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RESEARCH PAPER

Effect of Crop Booster on Growth, Yield and Quality of Groundnut (*Arachis hypogaea* L.) under Protective Irrigated Condition

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ABSTRACT

Groundnut is one of the important oilseed crops, which needs a proper nutrient management for its proper growth and development. Based on the above fact, a field experiment was conducted during *kharif* 2024 at the Zonal Agricultural Research Station, GKVK, UAS, Bangalore, to evaluate the effect of a crop booster on growth, yield and quality of groundnut under protective irrigated condition. The experiment was laid out in a randomized complete block design (RCBD) comprising eight treatments with three replications. The results revealed that the application of recommended dose of fertilizer (RDF) + 1.0 per cent foliar spray of the crop booster significantly improved growth, yield and yield attributes such as plant height (56.46 cm), number of branches per plant(6.89), number of leaves per plant (42.08), leaf area per plant (887 cm^2), leaf area index (2.95), total dry matter accumulation per plant (21.95 g), number of pods per plant (49.52), pod weight per plant (21.14 g), pod yield (3629 kg ha^{-1}) and haulm yield (4583 kg ha^{-1}) compared to RDF alone. Notably, this treatment also proved the most financial rewarding, generating higher gross returns (₹ 1,54,745 ha^{-1}), net returns (₹ 1,01,213 ha^{-1}) and B:C ratio (2.89).

HIGHLIGHTS

- Foliar nutrition enhanced growth parameters in groundnut.
- Foliar application of crop booster increased yield attributes and yield of groundnut.

Keywords: Groundnut, RDF, Crop booster, Micronutrient mixture, Productivity

Groundnut (*Arachis hypogaea* L.), often referred to as the "king of oilseeds" and popularly known as peanut, is one of the most versatile and economically significant legume crop cultivated across the globe. Belonging to the family Fabaceae, it is unique among legumes because of its geocarpic nature, while flowering occurs above ground, pod development takes place beneath the soil (Ray *et al*. 2025a,b). Groundnut is a dual-purpose crop valued for both

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food and industrial uses. Its seeds contain 44-50 per cent oil, 24-36 per cent protein and essential nutrients, making it a nutritious complement to cereal-based diets (Porkodi e*t al*. 2022, Ray *et al*. 2025c). The extracted oil is widely used in cooking, margarine and confectionery, while the protein-rich cake serves as quality livestock feed. Groundnut haulms also provide nutrient-rich fodder and the crop enhances soil fertility through biological nitrogen fixation, reducing reliance on synthetic fertilizers. Groundnut is cultivated in tropical, subtropical and warm temperate regions between 40° N and 40° S latitudes. The production is largely confined to Asian and African countries. Globally, China leads in groundnut production with 19.35 million tonnes, followed by India with 10.19 million tonnes. In India groundnut is cultivated in 4.70 million hectares with production of 10.1 million tonnes and with productivity of 20 q ha^{-1}. The key groundnut producing states include Gujarat, Rajasthan, Andhra Pradesh, Karnataka and Tamil Nadu. In Karnataka groundnut is cultivated in an area of 3.73 lakh hectares with a production of 2.41 lakh tonnes and with the average productivity of 6.4 q ha^{-1} (Anon., 2023; Maity *et al.* 2025).

Groundnut helps to reduce the nation's vegetable oil deficit, yet its yield in India remains low compared to other producing countries due to poor varieties, rainfed cultivation, erratic monsoons, low soil fertility, pest and disease pressure and inadequate nutrient management. Among the various agro-techniques in groundnut cultivation, nutrient management plays a pivotal role in overcoming the major productivity constraints (Palai *et al*. 2024; Maitra *et al*. 2025a). Adoption of appropriate nutrient management strategies, involving both soil application and foliar nutrition is essential under present conditions to enhance crop productivity (Ray *et al*. 2024; Hemashree *et al*. 2025; Maitra *et al*. 2025b). Foliar feeding is an important modern fertilization strategy. In the current context, the climate change increases weather unpredictability and resource pollution, which complicate crop management (Mohanty *et al*. 2016; Santosh *et al*. 2024). Hence, the foliar nutrient application provides a dependable way to supplement plant nutrition. In groundnut, foliar use of nutrient formulations like crop booster has proven effective in improving yield and productivity (Latha and Nandanasababady, 2003; Maitra and Zaman, 2017; Krishna *et al*. 2024). Groundnut crop booster is a mixture of nutrients and growth regulator, which includes ferrous sulphate (FeSO4), magnesium sulphate (MgSO4), potassium sulphate (K2SO4), borax and naphthalene acetic acid (NAA).

