



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

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www.agronomyjournals.com

2025; SP-8(2): 42-46

Received: 13-12-2024

Accepted: 20-01-2025

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Weed dynamics and production potential of soybean (*Glycine max* L. Merrill) as influenced by land configuration and weed control

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DOI: <https://doi.org/10.33545/2618060X.2025.v8.i2Sa.2536>

Abstract

An experiment on weed dynamics and production potential of soybean as influenced by land configuration and weed control was carried out during the *kharif* season of 2022-23 at Research Farm of Agronomy Department, College of Agriculture, VNMKV, Parbhani with an objective to study the effect of land configuration and weed management on yield of soybean, efficiency of different weed management practices under varying land configuration as well as on weed flora and crop weed competition in soybean. The experiment was laid out in split plot design with three replications. The treatments were consisting of three land configurations as main plot treatments, L₁: 2 Row BBF, L₂: 4 Row BBF, L₃: Flat bed and four weed management practices as sub plot treatments, W₁: PE Diclosulum 84% WDG @22-26g a.i./ha, W₂: PoE Sodium acifluorfen 16.5%+ Clodinofof-propargyl 8% EC @80+165 a.i. g/ha, W₃: Weed control, W₄: Weedy check. On the basis of present studies, results revealed that, regarding all land configurations, seed yield (kg ha⁻¹), straw yield (kg ha⁻¹), biological yield (kg ha⁻¹), GMR, NMR and B:C ratio were observed significantly maximum with 4 row BBF (L₂) and regarding weed management practices, maximum values of the above mentioned parameters were recorded with treatment weed control (W₃). Among weed management practices, the treatment (W₂) PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @80+165 a.i. g/ha was found efficient in controlling monocot and dicot weeds as well as productive and profitable, it was comparable with weed free.

Keywords: Soybean, weed management, land configuration, BBF, pre-emergence herbicide, post-emergence herbicide

Introduction

As Soybean crop is preferably grown in *kharif* season, adequate moisture favours weed population to a greater extent. Weed infestation was reported to loses up to 31-84 per cent of grain yield in Soybean. The dominant weed flora observed in oilseed crops are *Cyperus rotundus*, *Cynodm dactylon*, *Digitaria sanguinalis*, *Panicum repens*, *Dactylactenium aegyptium*, *Amaranthus viridis*, *Azeratum conizoides*, *Euphorbia hirta*, *Phyllanthus spp.*, *Portulaca olerasia*, *Eclipta alba*, *Chenopodium album*, *Parthenium hystarophorus*, *Celosia argentia*, *Legasca mallis* and *Trichodesma indicum*. The critical period for weed control in Soybean is found to be 30 to 45 days after sowing, which proportionately increases grain yield up to 74 per cent (Chhokar and Balyan, 1999) [4]. Planting method can play an important role for easy and uniform germination as well as growth and development and also protects the crop from water logging condition. Jain and Dubey (1998) [7] reported that maximum yield of soybean was recorded under ridges and furrow sowing over flat bed. Different land configuration methods are available for moisture conservation. The broad bed furrow (BBF) farming has many advantages with regard to water saving, mechanical weeding, fertilizer placement, available moisture conservation, less lodging and better crop stand (Astatke *et al.*, 2002) [1]. Higher biological yield and highest net and gross return from land configuration treatment as compared to conventional system has been reported (Jat and Singh 2003) [8]. The adoption of proper land configuration system will help increase income to the farmers besides preventing land degradation due to runoff erosion (Tomar *et al.* 2011) [18].

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Materials and Methods

A field experiment on weed dynamics and production potential of soybean as influenced by land configuration and weed control was carried out during the *kharif* season of 2022-23 at Research Farm of Agronomy Department, College of Agriculture, VNMKV, Parbhani. The topography of the experimental field was uniform and well levelled. The soil was black in colour and well drained. The experiment was laid out in split plot design with three replications. The treatments were consisting of three land configurations as main plot treatments, L₁: 2 Row BBF, L₂: 4 Row BBF, L₃: Flat bed and four weed management practices as sub plot treatments, W₁: PE Diclosulum 84% WDG @22-26g a.i./ha, W₂: PoE Sodium acifluorfen 16.5%+ Clodinfop-propargyl 8%EC @80+165 a.i. g/ha, W₃: Weed control, W₄: Weedy check. The size of the gross plot and net plot was 6.3 m x 4.5 m and 5.4 m x 4.5 m, respectively. The weed samples were collected at 20 and 40 DAS from quadrat 1.0 m² area was dried at 70 °C and weight was expressed as g m⁻².

