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Effect of pre and post emergence application of herbicides on growth and yield of *Dolichos* bean

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ABSTRACT

A field experiment was conducted at the Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the kharif season of 2025–26 to evaluate the effects of pre- and post-emergence herbicides on weed flora, growth, and yield dynamics of dolichos bean (*Dolichos lablab* L.) cv. Konkan Bhushan. The study was arranged in a Randomized Block Design (RBD) with three replications and eight treatments include T_1 -Oxyfluorfen 30 EC @ 150 g a.i./ha as PE fb 1 HW at 35 DAS, T_2 -RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS, T_3 -RM Diclosulam 0.9% + Pendimethalin 35% SE @ 897.5 g a.i./ha as PE fb 1 HW at 35 DAS, T_4 -Quizalofop Ethyl 5% EC @ 40 g a.i./ha as PoE at 20 DAS fb 1 HW at 35 DAS, T_5 -Imazethapyr 10% SL @ 100 g a.i./ha as PoE at 20 DAS fb 1 HW at 35, T_6 -RM Imazethapyr 35% + Imazamox 35% WG @ 100 g a.i./ha as PoE at 20 DAS fb 1 HW, T_7 -farmers' practice of three hand weedings at 20, 40, and 60 DAS, and T_8 -weedy check. The predominant weed flora identified included *Cyperus rotundus*, *Cynodon dactylon*, *Echinochloa colona*, *Amaranthus viridis*, and *Parthenium hysterophorus*.

Results revealed that while the farmers' practice of three hand weedings (HW) at 20, 40, and 60 days after sowing (DAS) recorded the highest weed control efficiency (92.63%), maximum plant height (71.30 cm), and highest pod yield (95.63 q ha⁻¹), it demands unsustainable labor costs. Among the chemical treatments, the pre-emergence application of a ready-mix (RM) of pendimethalin 30% + imazethapyr 2% EC @ 860 g a.i./ha followed by (fb) 1 HW at 35 DAS proved structurally superior. This specific chemical treatment achieved a high weed control efficiency of 81.91%, minimized the weed index to 6.42%, and yielded a significantly high pod productivity of 89.49 q ha⁻¹. Furthermore, this treatment secured the highest net profit efficiency with a benefit-cost (B:C) ratio of 2.40, outperforming even manual weeding. Integrated chemical weed management utilizing pendimethalin + imazethapyr offers a highly lucrative and viable alternative for large-scale dolichos bean production.

Keywords: *Dolichos* bean, Pod yield, Weeds, Pre emergence, Post emergence

1. Introduction

Dolichos bean (*Dolichos lablab* L.) is an important vegetable legume cultivated for its tender green pods. The crop is valued for its nutritional importance. Fresh green pods contain about 86.1% moisture, 3.8% protein, 6.7% carbohydrates, 0.75% fat, 0.9% minerals, and vitamin A in contrast, mature dry seeds provide 23% protein, 62.5 g carbohydrates, and around 340 calories per 100 g of edible portion (Tindall, 1983)^[1], and its contribution to farm income. However, weed infestation is one of the major constraints affecting the productivity of dolichos bean. Weeds compete with the crop for essential resources such as nutrients, moisture, light and space, particularly during the early stages of crop growth. Manual weeding is effective in reducing weed competition, but repeated hand weeding is labour-intensive and increases the cost of cultivation. Herbicides can provide timely and effective weed suppression and may reduce the dependence on manual labour. However, the effectiveness of a herbicide depends on the weed spectrum, time of application, dose and crop tolerance. Therefore, identification of an effective and crop-safe herbicide is important for improving crop growth and productivity.

The present investigation was therefore undertaken with the objective to identify a suitable herbicide for better growth and yield of dolichos bean and to study relative performance of different herbicides in weed control.

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2. Materials and Method

2.1 Experimental site

The experiment was conducted during the Kharif season of 2025–26 at the Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The study was conducted on dolichos bean cv. Konkan Bhushan. The experimental findings covered weed infestation, crop growth, yield attributes, pod yield.

2.2 Experimental design and treatments

The experiment was laid out in a Randomized Block Design with three replications and eight treatments. The experimental plot measured 3.15×1.80 m and crop spacing was 45×30 cm. The treatments consisted of six herbicidal treatments, farmers' practice and a weedy check.

