



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(9): 683-667
Received: 06-07-2026
Accepted: 09-08-2026

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Effect of pre and post emergence herbicides on growth and Yield of tomato (*Solanum Lycopersicum* L.)

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9j.6588>

Abstract

A field experiment entitled “Effect of Pre and Post emergence Herbicides on Growth and Yield of Tomato” was conducted during *Kharif* 2025 at the College of Agriculture, Navile, Shivamogga, Karnataka, to evaluate the effect of different herbicidal weed management practices on the growth, yield and economics of tomato. The experiment was laid out in a randomized complete block design comprising eight treatments replicated thrice. Among the treatments, the weed-free check (T_7) recorded the highest growth and yield attributes. However, among the herbicidal treatments, post emergence application of halosulfuron-methyl 6% + metribuzin 50% WG @ 75 + 625 g a.i. ha^{-1} at 20 DAT (T_6) performed better and was statistically on par with the weed-free check for major growth and yield parameters. Treatment T_6 recorded higher plant height (124.20 cm), number of branches $plant^{-1}$ (34.60), fruits $plant^{-1}$ (46.80), fruit diameter (6.17 cm), individual fruit weight (84.20 g) and fruit yield (83.80 t ha^{-1}). Whereas T_6 recorded higher gross returns (₹20,96,267 ha^{-1}), net returns (₹18,70,067 ha^{-1}) and the highest benefit:cost ratio among the herbicidal treatments. Thus, post emergence application of halosulfuron-methyl 6% + metribuzin 50% WG @ 75 + 625 g a.i. ha^{-1} at 20 DAT was found to be an effective and economically viable weed management practice for improving the growth and productivity of tomato.

Keywords: Tomato, post emergence herbicides, halosulfuron-methyl + metribuzin, growth and yield

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the major vegetable crops cultivated in India and is valued for its nutritional and commercial importance. The fruits are a good source of vitamins, minerals and antioxidant compounds, particularly lycopene and vitamin C and constitute an important component of the human diet. In India, tomato is cultivated over about 8.53 lakh ha, with a production of 215.49 lakh tonnes and an average productivity of 25.3 t ha^{-1} . Karnataka is also an important tomato-growing state, with an area of about 0.71 lakh ha, production of 27.76 lakh tonnes and average productivity of approximately 39.1 t ha^{-1} (Anon., 2025)

Weed competition is one of the important constraints affecting the growth and productivity of tomato, especially during the initial stages of crop establishment. The comparatively slow initial growth of tomato and wider spacing between plants often provide favourable conditions for the emergence and growth of weeds. Once established, weeds compete with the tomato crop for essential resources such as soil moisture, nutrients, light and growing space, thereby restricting crop growth and ultimately reducing fruit yield. Although hand weeding is an effective method of weed control, its adoption is often limited by the non-availability of labour at the required time and the increasing cost of manual operations. Therefore, the use of suitable herbicides offers a practical and economical alternative for effective weed management and for minimizing crop-weed competition. Pre emergence herbicides can help in controlling the initial flush of weeds, whereas post emergence herbicides are useful in managing weeds that emerge during later stages of crop growth. However, the effectiveness of herbicide-based weed management depends largely on the herbicide selected, its dose and the stage of application. An appropriate herbicide programme should provide effective weed suppression without causing any adverse effects on the tomato crop, thereby enabling better utilization of available resources and supporting improved vegetative growth and fruit development. Hence, the present investigation was undertaken to

evaluate the effect of different pre and post emergence herbicides on the growth and yield of tomato.