Results and Discussion

Weed control efficiency

The data regarding weed control efficiency for monocot and

dicot weeds as influenced by various treatments are presented in given Table 1.

At 20 DAS, highest weed control efficiency was recorded with weed control (W₃) and PE Diclosulum 84% WDG @22-26 g/ha at 40 DAS (W₁) whereas, at 40 DAS, highest weed control efficiency were recorded with weed control (W₃) and PoE Sodium aceflurofen 16.5% + Clodinfop propargyl 8% EC 80 + 165 a.i. g/ha (W₂) for both monocot and dicot weeds.

Weed control efficiency is more in W₃ (weed control) because of weed free environment due to mechanical weeding while in post emergence herbicide treatment it was due to extended control for both monocot and dicot weeds. results are in line with Thakare *et al.* (2015)^[17].

Weed index

The result regarding weed index is presented in given Table 1. The results revealed that lower weed index is recorded in weed control (W₃). The highest weed index was observed with the weedy check (W₄). Results are line with Thakare *et al.* (2015)^[17].

Table 1: Weed control efficiency (%) and weed index (%) of monocot and dicot weeds influenced by different treatments

Treatments	20 DAS		40 DAS		Weed index (%)
	Monocot	Dicot	Monocot	Dicot	
Land configurations					
L ₁ : (2 Row BBF)	-	-	-	-	-
L ₂ : (4 Row BBF)	-	-	-	-	-
L ₃ : (Flat Bed)	-	-	-	-	-
Weed management practices					
W ₁ :(PE Diclosulum 84% WDG @22- 26g a.i./ha)	76.60	75.55	49.86	39.56	15.21
W ₂ :(PoE Sodium aceflurofen 16.5%+ Clodinfop propargyl 8%EC @ 80 +165 a.i.g/ha)	38.44	38.70	64.85	55.39	13.27
W ₃ : Weed control	89.20	83.74	79.51	71.07	0
W ₄ : Weedy check	0	0	0	0	54.97

Yield

Data regarding mean of seed yield (kg ha⁻¹), stalk yield (kg ha⁻¹) and biological yield (kg ha⁻¹) as influenced by different land

configurations and weed management practices and are presented in Table 2.

Table 2: Seed yield (kg ha⁻¹), Straw yield (kg ha⁻¹), Biological yield (kg ha⁻¹), Gross Monetary Returns (₹ ha⁻¹), Net Monetary Returns (₹ ha⁻¹) and Benefit:Cost ratio as influenced by different land configurations and weed management practices

Treatment	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Biological yield (kg ha ⁻¹)	Gross monetary returns (₹ ha ⁻¹)	Net monetary returns (₹ ha ⁻¹)	B:C ratio
Land configurations						
L ₁ : 2Row BBF	2352	3116	5468	103166	63666	2.61
L ₂ :4 Row BBF	2406	3145	5551	108304	68804	2.74
L ₃ : Flat bed	2060	2768	4828	88583	53598	2.53
S.E m. _±	63.59	67.02	129.91	2734.75	1143.91	-
CD at 5%	249.68	263.1	510.03	6208.01	5143	-
Weed management practices						
W ₁ :(PE Diclosulum 84% WDG @22-26g a.i./ha)	2346	3222	5601	101348	64597	2.75
W ₂ :(PoE Sodium aceflurofen 16.5%+ Clodinfop propargyl 8% EC80+165a.i.g/ha)	2618	3492	6082	113036	74920	2.96
W ₃ : Weed control	2687	3655	6340	116004	80681	3.28
W ₄ : Weedy check	1418	1970	3369	60601	28133	1.86
S.E m. _±	54.10	71.55	124.73	2326.6	1538	-
CD at 5%	160.76	212.59	370.62	6912.94	6613	-
Interaction (LXW)						
S.E m. _±	93.71	123.92	216.04	4029.79	2664	-
CD at 5%	278.45	NS	NS	11973.56	7915	-
G.M.	2063	3010	5273	97317	62057	2.67

Seed yield (kg ha⁻¹)**Effect of land configurations**

Among different land configurations, 4 row BBF recorded the highest seed yield (2406 kg ha⁻¹), it was at par with the 2 row BBF and both are significantly superior over flat bed.

