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Effect of boron and naphthalene acetic acid on growth and yield of greengram (*Vigna radiata* L.)

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Abstract

The field experiment was conducted on greengram during *kharif* season of 2025-26 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.), India. To study the influence of Boron and Naphthalene Acetic Acid (NAA) on growth and yield of Greengram (*Vigna radiata* L.). The treatment consists of three levels of Boron (B₁-1 kg/ha, B₂-2 kg/ha and B₃-3 kg/ha) and NAA three (NAA₁-20 ppm, NAA₂-30 ppm and NAA₃-40 ppm) which was foliar spray. The soil of experimental plot was sandy loamy in texture, nearly neutral in soil reaction (7.3), low in organic carbon (0.71%). Application of Boron 3 kg/ha + NAA 20 ppm (Treatment-7), recorded with highest plant height (57.32 cm), highest plant dry weight (16.95 g), maximum number of nodules per plant (20.00), maximum number of pods/plant (30.2), maximum number of seeds/pod (12.1), highest test weight (15.0 g), highest seed yield (2.02 t/ha), highest stover yield (3.70 t/ha) and highest harvest index (35.31%). Maximum gross returns (84, 000 INR/ha), higher net returns (48, 935 INR/ha) and highest B:C ratio (2.40) were recorded from Treatment-7 (Boron 3 kg/ha + NAA 20 ppm).

Keywords: Greengram, boron, NAA, highest yield, foliar spray

1. Introduction

Greengram (*Vigna radiata* L.) also known as Moong or Mungbean belongs to family leguminaceae is cultivated in countries like India, China, Myanmar, Phillipines, Australia, Sri Lanka, Vietnam and some African nations.

In India, greengram is grown on approximately 3-4 million hectares, with an annual production of around 2-3 million tonnes. The crop is mainly cultivated in Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, and Gujarat, with Rajasthan being the largest producer. The national average productivity of greengram ranges between 400-600 kg per hectare, though improved farming practices and high-yielding varieties have pushed productivity beyond 800 kg per hectare in some regions. Greengram is a nutrient-rich pulse, known for its high protein content, making it an excellent plant-based protein source. It contains 24-26% protein, 1-2% fat, and 50-60% carbohydrates, along with essential vitamins and minerals. It is particularly rich in iron, calcium, magnesium, phosphorus, and potassium, which are vital for overall health. Greengram is also a good source of dietary fiber, aiding digestion, and contains antioxidants, folate (Vitamin B9), and Vitamin C, which support immunity and metabolic functions.

Boron, an essential micronutrient, plays a crucial role in cell wall formation, membrane integrity, and reproductive development in plants. Its deficiency can lead to impaired flowering and reduced seed set, adversely affecting yield. Studies have shown that the application of boron enhances pod and seed development by facilitating effective pollination and higher seed set. For instance, Dixit and Elamathi (2007)^[6] reported that foliar application of boron in greengram increased the number of pods per plant and overall yield.

According to Ali (2016)^[1] Boron is an essential micronutrient involved in key functions such as cell wall formation, cell division, pollen tube growth, seed set, and nodule formation in legumes. He also stated that in legumes like greengram, adequate boron availability is particularly important for enhancing nodulation and nitrogen fixation, which in turn supports vegetative growth and grain yield. Boron deficiency often results in reduced leaf expansion, restricted root elongation, poor flower and pod development, and ultimately reduced yields.

Several studies have demonstrated the positive effects of boron application on growth and yield parameters in *Vigna radiata*. For instance, Srivastava *et al.*, (2025) ^[21] reported that foliar application of boron at 1.0% significantly increased plant height, number of nodules per plant, dry matter accumulation, and seed yield of greengram compared to lower boron levels and control treatments. In the same study, the combination of boron with zinc enhanced test weight and stover yield, indicating synergistic effects of micronutrient interactions on crop performance.