Materials and Methods

A field experiment entitled “Effect of Pre and Post emergence Herbicides on Growth and Yield of Tomato” was conducted during *Kharif* 2025 at the College of Agriculture, Navile, Shivamogga, Karnataka. The experiment was laid out in a Randomized Complete Block Design (RCBD) with eight treatments replicated thrice. The treatments comprised two pre emergence herbicides consisting of pendimethalin 30% EC @ 0.75 kg a.i. ha⁻¹ (T₁) and oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha⁻¹ (T₂) and four post emergence herbicide treatments consisting of metribuzin 70% WP @ 0.52 kg a.i. ha⁻¹ (T₃), quizalofop-ethyl 5% EC @ 75 g a.i. ha⁻¹ (T₄), halosulfuron-methyl 75% WG @ 67.5 g a.i. ha⁻¹ (T₅) and a ready-mix combination of halosulfuron-methyl 6% + metribuzin 50% WG @ 75 + 625 g a.i. ha⁻¹ (T₆), along with weed-free (T₇) and weedy (T₈) checks. The pre emergence herbicides were applied at 3 DAT, whereas the post emergence herbicides were applied at 20 DAT. The weed-free treatment was maintained through hand weeding at 20, 40 and 60 DAT, and recommended agronomic practices were followed uniformly throughout the crop growth period. Observations on crop growth, yield attributes, fruit yield and economics were recorded at appropriate stages of crop growth. The experimental data obtained were subjected to analysis of variance (ANOVA) appropriate for RCBD as described by Gomez and Gomez (1984)^[2], and the significance of treatment effects was tested at the five per cent level of probability.

Results and Discussion

Plant height was significantly influenced by pre and post emergence herbicidal treatments at different growth stages (Table 1). At 30 DAT, hand weeding (T₇) recorded the highest plant height of 44.99 cm and was statistically on par with pendimethalin 30% EC (T₁), which recorded 42.83 cm. The weedy check (T₈) recorded the lowest plant height of 32.68 cm. At 60 DAT, hand weeding (T₇) recorded the highest plant height (96.67 cm), which was statistically on par with halosulfuron-methyl 6% + metribuzin 50% WG (T₆) (92.67 cm). At 90 DAT and harvest, T₇ recorded the highest plant height of 122.99 and 127.80 cm, respectively, and was statistically on par with T₆, which recorded 118.67 and 124.20 cm, respectively. The lowest plant height was recorded in the weedy check at all stages, with 67.30 cm at 90 DAT and 73.10 cm at harvest. The superior plant growth under hand weeding and effective herbicidal treatments may be attributed to reduced crop-weed competition, which ensured better availability of moisture, nutrients, light and growing space for tomato plants. These favourable conditions promoted improved vegetative growth and resulted in greater plant height. Similar improvement in tomato plant height under effective weed management has been reported by Mohamed and Abdalla (2023)^[6]. Number of branches per plant was also significantly influenced by the pre and post emergence herbicidal treatments at different stages of crop growth (Table 2). Hand weeding (T₇) recorded the highest number of branches per plant at 30, 60, 90 DAT and harvest, with values of 11.20, 19.50, 30.37 and 35.97, respectively. At 60 DAT, T₇ was statistically on par with halosulfuron-methyl 6% + metribuzin 50% WG (T₆), which recorded 19.00 branches per plant. A similar trend was observed at 90 DAT and harvest, where T₆ recorded 29.67 and 34.60 branches per plant, respectively, and remained on par with the weed-free treatment. Metribuzin 70% WP (T₃) was the next best treatment, whereas the weedy check (T₈) recorded the lowest

number of branches at all stages, with values of 7.30, 11.10, 20.90 and 26.40, respectively. The increased branching under effective weed control may be attributed to reduced crop-weed competition and improved availability of moisture and nutrients, which enhanced photosynthetic efficiency and assimilate production, thereby promoting the initiation and development of axillary buds. Similar findings were reported by Sharma *et al.* (2016)^[7], Kavitha *et al.* (2021) and Mohamed and Abdalla (2023)^[6].

