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Effect of mechanical intercultivation on growth and yield of soybean

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Abstract

A field experiment entitled “Standardization of mechanical intercultivation in soybean” was undertaken during *khariif*, 2018 at F block, Seed cell unit, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment consists of eight treatments laid out in randomized block design with three replications. The soil was loamy in texture, high in available nitrogen (330.12 kg ha⁻¹), medium in available phosphorous (16.83 kg ha⁻¹) and high in potassium (308.02 kg ha⁻¹). The growth parameters *viz.* plant height (59.04 cm), plant spread (35.19 cm), number of leaves plant⁻¹(43.56), number of branches plant⁻¹(6.03), number of active root nodules plant⁻¹(46.81), and were recorded highest on application Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The yield contributing characters recorded at harvest *viz.* number of pods plant⁻¹(49.78), pod weight plant⁻¹(22.40 g), number of seeds pod⁻¹(2.75), number of seed plant⁻¹(136.89), 100 seed weight (12.08 g) were obtained highest on application Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The highest seed yield (29.95 q ha⁻¹) and stover yield (38.63 q ha⁻¹) of soybean was obtained Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The soil moisture percentage at 60 DAS (16.22 %) was recorded highest on Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The highest gross returns (Rs. 114761ha⁻¹) and net monetary returns (Rs. 61557ha⁻¹) were recorded on Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The similar trend was observed in case of benefit: cost ratio. The highest benefit: cost ratio (2.16) recorded with Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS.

Keywords: Growth, yield, economics and soybean

Introduction

Soybean (*Glycine max* (L.) Merrill) popular as golden bean has become the miracle crop of 21st century, serve the dual purpose for being growth both as an oilseed crop and pulse crop as well (Thakare *et al.*, 2006) [8]. It is an excellent health food containing 40 to 44 per cent good quality protein, 20 per cent cholesterol free oil, 20 per cent carbohydrates and 0.69 per cent phosphorus. It also contains some phyto-chemicals, which protect human body against cancer, diabetes, blood pressure. It also fixes atmospheric nitrogen 45-60 kg ha⁻¹ through root nodules and ads about 0.5 to 1.5 tons organic matter ha⁻¹ leaf fall (Kanase *et al.*, 2006) [6].

In India, the area under soybean during *Khariif*, 2016 was 109 lakh ha with total production of 114 lakh metric tonnes with an average productivity of 1047 kg ha⁻¹. India rank fifth in area and production of Soybean in the world after USA, Brazil, China, Argentina (Anonymous, 2016) [2]. Major Soybean growing states in India are Madhya Pradesh, Maharashtra, Uttar Pradesh, Gujarat, etc. Soybean was introduced in Maharashtra state during 1984-85 and it was grown only on 5.6 lakh hectares till 1994 but now a days area under soybean is increasing largely. In Maharashtra, area under soybean cultivation during *Khariif*, 2016 was 54.01 lakh ha with total production of 39.45 lakh metric tonnes with an average productivity of 1102 kg ha⁻¹ (Anonymous., 2016) [2].

The practice of opening furrow in between rows of crop is beneficial for improving drainage system in field during heavy rains. Ridges may serve as micro- watershed accumulating water in furrow. Practice of making ridges by opening furrows may have an advantage in concentration of more rain water on bed which enriches soil moisture content (Gidda and Morey, 1981).

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The crop grown under rainfed condition are either subjected to excess water or water deficient conditions. Intermittent spells of drought of 10-15 days or even more are commonly observed affecting growth of crop.

Soybean [*Glycine max* (L.) Merrill.] has emerged as a potential crop and brought about perceptible change in the economy of the farmers in central India. Weeds are a major constraint and their control is essential for successful crop production. Mostly the farmers use pre-emergence and post-emergence herbicides for weed control in soybean but their efficacy is reduced by various climatic and edaphic factors. Hand weeding is traditional and effective method of weed control, but untimely unavailability of labour at peak time and increased labour wages are main limitations of manual weeding. The only alternative that needs to be explored the use of mechanical intercultivation practices.