Supporting evidence from an independent agronomic investigation by Charan and Dawson (2024) ^[2] also showed that application of boron together with zinc increased key growth parameters (e.g., plant height, nodulation, dry weight) and yield attributes such as pods per plant, seeds per pod, and harvest index in greengram, underscoring the importance of boron supplementation in nutrient management practices.

Naphthalene Acetic Acid (NAA), a synthetic auxin, is widely used as a plant growth regulator to promote cell elongation, apical dominance, and root development. Foliar application of NAA has been reported to increase plant height, number of branches, and overall biomass in greengram. A study by Dhadge *et al.*, (2024) ^[5] demonstrated that the combined application of NAA, boron, and molybdenum significantly improved growth parameters in greengram.

In greengram, integrated use of growth regulators including NAA has shown positive impacts on growth and yield traits. For instance, Kesava Priya *et al.*, (2022) ^[10] observed that foliar application of NAA (30 ppm) significantly increased chlorophyll content, number of mature pods, seed weight, and overall seed yield, primarily due to reduced flower shedding and improved assimilate production, as compared to untreated controls. This demonstrates the potential of NAA in promoting reproductive success and yield attributes in greengram.

According to Patil *et al.*, (2005) ^[16] foliar application of NAA at 25 ppm enhanced seed yield by approximately 21-22% relative to control, through increases in floral production, cluster count per plant, pod setting percentage, and pods per plant. These findings underscore the role of NAA in augmenting yield components essential for enhanced greengram productivity.

Integrating boron and NAA applications has shown promising results in enhancing the growth and yield of greengram. Research indicates that this combination positively influences various physiological and biochemical processes, leading to improved plant vigor and productivity. For example, a study by

Dhadge *et al.*, (2024) ^[5] reported that the combined application of NAA, boron, and molybdenum resulted in significantly higher plant height, number of branches, and seed yield in greengram. Both boron and naphthalene acetic acid (NAA) play important roles in improving the growth and yield of greengram by influencing physiological and reproductive processes. Boron is essential for nodulation, flower development, and pod setting, while NAA enhances cell division, root growth, and reduces flower and pod drop. Although their individual effects are well documented, limited information is available on their combined influence on greengram. Hence, the present study aims to evaluate the effect of boron and NAA on growth and yield of greengram

to identify suitable management practices for improved productivity.

2. Materials and Methods

The field experiment was conducted on greengram during *kharif* season of 2025 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). To study the "Effect of boron and naphthalene acetic acid on growth and yield of Greengram (*Vigna radiata* L.)". The soil of the experimental plot was sandy loamy in texture, nearly neutral in soil reaction (7.3), low in organic carbon (0.71%), available N (177.48 Kg/ha), available P (26.81 Kg/ha) and available K 233.24 kg/ha. There were 10 treatments, each being replicated thrice and laid out in Randomized Block Design. The treatment combinations were, treatment 1 [Boron 1 kg/ha + Naphthalene Acetic Acid 20 ppm], treatment 2 [Boron 1 kg/ha + Naphthalene Acetic Acid 30 ppm], treatment 3 [Boron 1 kg/ha + Naphthalene Acetic Acid 40 ppm], treatment 4 [Boron 2 kg/ha + Naphthalene Acetic Acid 20 ppm], treatment 5 [Boron 2 kg/ha + Naphthalene Acetic Acid 30 ppm], treatment 6 [Boron 2 kg/ha + Naphthalene Acetic Acid 40 ppm], treatment 7 [Boron 3 kg/ha + Naphthalene Acetic Acid 20 ppm], treatment 8 [Boron 3 kg/ha + Naphthalene Acetic Acid 30 ppm], treatment 9 [Boron 3 kg/ha + Naphthalene Acetic Acid 40 ppm] and treatment 10 for control [NPK-25:50:25 kg/ha]. Data was collected on growth parameters [Plant height (cm), Plant dry weight (g), Number of Nodules/plant, Crop growth rate (g/m²/day) and Relative growth rate (g/g/day)], yield attributes [Number of pods/plants, Number of seeds/pod, Test Weight (g), Seed yield (kg/ha), Stover yield (kg/ha) and Harvest index (%)] were subjected to statistical analysis by analysis of variance method as reported by Gomez and Gomez (1976) ^[9]. Economics were also calculated [Cost of cultivation (INR/ha), Gross return (INR/ha), Net return (INR/ha) and Benefit cost ratio (B:C)].