MATERIALS AND METHODS

The field experiment was conducted at Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru which is situated under the Agro-climatic zone V: Eastern dry zone of Karnataka at 13°07′ North latitude and 77°56′ East longitude with an altitude of 924 m above MSL. The soil of the experimental site was red sandy loam grouped under the class of *Alfisols* with neutral in pH (6.53), electric conductivity of 0.33 dS m^{-1} and organic carbon content was 0.413 per cent. The soil with277.00 kg ha^{-1} available nitrogen, 25.42 kg ha^{-1} available phosphorus and195.80 kg ha^{-1} potassium availability. The experiment was laid in Randomized complete block design with 8 treatments replicated thrice *viz*., T_1: Absolute control, T_2: RDF, T_3: RDF + 0.25 % foliar spray of crop booster, T_4: RDF + 0.5 % foliar spray of crop booster, T_5: RDF + 0.75 % foliar spray of crop booster, T_6: RDF + 1 % foliar spray of crop booster, T_7: RDF + 1 % foliar spray of 19:19:19 and T_8: RDF + 0.25 % foliar spray of multi-micronutrient mixture.

The groundnut variety KCG-6, seeds were sown at the rate of 110 kg ha^{-1} with a depth of 5 cm, maintaining 30 cm row to row and 10 cm plant to plant spacing. The soil was fertilized with 25: 75: 37.5 kg N: P: K $ha^{-1}$and 7.5 t ha^{-1} FYM before sowing. Foliar spray was done at flowering and pod filling stage with the help of a sprayer. At various growth stages, observations on growth parameters such as plant height, number of leaves $plant^{-1}$, leaf area $plant^{-1}$ and total plant dry matter production $plant^{-1}$ were recorded from five randomly tagged plants from each plot and yield attributing parameters such as number of pods per plant, pod weight per plant, pod yield and haulm yield were recorded at the harvest stage. The recorded data were statistically analysed using the ANOVA approach. When the 'F' test was determined to be significant at the 5 % level, the critical difference (CD) value was calculated.

RESULTS AND DISCUSSION

The growth parameters, yield attributes and yield of groundnut as influenced by foliar application of crop booster is presented in Table 1, Table 2 and Table 3, respectively.

GROWTH PARAMETERS OF GROUNDNUT

Plant height

Plant height was significantly influenced by foliar application of crop booster. Among the different treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher plant height (56.46 cm) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (54.92 cm) (T_5). Whereas, lower plant height (30.12 cm) was seen in absolute control (T_1). This could be due to the synergistic effect of soil applied recommended dose of fertilizers, which meets the basic nutrient requirement of the crop and foliar applied crop booster which supplies readily available secondary and micronutrients along with plant growth regulator during critical growth stages. Potassium, magnesium, iron and boron improved photosynthesis, chlorophyll content and meristematic activity, while naphthalene acetic acid stimulated cell elongation and vegetative vigour and ultimately resulting in higher plant height. These results are in accordance with Prajapati *et al*. (2024) and Yogesh *et al*. (2022).

Table 1: Growth parameters of groundnut as influenced by foliar application of crop booster

Treatments	Plant height at harvest (cm)	Number of branches plant^{-1}	Number of leaves plant^{-1}	Leaf area (cm^2 plant^{-1})	Leaf area index	Dry matter accumulation at harvest (g plant^{-1})
T_1: Absolute control	30.12	3.85	20.36	301	1.00	11.75
T_2: RDF	38.39	4.86	29.21	421	1.40	15.01
T_3: RDF + 0.25 % foliar spray of crop booster	46.83	5.88	35.58	693	2.31	18.43
T_4: RDF + 0.5 % foliar spray of crop booster	47.45	5.98	36.26	722	2.40	18.68
T_5: RDF + 0.75 % foliar spray of crop booster	54.92	6.80	41.73	821	2.73	21.83
T_6: RDF + 1.0 % foliar spray of crop booster	56.46	6.89	42.08	887	2.95	21.95
T_7: RDF + 1.0 % foliar spray of 19:19:19	46.92	5.89	36.09	701	2.33	18.56
T_8: RDF + 0.25 % foliar spray of multi-micronutrient mixture	46.38	5.81	34.97	685	2.28	18.27
F test	*	*	*	*	*	*
S. Em. ±	**2.63**	**0.27**	**1.72**	**38.07**	**0.12**	1.06
CD at 5%	7.96	0.82	5.20	115.48	0.36	3.21

RDF: Recommended dose of fertilizer; Foliar spray at flowering and pod filling stage.