Dry matter accumulation was significantly affected by pre and post emergence herbicidal treatments at different crop growth stages (Table 3). Hand weeding (T₇) recorded the highest dry matter accumulation of 32.13, 67.20, 103.18 and 113.16 g plant⁻¹ at 30, 60, 90 DAT and harvest, respectively. At 60 DAT onwards, T₇ was statistically on par with halosulfuron-methyl 6% + metribuzin 50% WG (T₆), which recorded 65.18, 96.73 and 105.10 g plant⁻¹ at 60, 90 DAT and harvest, respectively. Metribuzin 70% WP (T₃) was the next best treatment, recording 28.40, 61.00, 94.06 and 103.23 g plant⁻¹ at the respective stages. In contrast, the weedy check (T₈) recorded the lowest dry matter accumulation throughout the crop growth period. The greater accumulation of dry matter under hand weeding and effective herbicidal treatments may be attributed to reduced competition from weeds, which improved interception of light and enhanced nutrient and water availability. These favourable conditions promoted photosynthetic efficiency and biomass production, resulting in greater dry matter accumulation. Similar findings were reported by Mahajan *et al.* (2020)^[5] and Yousuf *et al.* (2023)^[10]. Leaf area was significantly influenced by pre and post emergence herbicidal treatments at different stages of crop growth (Table 4). Hand weeding (T₇) recorded the maximum leaf area of 1888.33, 3645.00, 3882.53 and 4132.61 cm² plant⁻¹ at 30, 60, 90 DAT and harvest, respectively. At 60 DAT and subsequent stages, T₇ was statistically on par with halosulfuron-methyl 6% + metribuzin 50% WG (T₆), which recorded 3420.00, 3628.67 and 3887.87 cm² plant⁻¹ at 60, 90 DAT and harvest, respectively. Metribuzin 70% WP (T₃) recorded the next higher leaf area, whereas the weedy check (T₈) recorded the lowest values throughout the crop growth period. The increased leaf area under effective weed management may be attributed to better availability of nutrients, moisture and sunlight, which promoted rapid cell division and expansion, resulting in improved canopy development and a larger photosynthetically active leaf surface. Similar findings were reported by Mohamed and Abdalla (2023)^[6], and Yousuf *et al.* (2023)^[10]. Pre and post emergence herbicidal treatments significantly influenced the yield attributes and fruit yield of tomato (Table 5). Hand weeding (T₇) recorded the highest number of fruits per plant (59.93), fruit diameter (6.37 cm), individual fruit weight (146.67 g), fruit yield per plant (5.81 kg) and fruit yield (107.60 t ha⁻¹). However, these values were statistically on par with halosulfuron-methyl 6% + metribuzin 50% WG (T₆), which recorded 46.80 fruits per plant, a fruit diameter of 6.17 cm, individual fruit weight of 84.20 g, fruit yield per plant of 3.94 kg and fruit yield of 83.80 t ha⁻¹. Among the remaining herbicidal treatments, metribuzin 70% WP (T₃) recorded the next higher values for the yield attributes and fruit yield, whereas the weedy check (T₈) recorded the lowest values. The higher yield attributes and fruit yield under hand weeding and T₆ may be attributed to effective reduction in crop-weed competition during the critical period of crop growth. Better availability of moisture, nutrients, light and growing space would have promoted vegetative growth, enhanced photosynthetic activity and increased assimilate production. The greater availability and translocation of assimilates towards developing fruits might have resulted in improved fruit set, fruit size,

individual fruit weight and ultimately higher fruit yield. The considerably lower yield under the weedy check indicated the adverse effect of continuous weed competition on crop growth and productivity. Similar improvement in tomato yield under effective weed management has been reported by Kumar *et al.* (2014) ^[4].

Among the different weed management treatments, the weed-free check (T₇) recorded the highest gross returns (₹17,70,000 ha⁻¹) and net returns (₹13,53,258 ha⁻¹). However, halosulfuron-methyl

6% + metribuzin 50% WG (T₆) recorded the highest B:C ratio (4.44), followed by the weed-free check (T₇) (4.24) and metribuzin 70% WP (T₃) (4.17), whereas the weedy check (T₈) recorded the lowest net returns (₹4,09,293 ha⁻¹) and B:C ratio (2.38) (Table 6). The higher economic efficiency of T₆ might be attributed to effective weed control and higher fruit yield coupled with comparatively lower labour and cultivation costs than repeated hand weeding. Similar findings were reported by Sharma *et al.* (2024) ^[8]. and Patel *et al.* (2024).

Table 1: Plant height (cm) at different growth stages as influenced by pre and post emergence herbicides in tomato

Treatments		Plant height (cm)			
		30 DAT	60 DAT	90 DAT	At harvest (120 DAT)
T ₁	Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	42.83	81.00	92.33	98.20
T ₂	Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	40.10	84.33	96.00	102.00
T ₃	Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	39.47	86.53	107.00	111.00
T ₄	Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	36.87	77.67	86.33	92.47
T ₅	Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	39.05	86.33	98.00	104.30
T ₆	Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	39.86	92.67	118.67	124.20
T ₇	Hand weeding (at 20,40,60 DAT)	44.99	96.67	122.99	127.80
T ₈	Weedy check (Untreated control)	32.68	62.00	67.30	73.10
S. Em. (±)		1.44	3.15	4.07	4.31
C.D. (p=0.05)		4.39	9.56	12.37	13.09