Broad bed furrow method of planting had profound effect on seed yield it might be due to more favoured overall growth and yield attributing characters and which in turn results in higher yield of soybean crop. Similar findings were reported by the Dikey *et al.* (2013)^[5].

Effect of weed management practices

A statistical analysis showed a significant difference among weed management practices was recorded for seed yield. The highest seed yield was obtained in weed control (W₃) (2687 kg ha⁻¹) practices and it was at par with the treatment application of PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @ 80+165 a.i.g/ha (W₂). The lowest seed yield obtained in weedy check (W₄). It might be due to less weed competition was observed between the plant and weeds. And Similar results were also reported by Bhalla *et al.* (1998)^[2].

Effect of interaction

The data pertaining to interaction effects on seed yield of different treatments were found to be significant. It might be due to lower competition between the crops and weeds and significant difference shown in seed yield of soybean. Given interaction table shows the maximum seed yield (kg ha⁻¹) recorded with the combination of (L₁) 2 row BBF with weed free control (W₃) and (L₁) 2 row BBF with the application of PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @ 80 + 165 a.i.g/ha (W₂). Similar results were found by Bharambe (1999)^[3].

Straw yield**Effect of land configurations**

The highest straw yield was recorded with the 4 Row (BBF) (3145 kg ha⁻¹) which was noticed to be at par with 2 row BBF and both are significantly superior over flat bed.

Straw yield is more in BBF due to scope for more space, light interception, benefit of more conserved moisture in furrows which resulted in enhanced growth in crop and straw yield. Findings are in line with the findings of Garud *et al.* (2018)^[6]

Effect of weed management practices

The straw yield (kg ha⁻¹) varied significantly superior due to weed management practices and highest straw yield obtained with weed control (3655 kg ha⁻¹) and it was at par with application of PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @ 80 +165 a.i. g/ha (W₂) recorded straw yield and it followed by treatment PE Diclosulum 84% WDG 22-26 g a.i./ha (W₁). The lowest straw yield obtained in weedy check (W₄). The results are following the findings reported by Singh *et al.* (2004)^[15].

Effect of interactions

The interaction effect of different treatments was found to be non-significant on straw yield of soybean (kg ha⁻¹).

Biological yield**Effect of land configurations**

The data regarding the biological yield was recorded with 4 row BBF (5551 kg ha⁻¹) which was noticed to at par with 2 Row BBF with and both are significantly superior over the flat bed

method of sowing.

Broad bed furrow method of sowing recorded the maximum biological yield over flat bed. It might be due to enhanced growth and yield parameters which resulted from favourable environment under BBF. Results are parallel with the findings of Kumar and Tiwari (2004)^[9].

Effect of weed management practices

The highest biological yield recorded weed control (W₃) (6340 kg ha⁻¹) and it was at par with the application of PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @ 80+165 a.i.g/ha (W₂) and was followed by with application of PE Diclosulum 84% WDG 22-26 g a.i./ha (W₁). The lowest biological yield recorded in weedy check (W₄). similar results were reported by findings of Singh *et al.* (2004)^[15].

Effect of interactions

The interaction effects of different land configurations and weed management practices were found non-significant on biological yield.

Economics

Data on pertaining to the gross monetary returns, net monetary returns and B:C ratio of soybean under different treatment are given in Table 2.

Gross monetary returns (GMR)**Effect of land configurations**

The gross monetary returns (₹ ha⁻¹) was significantly influenced by different land configurations. From the economic analysis, it was observed that among the land configurations, the 4 Row BBF recorded maximum gross monetary returns (108304 ₹ ha⁻¹) and it was at par with the 2 row BBF and was followed by flat bed similar findings were in line with the findings of Paliwal *et al.* (2011)^[11].

Effect of weed management practices

In weed management practices, highest Gross Monetary Returns recorded under weed control (W₃) treatment (116004 ₹ ha⁻¹) which was at par with application of PoE Sodium aceflurofen 16.5%+Clodinofof propargyl 8%EC@80+165a.i.g/ha (W₂) recorded and followed by PE Diclosulum 84% WDG 22-26g a.i./ha (W₁) while lowest GMR recorded under weedy check (W₄). Findings are in line with the findings of Samudre *et al.* (2019)^[14].