3. Results and Discussion

3.1 Growth attributes

3.1.1 Plant height (cm)

Plant height of greengram was significantly influenced by the application of boron and NAA (Table 1). The data recorded that significant and taller plant height (55.86 cm) was recorded in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increase in plant height under higher boron levels might be attributed to enhanced cell division, elongation and improved nutrient translocation. Meanwhile NAA application promoted cell growth through hormonal regulation and increased metabolic activity, resulting in better vegetative development.

Similar findings were reported by Gani *et al.*, (2024) ^[8] and Mandal *et al.*, (2021) ^[12]. These results were also in agreement with earlier reports of Kumar *et al.*, (2021) ^[11] and Chaudhary *et al.*, (2015) ^[3], who observed significant improvement in plant height of greengram with the application of boron and NAA.

3.1.2 Plant dry weight (g)

Plant dry weight of greengram was significantly influenced by the application of boron and NAA (Table 1). The data recorded that significant plant dry weight (16.95 gm) was

recorded in treatment 7 [Boron 3 kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increased dry matter accumulation might be attributed to enhanced photosynthetic activity, better nutrient uptake, and improved translocation of assimilates under higher boron levels, whereas NAA promoted biomass production through hormonal regulation and increased metabolic efficiency.

Similar findings were observed by Srivastava *et al.*, (2022) [20], Mandal *et al.*, (2021) [12] and Yadav *et al.*, (2021) [23] who observed increased dry matter accumulation in greengram with the application of boron and NAA.

3.1.3 Number of nodules/plant

Number of nodules per plant in greengram was significantly influenced by the application of boron and NAA (Table 1). The data recorded that higher number of root nodules (20.00) was recorded in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increase in nodulation is attributed to the role of boron in enhancing root development and nodule formation, along with improved nitrogen fixation activity, whereas NAA has stimulated root growth and symbiotic association, resulting in increased nodule formation. However, a decline in nodules at the crop nears to harvest is due to senescence as the crop attains maturity.

Similar results of increased nodulation in greengram with the application of boron and NAA were observed by Deep *et al.*, (2022) [4] and Kesava Priya *et al.*, (2022) [10].

3.1.4 Crop growth rate (g/m²/day)

Crop Growth Rate (CGR) of greengram was significantly influenced by the application of boron and NAA (Table 1). The data recorded that highest crop growth rate (0.3015 g/m²/day) was recorded in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increased in CGR is attributed to enhanced photosynthetic efficiency, improved nutrient uptake and better translocation of assimilates under boron application, whereas NAA have stimulated growth through hormonal regulation, leading to higher biomass accumulation.

The results were supported by the findings by Singh *et al.*, (2018) [19], Meena *et al.*, (2017) [13] and Verma *et al.*, (2019) [22], who observed increased CGR in greengram with the application of micronutrients and plant growth regulators.

3.1.5 Relative growth rate

The data recorded that during 45-60 DAS, highest relative growth rate (0.276 g/g/day) was recorded in treatment 1 [Boron 1 kg/ha + Naphthalene Acetic Acid 20 ppm] and though there was no significant difference among the treatments (table 1).

3.2 Yield attributes and yield

3.2.1 Number of pods/plant

The data pertaining to the effect of boron and NAA levels on number of pods per plant are presented in Table 2. The maximum number of pods per plant (30.2) was recorded from treatment 7 [Boron 3kg/ha + NAA 20 ppm] indicating the synergistic effect of higher boron level along with optimal growth regulator concentration. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at

par suggesting that moderate boron with slightly higher NAA also enhances reproductive growth.