Material methodology

A field experiment entitled "Standardization of mechanical intercultivation in soybean" was undertaken during *kharif*, 2018 at F block, Seed cell unit, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment consists of eight treatments involving of I₁-Farmers practice (Post-emergence application of imazethapyr 10 % SL @ 80 g a.i ha⁻¹ 20 DAS and weeding at 40 DAS), I₂-Tractor hoeing by blade hoe at 15 DAS and 30 DAS, I₃-Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS, I₄-Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + Tractor hoeing by blade hoe at 30 DAS, I₅-Post emergence application of imazethapyr 10 % SL @ 80 g a.i ha⁻¹ @ 20 DAS + opening of conservation furrow with tractor ridger at 30 DAS, I₆-Opening of conservation furrow with tractor cultivator at 30 DAS, I₇-Tractor hoeing by blade hoe at 15 DAS + opening of conservation furrow with tractor ridger at 30 DAS, T₈-Opening of conservation furrow with tractor ridger at 30 DAS. The experiment was laid out in randomized block design with three replications. The soil was loamy in texture, high in available nitrogen (330.12 kg ha⁻¹), medium in available phosphorous (16.83 kg ha⁻¹) and high in potassium (308.02 kg ha⁻¹).

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads

Effect on growth contributing characters

Data in table 1 reveals that the growth parameters *viz* plant height (59.04 cm) at harvest number of leaves (43.56) at 90 DAS, number of branches plant⁻¹ (6.03) at 90 DAS and at harvest plant spread (35.19 cm) at 60 DAS and nodulation count at flowering stage (46.81) were recorded on Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS. It is due to better availability of sunlight, soil moisture, nutrient and other environmental factors. The close conformity of result with the findings of an (Prachand *et al.* 2014) [7], (Habimana *et al.* 2013) [4], (Aksthar *et al.* 1990) reported that same result.

Effect on yield contributing characters

Data in table 2 reveals that the yield contributing characters recorded at harvest *viz.* number of pod plant⁻¹ (49.78), pod weight plant⁻¹ (22.40 g), number of seeds plant⁻¹ (136.89), 100 grain weight (12.08 g) were obtained highest on Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS optimum availability of soil moisture by moisture conservation practice. Also the loose and porous soil under intercultivation was found to provide better aeration, microbial activity and which gives increased yield contributing characters reported by (Prachand *et al.* 2014) [7], (Habimana *et al.* 2013) [4].

Effect on yield of soybean

The highest seed yield (29.95 q ha⁻¹) and stover yield (38.63 q ha⁻¹) of soybean was obtained Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. It enhanced availability of all resources like nutrients, moisture and light interception which favored more photosynthesis resulted in luxurious growth of soybean. This ultimately resulted in higher grain yield. These results are close conformity with the findings of, (Habimana *et al.* 2013) [4], (Prachand *et al.* 2014) [7] and (Kadu *et al.* 2018) [5].

Effect on characters Economics

The highest gross returns (Rs. 114761ha⁻¹) and net monetary returns (Rs. 61557ha⁻¹) were recorded on Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS. The similar trend was observed in case of benefit: cost ratio. The highest benefit: cost ratio (2.16) recorded with Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow by tractor ridger at 30 DAS.

Table 1: Effect on growth parameter by mechanical intercultivation in soybean

Treatment		Plant height	Plant spread	Number of leaves plant ⁻¹	Number of Branches plant ⁻¹	Nodulation count
I ₁ :	Farmers practice (PoE application of imazethapyr 10 % SL @ 80 g a.i ha ⁻¹ 20 DAS and weeding at 40 DAS)	56.24	31.50	40.60	5.38	43.07
I ₂ :	Tractor hoeing by blade hoe at 15 DAS and 30 DAS.	55.60	31.45	40.57	5.33	42.94
I ₃ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS.	59.04	35.19	43.56	6.03	46.81
I ₄ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + Tractor hoeing by blade hoe at 30 DAS.	55.95	31.49	40.59	5.37	43.05
I ₅ :	Post emergence application of imazethapyr 10 % SL @ 80 g a.i ha ⁻¹ @ 20 DAS+ opening of Conservation furrow with tractor ridger at 30 DAS.	58.66	34.57	42.63	5.90	45.67
I ₆ :	Opening of conservation furrow with tractor cultivator at 30 DAS	55.60	31.17	40.27	5.27	42.38
I ₇ :	Tractor hoeing by blade hoe at 15 DAS + opening of conservation furrow with tractor ridger at 30 DAS.	58.81	34.67	43.46	5.93	46.26

