



Research Article

EFFECT OF LAND CONFIGURATIONS AND WEED MANAGEMENT PRACTICES IN SOYBEAN

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Abstract: A field experiment was conducted during the kharif season of 2015 and 2016 to evaluate the effect of different land configurations and weed management practices on growth and yield of soybean at Instructional Farm, Krishi Vigyan Kendra, Aron, Guna (M.P.). The results revealed that the number and dry weight of weeds was significantly lower under S₂, S₃ and S₄ land configurations as compared to the flat bed sowing (S₁) at harvest stage. The total number of weeds/m² ranged from 52.20 to 57.32/m² under S₂, S₃ and S₄ as against 76.54 weeds/m² under S₁ land configuration. Consequently, the dry weight of weeds was also recorded in the similar range according to their number/m². The weed free (W₆) performed the best where only 4.49 weeds/m² were observed up to the harvest stage as against 194.82 weeds/m² under unweeded control. Amongst the applied herbicides, Aceloflorfen + Clodinafop (W₂) performed the best where 21.68 weeds/m² were observed as against 194.82 weeds/m² under control treatment. Among land configurations, raised bed furrow sowing gave significantly higher seed yield (13.04 q/ha) and maximum net income (Rs 24125/ha) with 1.93 B: C ratio. weed free condition recorded significantly higher seed yield (15.78 q/ha) as compared to the remaining treatments except Aceloflorfen + Clodinafop (W₂) which produced 15.36 q/ha seed. Application of Aceloflorfen + Clodinafop (W₂) resulted in highest net income up to Rs 34091/ha with B: C ratio 2.42.

Keywords: Soybean, Weed management, land Configuration and productivity

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Introduction

Soybean [*Glycine max* L. Merrill] is an important pulse as well as oilseed crop and has been termed as miracle bean because of higher protein (40%) and oil (20%) content [1]. Even though the area under soybean in India has shown an appreciable increase over past four decades, the productivity has remained only 1 t/ha as against world average of 2.2 t/ha [2]. The farmers of Madhya Pradesh have been growing soybean in Kharif season. The productivity of soybean in this region is very low as compared to national productivity due to multiple factors, from which the yield erosion on account of weeds is one of the important factors. The weed infestation in soybean field may reduce yield up to 77 percent depending upon the intensity, nature and the duration of weed competition [3]. The weed free maintenance up to 45 days after sowing resulted in 96 percent increase in seed yield of [4] The crop can smother the weeds that emerge 30-40 days after sowing. Weed infestation is considered as a complex constraint in soybean production. Several herbicides, viz. pendimethalin, alachlor, chlorimuron, imazethapyr, etc. are presently being used for controlling the weeds in soybean but these herbicides were not found much effective to control many broad-leaved weeds [5]. The improper crop establishment methods in soybean are another important reason of low productivity. Therefore, it is need to standardize land configurations for the cultivation of soybean. The broad bed furrow provides favourable environment for growth and development of the soybean crop under rainfed conditions [6]. Tillage and/or herbicides are used for weed control, but the degree of control achieved may vary widely depending on weed species present, soil type, climatic condition, crop grown, tillage method and cropping system [7]. Therefore, the present investigation was undertaken to evaluate the most suitable land configuration and weed management practice for getting higher productivity from soybean crop.

Materials and Method

The experiment was conducted during two consecutive kharif seasons of 2015 and 2016 at Instructional Farm, Krishi Vigyan Kendra, Aron, Guna. The soil of the experimental field having pH 7.8-7.9, EC 0.40 to 0.41 ds/m, OC 0.60 to 0.62%, available N 202.4 to 207.6 kg/ha, available P₂O₅ 45 to 48 kg/ha, available K₂O 130.5 to 142.5 kg/ha and available S 16 to 17 kg/ha. The total rainfall received during June to November was 875.6 and 555.6mm in 2015 and 2016, respectively. The treatment comprises four land configurations (flat bed, ridge furrow, broad bed furrow and raised bed furrow sowing) as the main plot treatments and six weed management practices (control, Aceloflorfen + Clodinafop, Imezathapyr + Imezamox, Imezathapyr + Pendimethalin, Imezathapyr and weed free having HW twice) as the sub plot treatments. The experiment was laid out in split plot design with three replications. The soybean variety JS 95-60 was sown in last week of June and first week of July having seed rate 80 kg/ha in rows 45 cm apart. The uniform fertilizer dose of 20 kg N, 60 kg P₂O₅, 20 kg K₂O and 40 kg S/ha was applied in all the treatments. The herbicides were applied as per treatments. The crop was harvested on last week of September. The crop was sown with keeping a seed rate of 00 kg/ha. The soybean variety JS 95-60 was used for experimentation.