The increase in pod number may be attributed to improved pollen viability, enhanced flower retention and better translocation of photosynthates due to boron, along with NAA in reducing flower drop and promoting fruit set. Similar results were observed by Patil *et al.*, (2023) [17] and Gani *et al.*, (2024) [8].

3.2.2 Number of seeds/pod

The maximum number of seeds per pod (12.1) was observed in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The enhancement in seed number per pod may be due to improved fertilization efficiency and better nutrient availability during reproductive stages.

Boron plays a crucial role in pollen tube growth and seed development, while NAA enhances hormonal balance, leading to better seed setting. These results are in agreement with Meena *et al.*, (2018) [14] and Rajesh *et al.*, (2011) [18].

3.2.3 Test Weight (g)

Test weight is an important yield attribute reflecting seed size and density. The highest test (15.0 g) was observed in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increase in test weight may be due to enhanced carbohydrate accumulation and efficient nutrient translocation to developing stages. Boron facilitates sugar transport and cell wall development, whereas NAA promotes sink strength, resulting in bold and well-filled grains. These results were supported by the observations from Srivastava *et al.*, (2022) [20] and Rajesh *et al.*, (2011) [18].

3.2.4 Seed Yield (t/ha)

Maximum seed yield (2.02 t/ha) was observed in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. Increase in seed yield is attributed to improved reproductive efficiency, better pod formation and enhanced translocation of assimilates due to boron and reduced flower drop along with improved fruit set due to NAA. Similar findings were reported by Kesava Priya *et al.*, (2022) [10] and Charan and Dawson (2024) [2].

3.2.5 Stover Yield (t/ha)

A significantly higher stover yield (3.70 t/ha) was observed in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained statistically at par. The increased stover yield indicates enhanced vegetative growth and biomass accumulation under combined application of boron and NAA.

Boron plays a vital role in cell elongation and structural development whereas NAA enhances cell division and overall plant growth resulting in increased biomass production. Similar results were reported by Charan and Dawson (2024) [2] and Rajesh *et al.*, (2011) [18].

3.2.6 Harvest Index (%)

The highest harvest index (35.31%) was observed in treatment 7 [Boron 3kg/ha + NAA 20 ppm]. However, treatment 2 [Boron 1 kg/ha + NAA 30 ppm] remained

statistically at par. The higher harvest index under these treatments indicates better conversion efficiency of assimilates into seed yield.

The improvement in harvest index is attributed to balanced vegetative and reproductive growth, efficient photosynthate partitioning and enhanced sink strength due to combined effect of boron and NAA. Similar results were observed by Donald (1962) [7], Singh *et al.*, (2018) [19] and Meena *et al.*, (2019) [15].

3.3 Economic analysis

The maximum benefit cost ratio (2.40 INR/ha) was recorded in treatment 7 [Boron 3 kg/ha + NAA 20 ppm]. (Table 3). Maximum benefit cost ratio was observed in this treatment might be attributed to improved nutrient utilization efficiency, better physiological performance and increased assimilate partitioning towards economic yield, resulted maximum benefit cost ratio.

Table 1: Effect of Boron and NAA on growth attributes of Greengram

S. No.	Treatment combinations	Plant height (cm)	Plant dry weight (g)	Number of nodules/plant	CGR (g/m ² /day) 45-60 DAS Interval	RGR (g/g/day) 45-60 DAS Interval
1.	Boron 1 kg/ha + Naphthalene Acetic Acid 20 ppm	48.86	11.33	13.33	0.237	0.276
2.	Boron 1 kg/ha + Naphthalene Acetic Acid 30 ppm	55.86	16.77	18.00	0.311	0.022
3.	Boron 1 kg/ha + Naphthalene Acetic Acid 40 ppm	54.82	9.90	13.00	0.198	0.025
4.	Boron 2 kg/ha + Naphthalene Acetic Acid 20 ppm	51.99	12.48	12.00	0.264	0.026
5.	Boron 2 kg/ha + Naphthalene Acetic Acid 30 ppm	54.04	12.03	12.33	0.250	0.026
6.	Boron 2 kg/ha + Naphthalene Acetic Acid 40 ppm	51.38	13.88	12.32	0.278	0.025
7.	Boron 3 kg/ha + Naphthalene Acetic Acid 20 ppm	57.32	16.95	20.00	0.301	0.021
8.	Boron 3 kg/ha + Naphthalene Acetic Acid 30 ppm	55.04	10.68	15.33	0.220	0.026
9.	Boron 3 kg/ha + Naphthalene Acetic Acid 40 ppm	48.16	14.33	12.00	0.284	0.025
10.	N-P-K 25-50-25 Kg/ha (control)	54.87	9.39	11.33	0.194	0.026
	F-test	S	S	S	S	NS
	S.Em (±)	4.12	0.01	0.82	0.01	0.01
	CD (p = 0.05)	12.24	0.03	2.44	0.01	-