I ₈ :	Opening of conservation furrow with tractor ridger at 30 DAS	55.63	31.31	40.48	5.30	42.45
	S.Em (±)	0.21	0.30	0.27	0.06	0.33
	C. D. at 5 %	0.63	0.90	0.81	0.18	0.99
	General mean	56.94	32.67	41.52	5.56	44.08

Table 2: Yield contributing characters as influenced by mechanical intercultivation in soybean

Treatment		Yield contributing characters				
		No. of pods plant ⁻¹	Pod weight plant ⁻¹ (g)	No of seeds pod ⁻¹	No. of seeds plant ⁻¹	100 seeds weight (g)
I ₁ :	Farmers practice (PoE application of imazethapyr 10 % SL @ 80 g a.i ha ⁻¹ 20 DAS and weeding at 40 DAS)	43.43	19.28	2.65	115.24	11.67
I ₂ :	Tractor hoeing by blade hoe at 15 DAS and 30 DAS.	42.84	19.10	2.59	111.12	10.04
I ₃ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS.	49.78	22.40	2.75	136.89	12.08
I ₄ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + Tractor hoeing by blade hoe at 30 DAS.	43.08	19.24	2.63	113.44	11.39
I ₅ :	Post emergence application of imazethapyr 10 % SL @ 80 g a.i ha ⁻¹ @ 20 DAS+ opening of Conservation furrow with tractor ridger at 30 DAS.	48.33	21.75	2.69	130.17	11.79
I ₆ :	Opening of conservation furrow with tractor cultivator at 30 DAS	41.56	18.70	2.55	106.12	9.66
I ₇ :	Tractor hoeing by blade hoe at 15 DAS + opening of conservation furrow with tractor ridger at 30 DAS.	48.44	21.80	2.72	131.57	11.89
I ₈ :	Opening of conservation furrow with tractor ridger at 30 DAS	42.74	19.03	2.57	110.08	9.70
	S.Em (±)	0.52	0.22	0.04	2.78	0.22
	C. D. at 5 %	1.56	0.66	NS	8.34	0.66
	General mean	45.02	20.16	2.65	119.33	11.03

Table 3: Seed yield, straw yield and economics of soybean influenced by mechanical intercultivation in soybean

Treatment		Grain Yield (q ha ⁻¹)	Straw Yield (q ha ⁻¹)	Net monetary returns (₹ ha ⁻¹)	B:C ratio
I ₁ :	Farmers practice (PoE application of imazethapyr 10 % SL@ 80 g a.i ha ⁻¹ 20 DAS and weeding at 40 DAS)	23.49	30.31	44206	1.96
I ₂ :	Tractor hoeing by blade hoe at 15 DAS and 30 DAS.	21.75	28.05	38853	1.87
I ₃ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS.	29.95	38.63	61557	2.16
I ₄ :	Pre-emergence application of pendimethalin 38.7 % CS PE @ 0.750 kg a.i ha ⁻¹ + Tractor hoeing by blade hoe at 30 DAS.	22.39	28.89	39697	1.86
I ₅ :	Post emergence application of imazethapyr 10 % SL @ 80 g a.i ha ⁻¹ @ 20 DAS + opening of Conservation furrow with tractor ridger at 30 DAS.	27.30	35.22	53589	2.04
I ₆ :	Opening of conservation furrow with tractor cultivator at 30 DAS	18.95	24.45	31436	1.76
I ₇ :	Tractor hoeing by blade hoe at 15 DAS + Opening of Conservation furrow with tractor ridger at 30 DAS.	27.88	35.97	55874	2.09
I ₈ :	Opening of conservation furrow with tractor ridger at 30 DAS	20.21	26.07	34710	1.81
	S.Em (±)	0.88	1.14		
	C. D. at 5 %	2.64	3.42		
	General mean	23.99	30.95	44990	1.94

Conclusion

Pre-emergence application of pendimethalin @ 38.7 % CS PE @ 0.750 kg a.i ha⁻¹ + opening of conservation furrow with tractor ridger at 30 DAS found beneficial for increase in growth and yield of soybean.

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