Result and Discussion

Study of weed flora

The overall picture on the periodical observation taken on the number and dry weight of narrow and broad leaf weeds has been reveal that the land configuration treatments, ridge furrow (S₂) and raised bed furrow (S₄) proved most effective in controlling both the types of weeds at all the stages as compared to S₃ and S₁.

Table-1 Plant height and dry matter production of soybean as influenced by land configurations and weed management treatments at successive stages of crop growth (Pooled)

Treatment	Symbol	Number of weeds/m ² at harvest			Dry weight of weeds (g/m ²) at harvest			Weed control efficiency (%)	Weed Index (%)
		Narrow leaf	Broad leaf	Total	Narrow leaf	Broad leaf	Total		
Land configurations									
Flat bed sowing	S ₁	54.05	22.49	76.54	20.73	8.72	29.45	-	-
Ridge furrow sowing	S ₂	42.00	15.32	57.32	16.93	6.16	23.09	-	-
Broad bed furrow sowing	S ₃	43.50	15.67	59.17	17.98	6.57	24.55	-	-
Raised bed furrow sowing	S ₄	38.23	13.97	52.20	15.27	5.21	20.48	-	-
SE (m)±		3.71	0.78	3.60	1.87	0.41	1.84	-	-
CD (P=0.05)		NS	2.41	11.09	NS	1.27	5.66	-	-
Weed management treatments									
Control	W ₁	160.28	34.54	194.82	66.51	15.28	81.79	-	56.57
Aceloflorfen + Clodinafop	W ₂	13.10	8.58	21.68	4.53	2.14	6.68	91.84	2.64
Imezathapyr + Imezamox	W ₃	29.11	11.43	40.54	10.98	3.54	14.52	82.25	33.68
Imezathapyr + Pendimethilin	W ₄	22.87	29.75	52.62	8.48	12.61	21.09	74.21	47.51
Imezathapyr	W ₅	38.71	14.99	53.69	14.88	5.62	20.50	74.93	29.99
Weed Free	W ₆	2.60	1.89	4.49	0.97	0.80	1.78	97.83	-
SE (m)±		4.54	1.43	4.62	2.28	0.73	2.36	-	-
CD (P=0.05)		12.78	4.02	13.00	6.42	2.05	6.64	-	-
Interaction (S*W)		NS	S	S	NS	S	NS	-	-

Table-2 Plant height and dry matter production of soybean as influenced by land configurations and weed management treatments at successive stages of crop growth (Pooled)

Treatment	Symbol	Seed yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Net income (₹/ha)	B: C ratio
Land configurations						
Flat bed sowing	S ₁	8.62	10.22	18.84	8011	1.32
Ridge furrow sowing	S ₂	12.14	14.92	27.06	21382	1.86
Broad bed furrow sowing	S ₃	11.40	13.96	25.37	18294	1.71
Raised bed furrow sowing	S ₄	13.04	15.62	28.66	24125	1.93
SE (m)±		0.57	1.12	1.65	-	-
CD (P=0.05)		1.77	3.44	5.08	-	-
Weed management treatments						
Control	W ₁	6.85	8.53	15.38	3935	1.18
Aceloflorfen + Clodinafop	W ₂	15.37	18.31	33.68	34091	2.42
Imezathapyr + Imezamox	W ₃	10.47	12.84	23.31	15887	1.67
Imezathapyr + Pendimethilin	W ₄	8.28	10.13	18.41	8051	1.34
Imezathapyr	W ₅	11.05	13.33	24.37	18051	1.76
Weed Free	W ₆	15.78	18.94	34.73	27653	1.87
SE (m)±		0.68	1.01	1.64	-	-
CD (P=0.05)		1.92	2.84	4.61	-	-
Interaction (S*W)		NS	NS	NS	-	-

The position at the harvest stage is very clear where number and dry weight of weeds was significantly lower under S₂, S₃ and S₄ land configurations as compared to the flat bed sowing (S₁). The total number of weeds/m² ranged from 52.20 to 57.32/m² under S₂, S₃ and S₄ as against 76.54 weeds/m² under S₁ land configuration. Consequently, the dry weight of weeds was also recorded in the similar range according to their number/m². The significant decrease in weed population under ridge furrow and raised bed furrow treatments might be as a result of significant damage or killing of weeds under the process of making ridges and furrows and raising the seed bed. Soybean can be grown under raised bed with pre and post emergence herbicides [8]. The similar results have also been supported by [9] and [10]. The results further indicated that the weed free (W₆) performed the best where only 4.49 weeds/m² were observed up to the harvest stage as against 194.82 weeds/m² under unweeded control. Amongst the applied herbicides, Aceloflorfen + Clodinafop (W₂) performed the best where 21.68 weeds/m² were observed as against 194.82 weeds/m² under control treatment. In case of other herbicidal treatments, W₃, W₄ and W₅, the weed population was found in the equal range (40.54 to 53.69/m²). It is very apparent that Aceloflorfen in combination with clodinafop (W₂) activated in such way that most of the weeds were controlled or finished and the weed competition with crop plants for space, light, nutrients and moisture must have been reduced to a greater extent right from the early stage of crop growth. These findings are in close agreement with those of [11] and [12].