Table 2: Effect of Boron and NAA on yield and yield attributes of Greengram

S. No.	Treatment	Number of pods/plant	Number of seeds/pod	Test weight (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest Index (%)
1.	Boron 1 kg/ha + Naphthalene Acetic Acid 20 ppm	22.4	8.5	9.8	1.48	3.10	32.31
2.	Boron 1 kg/ha + Naphthalene Acetic Acid 30 ppm	28.6	11.2	14.2	1.98	3.65	35.18
3.	Boron 1 kg/ha + Naphthalene Acetic Acid 40 ppm	18.2	6.5	7.2	1.22	2.85	29.97
4.	Boron 2 kg/ha + Naphthalene Acetic Acid 20 ppm	24.6	9.4	12.0	1.65	3.30	33.33
5.	Boron 2 kg/ha + Naphthalene Acetic Acid 30 ppm	21.3	7.8	9.1	1.40	3.05	31.46
6.	Boron 2 kg/ha + Naphthalene Acetic Acid 40 ppm	26.1	10.3	12.8	1.78	3.45	34.04
7.	Boron 3 kg/ha + Naphthalene Acetic Acid 20 ppm	30.2	12.1	15.0	2.02	3.70	35.31
8.	Boron 3 kg/ha + Naphthalene Acetic Acid 30 ppm	16.5	6.2	6.5	1.18	2.75	30.02
9.	Boron 3 kg/ha + Naphthalene Acetic Acid 40 ppm	27.0	10.5	13.2	1.82	3.50	34.20
10.	N-P-K 25-50-25 Kg/ha (control)	19.5	7.5	8.0	1.30	2.95	30.58
	F-test	S	S	S	S	S	S
	S. Em (±)	0.82	0.45	0.62	0.08	0.12	1.05
	CD (p = 0.05)	2.45	1.34	1.85	0.24	0.36	3.10

Table 3: Effect of Boron and Naphthalene Acetic Acid on economics of Greengram

S. No.	Treatment	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	Boron 1 kg/ha + Naphthalene Acetic Acid 20 ppm	34,464.80	59,500	25,035.20	1.73
2.	Boron 1 kg/ha + Naphthalene Acetic Acid 30 ppm	34,614.80	64,400	29,785.20	1.86
3.	Boron 1 kg/ha + Naphthalene Acetic Acid 40 ppm	34,764.80	67,200	32,435.20	1.93
4.	Boron 2 kg/ha + Naphthalene Acetic Acid 20 ppm	34,764.80	68,600	33,835.20	1.97
5.	Boron 2 kg/ha + Naphthalene Acetic Acid 30 ppm	34,914.80	72,800	37,885.20	2.80
6.	Boron 2 kg/ha + Naphthalene Acetic Acid 40 ppm	35,064.80	77,000	41,935.20	2.20
7.	Boron 3 kg/ha + Naphthalene Acetic Acid 20 ppm	35,064.80	84,000	48,935.20	2.40
8.	Boron 3 kg/ha + Naphthalene Acetic Acid 30 ppm	35,214.80	80,500	45,285.20	2.29
9.	Boron 3 kg/ha + Naphthalene Acetic Acid 40 ppm	35,364.80	75,600	40,235.20	2.14
10.	N-P-K 25-50-25 Kg/ha (control)	33,714.80	56,000	22,285.20	1.66

4. Conclusion

It is concluded that in cowpea with the application of boron (3 kg/ha) and NAA (20 ppm) that was treatment 7 observed higher yield and benefit cost ratio.