Table :1 Treatment details

T ₁	Oxyflurofen 30EC @ 150g a.i./ha as PE fb 1 HW at 35 DAS
T ₂	RM Pendimethalin 30% +Imazethapyr 2% EC @860g a.i./ha as PE fb 1 HW at 35 DAS
T ₃	RM Diclosulam 0.9%+ Pendimethalin 35% SE @897.5g a.i./ha as PE fb 1 HW at 35 DAS
T ₄	Quizalofop Ethyl 5%EC @ 40g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS fb 1 HW at 35 DAS
T ₅	Imazethapyr 10 % SL @100g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS fb 1 HW at 35 DAS
T ₆	RM Imazethapyr 35 % + Imazamox 35 % WG @100g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS
T ₇	Farmers practice (HW at 20,40 and 60 DAS)
T ₈	Weedy Check

2.3 Observations recorded

Observations were recorded on monocot, dicot and total weeds, weed dry matter, weed control efficiency, weed index, plant height, number of leaves per plant, number of branches per plant, pod characters and pod yield B:C ratio.

Weed flora

The major weed flora identified in the experimental field included *Cynodon dactylon*, *Cyperus rotundus*, *Echinochloa colona*, *Dactyloctenium aegyptium*, *Eleusine indica*, *Parthenium hysterophorus*, *Euphorbia hirta*, *Amaranthus viridis*, *Chenopodium album*, *Portulaca oleracea* and *Celosia argentea*.

3. Results and Discussion

Table 2. monocot weeds (m^{-2}), dicot weeds (m^{-2}), Total Weeds (m^{-2}), Weed Dry Weight ($g\ m^{-2}$), Weed Control Efficiency (WCE %), Weed Index (WI %).

Tr No.	Treatments	Moncot Weeds (m^{-2})	Dicot Weeds (m^{-2})	Total Weeds (m^{-2})	Weed Dry Weight ($g\ m^{-2}$)	Weed Control Efficiency (WCE %)	Weed Index (WI %)
T ₁	Oxyflurofen 30EC @ 150g a.i./ha as PE fb 1 HW at 35 DAS	56.40 (8.01)	22.82 (5.28)	78.34 (9.35)	166.24 (13.39)	59.47	42.03
T ₂	RM Pendimethalin 30% +Imazethapyr 2% EC @860g a.i./ha as PE fb 1 HW at 35 DAS	20.98 (5.08)	12.53 (4.04)	33.51 (6.29)	74.21 (9.11)	81.91	6.42
T ₃	RM Diclosulam 0.9%+ Pendimethalin 35% SE @897.5 g a.i./ha as PE fb 1 HW at 35 DAS	45.34 (7.23)	21.38 (5.12)	66.05 (8.63)	128.54 (11.84)	68.67	25.26
T ₄	Quizalofop Ethyl 5%EC @ 40g a.i./ha as PoE(15-20 DAS) fb 1 HW at 35 DAS fb 1 HW at 35 DAS	51.55 (7.68)	27.98 (5.79)	77.45 (9.30)	221.21 (15.37)	46.08	49.44
T ₅	Imazethapyr 10 % SL @100g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS	59.44 (8.21)	30.58 (6.03)	90.09 (9.99)	175.36 (13.74)	57.25	46.48
T ₆	RM Imazethapyr 35 % + Imazamox 35 % WG @100g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS	42.47 (7.02)	16.81 (4.60)	59.06 (8.19)	111.18 (11.04)	72.9	15.46
T ₇	Farmers practice (HW at 20,40 and 60 DAS)	9.18 (3.53)	6.97 (3.14)	16.15 (4.52)	30.24 (6.00)	92.63	--
T ₈	Weedy Check	201.04 (14.68)	103.14(10.66)	304.18 (17.94)	410.25 (20.75)	--	65.99
	S.E m±	0.51	0.35	0.60	0.50	--	--
	CD (5%)	1.56	1.05	1.83	1.52	--	--

(Figures in parenthesis indicates square root transformation $\sqrt{X} + 0.5$)

Influenced of herbicides on monocot weeds

The data in respect of monocot weed count recorded at harvest are presented in table 1 revealed that, the monocot weed population significantly minimum monocot weeds (9.18) were counted in the treatment T₇-Farmer practice of 3 HW and found to be par with T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha fb 1 HW at