Weed control efficiency

The results reveal that the WCE was found highest upto 97.83% under weed free (W₆) treatment. The second best weed management treatment was Aceloflorfen + Clodinafop (W₂) which also resulted in quite higher WCE up to 91.84%. This was followed by Imezathapyr + Imezamox (W₃) where the WCE was 82.25%. The WCE was equally decline to some extent (74.21 to 74.93%) in case of W₄ and W₅ treatments. The weed control efficiency under different treatments was exactly in accordance with the control of weeds.

Weed index

The scrutiny of the data revealed that the weed index was found lowest (2.64) in case of Aceloflorfen + Clodinafop (W₂) treatment. This was followed by Imezathapyr (W₅) with 29.99 WI and then Imezathapyr + Imezamox (W₃) with 33.68 WI and Imezathapyr + Pendimethilin (W₄) with 47.51 WI. The maximum WI (56.57%) was recorded in case of control (W₁) treatment. The WI in different treatments was exactly in accordance with the yield obtained under the treated plots.

Productivity parameters

Soybean seed yield per hectare is the final expression of physiological and metabolic activities of plants. Soybean yield is the product of cumulative action of all the factors applied.

Effective weed control and land configuration methods and consequently judicious supply of essential plant nutrients along with soil moisture status contributed to better plant growth, thereby effectively increasing the yield per plant and per hectare.

In the present investigation the best land configuration method was raised bed furrow (S4) which recorded significantly higher seed up to 13.04 q/ha as compared to the remaining land configurations except ridge furrow sowing (S2) yielding 12.14 q/ha. The broad bed furrow sowing (S3) produced 11.40 q/ha seed. The significantly lowest seed yield (8.62 q/ha) was secured from flat bed sowing (S1). The yield of any crop depends on its capacity to accumulate photosynthates per unit area and its ability to remobilize the photosynthates towards the sink. In this respect ridge furrow sowing (S2) and raised bed furrow sowing (S4) took a lead over S1 and S3 land configuration treatments. The present results are in conformity with those of [13] and [14].

The weed free condition recorded significantly higher seed yield (15.78 q/ha) as compared to the remaining treatments except Aceloflorfen + Clodinafop (W2) which produced 15.36 q/ha seed. Thus, W2 proved the best substitute of W6 comprising tedious, time consuming and costly manual practice to keep weed free condition. In, the other herbicidal combinations, as in case of W3, W4 and W5, their effect was not up to that extent, where the seed yields were in the lower range (8.82 to 11.05 q/ha). The significantly lowest seed yield was obtained from the control (W1) treatment. The treatment pertaining to land configurations, indicated that the S2, S3 and S4 resulted in statistically equally highest straw yield (13.96 to 15.62 q/ha) and proved significantly superior to S1 (flat bed sowing) where the straw yield being only 10.22 q/ha. This was due to maximum increase in the vegetative growth under S2, S3 and S4 treatments over S1 as a result of increased plant growth factors particularly enhanced soil moisture. The weed free treatment resulted in significantly higher straw yield (18.94 q/ha) over rest of the treatments except Aceloflorfen + Clodinafop (W2) where the straw yield was equal (18.31 q/ha). Therefore, the straw yield was lowered down significantly under W3, W4 and W5 treatments (10.13 to 13.33 q/ha). The significantly lowest straw yield (8.53 q/ha) was noted from the control (W1) treatment. The maximum increase in straw yield under W2 and W6 treatments was as a result of maximum control of weeds, reduced crop weed competition to ensure maximum vegetative growth of plants. The performance of weed management treatments on soybean yield was exactly in accordance with the yield attributing characters responsible for yield contribution. The best performance of dual herbicides as in W2 on soybean yield has also been reported by [15], [16] and [17].

Conclusion

Thus, it is concluded that soybean sowing in raised bed and weed free treatment influenced the number and dry weight of weeds and yield of soybean significantly under the rain-fed conditions of Guna Region. However, the application of Aceloflorfen + Clodinafop as post emergence is most economical among weed management treatments.

Application of research: The raised bed sowing method of soybean can be applied where the field having no slop and damage of crop occurred due to water stagnation. The findings may be utilized to manage the weed population having narrow and broad leaf both type of weed flora.

Research Category: Land configuration, weed management.

Abbreviations:

t- Ton
q- Quintal
kg- Kilogram
g- Gram
ha- Hectare
m- Meter
WCE- Weed Control Efficiency
WI- Weed Index

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