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Table 2: Number of branches per plant at different growth stages as influenced by pre and post emergence herbicides in tomato

Treatments		Number of branches per plant			
		30 DAT	60 DAT	90 DAT	At harvest (120 DAT)
T ₁	Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	10.81	15.20	22.00	30.80
T ₂	Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	10.03	15.80	22.80	31.60
T ₃	Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	9.80	17.40	25.80	32.23
T ₄	Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	8.90	14.30	21.10	28.90
T ₅	Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	9.40	15.90	23.60	31.90
T ₆	Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	9.96	19.00	29.67	34.60
T ₇	Hand weeding (at 20,40,60 DAT)	11.20	19.50	30.37	35.97
T ₈	Weedy check (Untreated control)	7.30	11.10	20.90	26.40
S. Em. (±)		0.34	0.66	0.89	1.16
C.D. (p=0.05)		1.03	2.02	2.71	3.52

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Table 3: Total dry matter accumulation (g plant⁻¹) at different growth stages as influenced by pre and post emergence herbicides in tomato

Treatments		Total dry matter accumulation (g plant ⁻¹)			
		30 DAT	60 DAT	90 DAT	At harvest (120 DAT)
T ₁	Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	29.80	52.00	88.16	96.96
T ₂	Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	28.53	53.33	93.00	98.70
T ₃	Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	28.40	61.00	94.06	103.23
T ₄	Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	23.40	43.77	89.90	90.53
T ₅	Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	26.30	58.67	93.97	101.06
T ₆	Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	28.70	65.18	96.73	105.10
T ₇	Hand weeding (at 20,40,60 DAT)	32.13	67.20	103.18	113.16
T ₈	Weedy check (Untreated control)	19.17	29.38	84.60	82.57
S. Em. (±)		1.07	1.80	2.79	2.89
C.D. (p=0.05)		3.25	5.54	8.59	8.90

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Table 4: Leaf area (cm² plant⁻¹) at different growth stages as influenced by pre and post emergence herbicides in tomato

Treatments	Leaf area (cm ² plant ⁻¹)			
	30 DAT	60 DAT	90 DAT	At harvest (120 DAT)
T ₁ Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	1753.20	2770.00	3069.67	3532.73
T ₂ Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	1665.57	2800.00	3137.67	3550.53
T ₃ Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	1598.40	3350.00	3308.00	3734.00
T ₄ Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	1350.00	1958.33	2542.67	3003.00
T ₅ Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	1498.90	3020.00	3181.33	3613.67
T ₆ Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	1632.80	3420.00	3628.67	3887.87
T ₇ Hand weeding (at 20,40,60 DAT)	1888.33	3645.00	3882.53	4132.61
T ₈ Weedy check (Untreated control)	1120.33	1393.33	2132.73	2567.13
S. Em. (±)	61.66	80.99	95.52	116.98
C.D. (p=0.05)	187.04	249.44	294.20	354.85

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Table 5: Yield parameters as influenced by pre and post emergence herbicides in tomato

Treatments	Number of fruits per plant	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield per plant (kg)	Fruit yield per ha (tonnes)
T ₁ Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	39.80	5.13	77.40	3.08	67.40
T ₂ Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	41.20	5.40	78.80	3.25	70.90
T ₃ Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	44.60	5.73	82.10	3.66	78.90
T ₄ Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	38.70	4.37	75.80	2.93	63.90
T ₅ Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	42.90	5.05	80.53	3.45	74.80
T ₆ Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	46.80	6.17	84.20	3.94	83.80
T ₇ Hand weeding (at 20,40,60 DAT)	48.80	6.37	86.40	4.22	88.50
T ₈ Weedy check (Untreated control)	29.20	3.77	67.47	2.10	35.23
S. Em. (±)	1.73	0.15	3.40	0.13	3.31
C.D. (p=0.05)	5.27	0.46	10.32	0.42	10.06

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Table 6: Economics in tomato as influenced by pre and post emergence herbicides