35 DAS as PE (20.98), while significantly the maximum monocot weeds were counted in the treatment T₈-Weedy check (201.04). Monocot weeds difficult to control because they are perennial species with deep rhizomes and tuberous roots that regenerate even after herbicide application. This underground reserve system makes them tolerant to most pre-emergence and post-emergence herbicides, leading to poor suppression in dolichos bean. However, Pendimethalin 30% + Imazethapyr 2% EC gives better result to control against monocot

weeds. Similar findings was reported by Rao *et al.* (2005)^[2] in cowpea, Patil and Jadhav (2014)^[3] in cluster bean.

Influenced of herbicides on dicot weeds

The data in respect of dicot weed count recorded at harvest are presented in table 1 revealed that, the dicot weed population significantly minimum dicot weeds (6.97) were counted in the treatment T₇-Farmer practice of 3 HW and found to be at par with the treatment T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha fb 1 HW at 35 DAS as PE (12.53). However, significantly the maximum dicot weeds were counted in the treatment T₈-Weedy check (103.14). Similar findings were earlier recorded by Meena *et al.* (2020)^[4] in cluster bean, Maurya *et al.* (2016)^[5] in pea, Manjunath and Hosmath (2016)^[6] in soyabean.

Influenced of herbicides on total weeds

The data in respect of total weed count recorded at harvest are presented in table 1 revealed that, the total weed population, significantly minimum total weed population (16.15) was recorded in the treatment T₇-Farmer practice of 3 HW which was found to be at par with treatment T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha fb 1 HW at 35 DAS as PE (33.51) and followed by the treatments T₆-RM Imazethapyr 35% + Imazamox 35% WG @ 100 g a.i./ha fb 1 HW at 35 DAS as PoE (59.06) and T₃- RM Diclosulam 0.9% + Pendimethalin 35% SE @897.5 g a.i./ha as PE fb 1 HW at 35 DAS (66.05). However, significantly the maximum total weed population was recorded in the treatment T₈-Weedy check (304.18). Similar findings reported by Subbalaxmi *et al.* (2021)^[7] in mungbean, Jhadhav *et al.* (2025)^[8] in soyabean.

Influenced of herbicides on dry matter of weeds

The data in respect of dry matter of weeds is recorded at harvest are presented in table 1 revealed that the, significantly the lowest weed dry matter was recorded in T₇-Farmers' practice (HW at 20,40,60 DAS) (30.24 g/m²). Among the herbicidal treatments, T₂- RM Pendimethalin 30% + Imazethapyr 2% EC @ 860g a.i./ha as PE fb 1 HW at 35 DAS (74.21 g/m²) and T₆-RM Imazethapyr 35 % + Imazamox 35 % WG @100g a.i /ha as PoE (15-20 DAS) fb 1 HW at 35 DAS (111.18 g/m²) recorded significantly lowest dry weight of weeds. However, significantly the highest dry matter was accumulated in T₈-Weedy check (410.25 g/m²). Similar findings reported by Doba and Maheriya (2021)^[9] in dolichos bean, Khairnair *et al.* (2013)^[10] in mungbean, Meena *et al.*(2020)^[4] in cluster bean, Maurya *et al.* (2016)^[5] in pea,

Weed control efficiency (%) as influenced by different herbicidal treatments

Weed control efficiency varied significantly across the treatments based on biomass suppression. Manual weeding (T₇) achieved the highest overall WCE of 92.63%. Among the herbicides, T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS delivered the superior chemical weed control efficiency of 81.91%, followed by the post-emergence ready-mix T₆ at 72.90%. Single-molecule applications like quizalofop-ethyl (T₄) and imazethapyr (T₅) recorded the lowest efficiencies at 46.08% and 57.25% respectively, due to their narrow control spectrum. Similar findings were earlier reported by Doba and Maheriya (2021)^[9] in dolichos bean, Manibharati *et al.* (2024)^[11] in cowpea.

