ratio
				50 DAS	75 DAS			
Weedy check	-	19.54	37.84	2.20	1.70	521	2344	1.13
Pendimethalin 0.75 kg ha ⁻¹ PE	57.79	19.84	38.38	2.45	1.88	915	15113	1.80
Metribuzin 0.35 kg ha ⁻¹ PE	58.79	19.85	38.53	2.43	1.89	835	12518	1.68
Fenoxaprop-p-ethyl 0.075 kg ha ⁻¹ POE	59.82	19.95	38.59	2.50	1.94	1005	18078	1.94
Imazethapyr 0.1 kg ha ⁻¹ POE	61.65	19.95	38.74	2.55	1.95	1045	19265	1.98
Pendimethalin + HW 30 DAS	76.96	20.86	40.44	2.80	2.22	1376	29508	2.38
Metribuzin 350 g ha ⁻¹ + HW 30 DAS	71.09	20.45	40.14	2.76	2.15	1131	21019	2.00
Pendimethalin 750 g ha ⁻¹ + Fenoxaprop-p-ethyl POE	69.74	20.34	39.81	2.70	2.12	1184	23267	2.12
Pendimethalin 750 g ha ⁻¹ + Imazethapyr at POE	71.56	20.34	40.06	2.75	2.20	1232	24705	2.17
Metribuzin 350 g ha ⁻¹ + Fenoxaprop-p-ethyl POE	70.04	20.26	39.97	2.71	2.15	1130	21638	2.06
Metribuzin 350 g ha ⁻¹ + Imazethapyr POE	69.89	20.22	40.00	2.73	2.18	1185	23426	2.13
One hand weeding at 20 DAS	66.61	20.15	39.50	2.65	2.05	1116	21507	2.08
Two hand weeding 15 and 30 DAS	74.58	20.75	40.31	2.78	2.17	1321	27244	2.26
Weed free up to 50 days	92.18	20.88	40.63	2.91	2.29	1421	26749	2.04
SEm±		0.66	0.66	0.06	0.06	71	-	-
CD (P=0.05)		NS	NS	0.17	0.14	207	-	-

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