Treatments	Cost of cultivation (₹ ha ⁻¹)	Gross Returns (₹ ha ⁻¹)	Net Returns (₹ ha ⁻¹)	B:C Ratio
T ₁ Pendimethalin 30% EC @ 0.75 kg a.i. ha ⁻¹ as PE (3 DAT)	3,65,292	13,48,000	9,82,708	3.69
T ₂ Oxyfluorfen 23.5% EC @ 0.125 kg a.i. ha ⁻¹ as PE (3 DAT)	3,66,114	14,18,000	10,51,886	3.87
T ₃ Metribuzin 70%WP, 0.52 kg a.i. ha ⁻¹ as POE (20 DAT)	3,78,192	15,78,000	11,99,808	4.17
T ₄ Quizalofop ethyl 5% EC @ 75 g a.i. ha ⁻¹ as POE (20 DAT)	3,61,342	12,78,000	9,16,658	3.53
T ₅ Halosulfuron methyl 75% WG 67.5 g a.i. ha ⁻¹ as POE (20 DAT)	3,79,482	14,96,000	11,16,518	3.94
T ₆ Halosulfuron methyl 6% + Metribuzin 50% WG (75 g +625 g) a.i. ha ⁻¹ as POE (20 DAT)	3,76,942	16,76,000	12,99,058	4.44
T ₇ Hand weeding (at 20,40,60 DAT)	4,16,742	17,70,000	13,53,258	4.24
T ₈ Weedy check (Untreated control)	2,95,373	7,04,666	4,09,293	2.38
S. Em. (±)	-	66,333	66,333	-
C.D. (p=0.05)	-	2,01,201	2,01,201	-

Note: PE: Pre emergence, POE: Post emergence, DAT: Days after transplanting, EC: Emulsifiable Concentrate, WP: Wettable Powder, WG: Water Dispersible Granules.

Conclusion

Based on the results of the present investigation, the weed-free check (T₇) recorded superior growth and yield performance in tomato. However, among the herbicidal treatments, post emergence application of halosulfuron-methyl 6% + metribuzin 50% WG @ 75 + 625 g a.i. ha⁻¹ at 20 DAT (T₆) produced growth and yield parameters comparable with the weed-free check and remained statistically on par for most of the important observations. In addition, T₆ recorded the highest B:C ratio (4.44), indicating its greater economic advantage. Therefore, the application of halosulfuron-methyl 6% + metribuzin 50% WG at 20 DAT can be considered an effective and economically viable herbicidal option for improving the growth, fruit yield and profitability of tomato.

Reference

- Anonymous. First advance estimates of area and production of horticultural crops for 2024-25. New Delhi: Department of Agriculture and Farmers Welfare, Government of India; 2025.
- Gomez KA, Gomez AA. Statistical procedures for agricultural research. New York: John Wiley and Sons; 1984.
- Kavitha MP, Maheswari MU, Krishna K, Balaji G, Yuvaraj R, Sachin R, *et al.* Effect of weed management treatments on growth and yield of tomato. Indian J Weed Sci. 2021;53(1):114-116.
- Kumar RS, Nagaraju N, Reddy PS. Effect of weed competition on growth and yield of tomato under different weed management practices. Int J Agric Sci. 2014;10(2):567-571.

5. Mahajan A, Kumar A, Puniya R, Stanzen L, Sharma A, Sharma RK. Effect of pre and post emergence herbicides on growth of summer urdbean and associated weeds. *Ann Agric Res New Ser.* 2020;41(1):1-5.
6. Mohamed IA, Abdalla RM. Weed control, growth and yield of tomato after application of metribuzin and different pendimethalin products in Upper Egypt. *J Soil Sci Plant Nutr.* 2023;23(2):1948-1964.
7. Sharma NK, Mundra SL, Kalita S. Effect of weed control on growth and productivity of soybean. *Indian J Weed Sci.* 2016;48(1):90-92.
8. Sharma S, Tomar V, Tiwari NK, Behl RK, Sharma PK, Singh J, *et al.* Effect of pre- and post-emergence herbicide application on the growth and yield of late-sown wheat (*Triticum aestivum* L.). *Int J Res Agron.* 2024;7(6):711-714.
9. Patel P, Kulkarni S, Shwetha BN, Bellakki MA. Efficacy of pre and post emergent herbicides on weed and yield parameters of rice bean (*Vigna umbellata* L.). *Int J Res Agron.* 2024;7(11):275-278.
10. Yousuf M, Sharma RK, Sirazuddin, Negi V, Mishra RK, Rama Raju T. Evaluation of pre and post emergence herbicides for weed control on growth and yield in chickpea. *Int J Environ Clim Change.* 2023;13(11):932-936.