Influence of herbicides on weed index

The weed index measurements showed that unchecked competition in (T₈) weedy check resulted in the highest crop yield loss of 65.99%. Among the herbicidal options, T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS registered the minimum weed index of 6.42%, indicating that this treatment effectively eliminated commercial yield losses. It was followed by T₆ with a moderate yield loss index of 15.46%. These findings confirm that integrating a broad-spectrum pre-emergence ready-mix

with a single hand weeding at 35 DAS (T₂) matches manual weeding effectiveness while optimizing labor expenses. Similar observations recorded by Doba and Maheriya (2021)^[9] in dolichos bean.

Influence of herbicide on plant height (cm)

The data in respect of plant height is recorded at harvest are presented in table 2 revealed that the, maximum plant height was recorded under farmers practice (71.30 cm). Among herbicidal treatments, T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS recorded 70.23 cm plant height. It was followed by T₃ (69.30 cm) and T₆ (67.37 cm). The minimum plant height was recorded in T₁ (55.43 cm), followed by the weedy check (57.27 cm). These results are similar to the findings Maurya *et al.* (2016)^[5] in vegetable pea, Shambhavi *et al.* (2025)^[12] in cluster bean, and Gurung *et al.* (2026)^[13] in vegetable cowpea.

Influence of herbicide on number of leaves

The data in respect of number of leaves is recorded at harvest are presented in table 2 revealed that the, at harvest, farmers' practice recorded the highest number of leaves (49.02 plant⁻¹). Among herbicidal treatments, T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS recorded 47.19 leaves plant⁻¹, followed by T₆ (45.23) and T₃ (42.54). The lowest number of leaves was observed under the T₈ - weedy check (33.63). These results are in agreement with earlier findings reported by Rawat *et al.* (2025)^[14] in garden pea, Shambhavi *et al.* (2025)^[12] in cluster bean.

Influence of herbicide on pod yield per plant (gr)

The data in respect of yield plant⁻¹ is recorded at harvest are presented in table 2 revealed that the, farmers practice recorded the highest pod yield per plant (96.83 g) which was found at par with herbicidal treatment T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS recorded the highest pod yield (90.61 g plant⁻¹), followed by T₆ (81.86 g) and T₃ (72.36 g). The minimum pod yield was recorded under the weedy check (32.93 g plant⁻¹). The higher yield under T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS, Similar findings regarding yield improvement under effective weed management practices were reported by Khairnair *et al.* (2013)^[10] in mungbean, Meena *et al.* (2020)^[4] in cluster bean, Maurya *et al.* (2016)^[5] in pea.

Effect on pod yield per plot (kg)

Pod yield per plot was significantly influenced by weed-management treatments. Farmers practice recorded 5.42 kg plot⁻¹ which is at par with treatment T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS recorded 5.07 kg plot⁻¹ and T₆ recorded 4.58 kg plot⁻¹. The lowest pod yield was observed in the weedy check (1.84 kg plot⁻¹). Thus, among the herbicidal treatments, T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS maintained the highest pod productivity per plot. Similar findings reported by Maurya *et al.* (2016)^[5] in pea, Manjunath and Hosmath (2016)^[6] in soyabean.

Effect on pod yield per hectare (q)

The experimental results indicated that effective weed management substantially improved pod yield on a hectare basis. The source document reports the highest yield under farmers' practice, while T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS was the leading herbicidal treatment with a reported yield of approximately 89.49 q ha⁻¹ in the results narrative. The weedy check recorded substantially lower yield.

The higher productivity under T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha as PE fb 1 HW at 35 DAS was associated with its superior weed suppression and better crop growth. Similar observations on weed control by cultural methods were reported by Doba and Maheriya (2021)^[9] in dolichos bean, Parushuraman *et al.* (2000)^[15] in cowpea.

Economics and B:C ratio

The results revealed that, GMR was influenced by different treatments. The highest GMR (Rs. 191260 ha⁻¹ (Choudhary *et al.*, 2007) [16]) and NMR (Rs. 107884 ha⁻¹ (Choudhary *et al.*, 2007) [16]) were recorded in T₇-Farmers' practice of three hand weedings, which proved superior over all other treatments. Among the herbicidal treatments, pre-emergence application of T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860g a.i./ha fb 1 HW at 35 DAS as PE registered maximum GMR (Rs. 178980 ha⁻¹ (Choudhary *et al.*, 2007) [16]) and NMR (Rs. 104304 ha⁻¹ (Choudhary *et al.*, 2007) [16]), followed by