Effect of interactions

The interaction effect of different weed management practices and land configurations found significant for gross monetary return (₹ ha⁻¹). Given interaction table shows, the maximum gross monetary Returns (₹ ha⁻¹) recorded with the combination of (L₂) 4 row BBF with weed control (W₃) and (L₂) 4 row BBF with application of PoE Sodium aceflurofen 16.5% + Clodinofof propargyl 8% EC @ 80 + 165 a.i.g/ha (W₂). And similar findings are observed by the Ram *et al.* (2011)^[12].

Net monetary returns (NMR)**Effect of land configuration**

The net monetary return (₹ ha⁻¹) was significantly influenced by different land configurations. From the economic analysis it was observed that among the land configurations, the 4 Row BBF recorded (68804 ₹ ha⁻¹) at par with 2 row BBF and followed by flat bed. The findings are in line with the Saha *et al.* (2016)^[13].

Effect of weed management practices

Treatment W₃ (weed control) recorded highest net monetary returns (80681 ₹ ha⁻¹) and was at par with PoE Sodium aceflurofen 16.5% + Clodinofof propargryl 8% EC @ 80+165 a.i.ha⁻¹ recorded (W₂) followed by PE Diclosulum 8% 22-26 g.a.i./ha, while the lowest net monetary returns were recorded with weedy check (W₄). Similar results were reported by the Tuti and Das (2011)^[19].

Effect of interactions

Data pertaining interaction between the land configurations and weed management practices shows the significant. Given interaction table shows, the maximum Net monetary Returns (₹ ha⁻¹) recorded with the combination of (L₂) 4 row BBF with weed control (W₃) and (L₁) 2 row BBF with weed control (W₃). Similar findings are observed by the Pal *et al.* (2015)^[10].

Benefit: Cost ratio (B:C ratio)

Effect of land configurations

From the economic analysis it was observed that among the land configuration, highest B:C ratio observed in 4 Row BBF (2.74) compared to 2 row BBF and flat bed recorded the B:C ratio. The findings are in line with the findings of Verma *et al.* (2018)^[20].

Effect of weed management practices

Among the weed management practices, (W₃) weed control recorded the highest B:C ratio (3.28) followed by application of PoE Sodium aceflurofen 16.5% + Clodinofof propargryl 8% EC @ 180+165 a.i.ha⁻¹ while lowest was recorded with weedy check (W₄) recorded. Results are recorded relevant with the findings of Singh and Kumar (2008)^[16].

Table 3: Interaction table showing LxW on Seed yield (kg ha⁻¹) of soybean as influenced by the different land configurations and weed management practices

Treatments Land configurations	Weed management practices			
	W ₁	W ₂	W ₃	W ₄
L ₁	2459	2745	2885	1201
L ₂	2530	2617	2626	1854
L ₃	2051	2494	2551	1143
S.E m. _±	93.71			
CD at 5%	278.45			

Table 4: Interaction table showing LxW on Gross Monetary Returns (₹ ha⁻¹) of soybean as influenced by the different land configurations and weed management practices

Treatments Land configurations	Weed management practices			
	W ₁	W ₂	W ₃	W ₄
L ₁	107027	112541	112918	52933
L ₂	108790	119325	125382	79722
L ₃	88228	107242	109714	49149
S.E m. _±	4029.79			
CD at 5%	11973.56			

Table 5: Interaction table showing LxW on Net Monetary Returns (₹ ha⁻¹) of soybean as influenced by the different land configurations and weed management practices

Treatments Land configurations	Weed management practices			
	W ₁	W ₂	W ₃	W ₄
L ₁	69126	75069	81833	29394
L ₂	75088	79904	87054	40765
L ₃	49579	69789	73156	15311
S.E m. _±	2664			
CD at 5%	7915			

Conclusion

The above experiment demonstrates noteworthy outcomes in the realm of weed control within soybean cultivation. Among the different land configurations 4 row BBF and 2 row BBF were found superior in terms of yield of crop and was found productive and remunerative as compared to the flat bed recording higher seed yield and net returns. Among weed management practices, in soybean the treatment (W₂) PoE Sodium aceflurofen 16.5% + Clodinofof propargryl 8% EC 80+165 a.i.g/ha was found efficient in controlling monocot and dicot weeds as well as productive and profitable and was comparable with weed free.

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