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6. Competing Interests

Authors have declared that no competing interests exist.

References

1. Ali MA. Boron increases the growth and yield of mungbean. *Journal of Advances in Agriculture*. 2016;6(2):922-924.
2. Charan R, Dawson J. Effect of micronutrients on growth and yield of greengram. *International Journal of Plant Sciences*. 2024.
3. Chaudhary S, Kumar R, Singh P. Effect of micronutrients on growth and yield of greengram. *Legume Research*. 2015;38(3):345-349.
4. Deep A, Kumar V, Singh B. Influence of micronutrients and growth regulators on nodulation and yield of greengram. *Indian Journal of Agronomy*. 2022;67(2):215-220.
5. Dhadge SJ, Patil DB, Jadhav SG. Effect of NAA, boron and molybdenum on growth and yield of greengram. *Journal of Crop Research*. 2024.
6. Dixit PM, Elamathi S. Effect of foliar application of nutrients on growth and yield of greengram. *Legume Research*. 2007;30(4):305-307.
7. Donald CM. In search of yield. *Journal of the Australian Institute of Agricultural Science*. 1962;28:171-178.
8. Gani M, Rahman M, Islam M. Effect of micronutrients on growth and yield of mungbean. *Bangladesh Journal of Agricultural Research*. 2024.
9. Gomez KA, Gomez AA. Statistical procedures for agricultural research. New York: Wiley; 1976.
10. Kesava Priya R, Ramesh T, Kumar S. Effect of plant growth regulators on growth and yield of greengram. *International Journal of Agricultural Sciences*. 2022.
11. Kumar S, Singh R, Yadav L. Influence of micronutrients on growth and yield of greengram. *Journal of Food Legumes*. 2021;34(2):112-115.
12. Mandal S, Das A, Ghosh P. Effect of micronutrients on growth and productivity of greengram. *Journal of Crop and Weed*. 2021;17(1):45-50.
13. Meena RS, Yadav GS, Meena VS. Effect of micronutrients on crop growth rate in pulses. *Legume Research*. 2017.
14. Meena RS, Kumar S, Yadav GS. Effect of micronutrients on yield attributes of greengram. *Indian Journal of Agronomy*. 2018.
15. Meena RS, Kumar S, Meena VS. Influence of micronutrients on harvest index in pulses. *Agricultural Reviews*. 2019.
16. Patil BN, *et al.* Effect of NAA on yield and yield components of greengram. *Legume Research*. 2005.
17. Patil DB, Jadhav SG, Dhadge SJ. Effect of plant growth regulators on yield attributes of greengram. *Journal of Crop Improvement*. 2023.
18. Rajesh K, Singh P, Kumar A. Effect of micronutrients on yield attributes of greengram. *Legume Research*. 2011;34(3):220-222.
19. Singh R, Kumar V, Yadav S. Effect of micronutrients and growth regulators on crop growth rate of pulses. *Journal of Agronomy*. 2018.
20. Srivastava A, Kumar R, Singh B. Effect of boron on growth and yield of greengram. *Indian Journal of Agricultural Sciences*. 2022.
21. Srivastava A, Kumar R, Singh B. Influence of boron and zinc on growth and yield of greengram. *Journal of Plant Nutrition*. 2025.
22. Verma P, Singh D, Yadav R. Effect of micronutrients on crop growth rate in pulses. *International Journal of Chemical Studies*. 2019.
23. Yadav R, Kumar S, Singh P. Effect of micronutrients on dry matter accumulation in greengram. *Journal of Pharmacognosy and Phytochemistry*. 2021.