T₆-RM Imazethapyr 35% + Imazamox 35% WG @ 100 g a.i./ha fb 1 HW at 35 DAS as PoE (Rs. 161700 ha⁻¹ (Choudhary *et al.*, 2007) [16] GMR and Rs. 81,024 ha⁻¹ (Choudhary *et al.*, 2007) [16] NMR). The lowest GMR (Rs. 65040 ha⁻¹ (Choudhary *et al.*, 2007) [16]) and NMR (Rs. -5836 ha⁻¹ (Choudhary *et al.*, 2007) [16]) were recorded in T₈-Weedy check. the treatment T₂-RM Pendimethalin 30% + Imazethapyr 2% EC @ 860g a.i./ha as PE fb 1 HW at 35 DAS (2.40) was the most profitable herbicidal treatment, followed by T₇-Farmers' practice (2.29). The lowest B:C ratio (1.08) was observed in T₈-Weedy check, similar observations recorded by Doba and Maheriya (2021)^[9] in dolichos bean, Thind *et al.* (1997)^[17] in cowpea.

Table 3. Plant height at harvest (cm), Leaves plant⁻¹, Days to 1st harvest, No. of pods plant⁻¹ Pod yield plot⁻¹ (kg), Pod yield hectare⁻¹, GMR (Rs/ha), Cost of cultivation (Rs/ha), B:C ratio.

Tr No.	Treatments	Plant height (cm)	Leaves plant ⁻¹	Number of pods plant ⁻¹	Pod yield plot ⁻¹ (kg)	Pod yield hectare ⁻¹ (q)	GMR (Rs/ha)	Cost of cultivation (Rs/ha)*	B:C ratio
T ₁	Oxyfluorfen 30EC @ 150g a.i./ha as PE fb 1 HW at 35 DAS	55.43	38.28	27.31	3.14	55.44	110880	79,901	1.38
T ₂	RM Pendimethalin 30% +Imazethapyr 2% EC @860g a.i./ha as PE fb 1 HW at 35 DAS	70.23	47.19	37.19	5.07	89.49	178980	74676	2.40
T ₃	RM Diclosulam 0.9%+ Pendimethalin 35% SE @897.5 g a.i./ha as PE fb 1 HW at 35 DAS	69.30	42.54	31.13	4.05	71.47	142940	76,701	1.86
T ₄	Quizalofop Ethyl 5%EC @ 40g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS fb 1 HW at 35 DAS	59.10	37.77	21.32	2.74	48.35	96700	75,076	1.28
T ₅	Imazethapyr 10 % SL @100g a.i./ha as PoE (15-20 DAS) fb 1 HW at 35 DAS	64.10	41.13	24.24	2.90	51.18	102360	74,826	1.36
T ₆	RM Imazethapyr 35 % + Imazamox 35 % WG @100g a.i. /ha as PoE (15-20 DAS) fb 1 HW at 35 DAS	67.37	41.13	33.27	4.58	80.85	161700	80,676	2.00
T ₇	Farmers practice (HW at 20,40 and 60 DAS)	71.30	49.02	40.25	5.42	95.63	191260	83376	2.29
T ₈	Weedy Check	57.27	33.63	20.23	1.84	32.52	65040	70,876	0.91
	S.E m±	2.46	1.50	0.79	0.23	2.41	--	--	--
	CD (5%)	7.45	4.55	2.41	0.69	7.31	--	--	--

Conclusion

On the basis of present investigation uncontrolled weed growth severely cuts dolichos bean productivity due to intense resource competition. While the farmers' practice of three hand (20,40,60 DAS) weedings yields the highest crop growth and pod productivity, it is heavily constrained by high labor costs. Among the herbicidal options, the pre-emergence application of ready-mix Pendimethalin 30% + Imazethapyr 2% EC @ 860 g a.i./ha followed by one hand weeding at 35 DAS is the most effective and profitable treatment. This broad-spectrum chemical method optimizes production expenses, yielding 89.49 q ha⁻¹ with a peak benefit-cost ratio of 2.40 and net returns of Rs. 104,304 ha⁻¹, similar observations recorded by Pandey *et al.* (2000)^[18] in pea.

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