Table 2: Yield attributes of groundnut as influenced by foliar application of crop booster

Treatments	Yield attributes			
	No of pods plant^{-1}	Pod weight plant^{-1} (g)	Test weight (g)	Shelling %
T_1: Absolute control	21.43	10.55	32.24	61.19
T_2: RDF	30.48	13.59	34.31	70.48
T_3: RDF + 0.25 % foliar spray of crop booster	39.05	16.95	36.85	70.92
T_4: RDF + 0.5 % foliar spray of crop booster	40.34	17.16	37.02	71.10
T_5: RDF + 0.75 % foliar spray of crop booster	46.41	20.13	37.53	71.32
T_6: RDF + 1.0 % foliar spray of crop booster	49.52	21.14	38.52	71.34
T_7: RDF + 1.0 % foliar spray of 19:19:19	39.19	17.01	36.51	71.08
T_8: RDF + 0.25 % foliar spray of multi-micronutrient mixture	38.66	16.84	35.85	70.73
F test	*	*	NS	NS
S. Em. ±	2.29	1.02	1.51	2.91
CD at 5%	6.94	3.09	—	—

RDF: Recommended dose of fertilizer; Foliar spray at flowering and pod filling stage.

Table 3: Yield of groundnut as influenced by foliar application of crop booster

Treatments	Kernel yield (kg ha^{-1})	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1: Absolute control	1332	2177	3010	0.41
T_2: RDF	1910	2710	3552	0.43
T_3: RDF + 0.25 % foliar spray of crop booster	2214	3122	4038	0.44
T_4: RDF + 0.5 % foliar spray of crop booster	2310	3249	4053	0.44
T_5: RDF + 0.75 % foliar spray of crop booster	2516	3528	4524	0.44
T_6: RDF + 1.0 % foliar spray of crop booster	2589	3629	4583	0.44
T_7: RDF + 1.0 % foliar spray of 19:19:19	2229	3136	4043	0.44
T_8: RDF + 0.25 % foliar spray of multi-micronutrient mixture	2206	3119	4036	0.44
F test	*	*	*	**NS**
S. Em. ±	**91.07**	**124.95**	**158.25**	**0.02**
CD at 5%	**276.24**	**379.00**	**480.00**	—

RDF: Recommended dose of fertilizer; Foliar spray at flowering and pod filling stage.

Number branches per plant

The foliar application of crop booster markedly influenced the number of branches per plant. Among the different treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher number of branches per plant (6.89) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (6.80) (T_5). Whereas, lower number of branches per plant (3.85) was observed in absolute control (T_1). This enhancement in branching can be attributed to the balanced supply of potassium, magnesium, iron and boron through the crop booster which supported photosynthesis, chlorophyll biosynthesis, assimilate transport and meristematic activity. In addition, the presence of naphthalene acetic acid a growth regulator, promoted lateral branching by modifying apical dominance and sustaining vegetative growth. Thus, the integration of crop booster with RDF proved more effective in stimulating branching. These findings are in line with Mekdad (2019) and Patil *et al*. (2020).

Number of leaves per plant

Number of leaves per plant was significantly influenced by foliar application of crop booster. Among various treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher number of leaves per plant (42.08) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (41.73) (T_5). The lower number of leaves per plant (20.36) was observed in the absolute control(T_1). This could be due to balanced supply of nutrients through the crop booster which improved photosynthetic efficiency, chlorophyll synthesis and leaf initiation. Additionally, the presence of growth regulator promoted cell division, elongation and delayed senescence. This delay in leaf aging ensured prolonged photosynthetic activity and sustained leaf retention, even at the harvest stage, ultimately contributing to better yield potential. These results are similar to findings of Gebremedhin *et al*. (2015) and Kumar *et al*. (2010).

Leaf area per plant

Foliar application of crop booster significantly influenced leaf area per plant. Among the different treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher leaf area per plant (887 cm^2) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (821 cm^2) (T_5). Whereas, lower leaf area per plant (301 cm^2) was seen in absolute control (T_1). The increase in leaf area due to crop booster application can be attributed to the synergistic supply of essential macro- and micronutrients along with the growth regulator NAA. Potassium and magnesium enhance chlorophyll synthesis and photosynthetic activity, while iron and boron improve nutrient assimilation and enzymatic functions. Additionally, NAA promotes cell expansion and leaf development thereby contributing to improved canopy growth. This synergistic effect of RDF and foliar crop booster not only enhanced vegetative vigour but also helped maintain greater leaf area even at harvest. These results are in accordance with Praisy *et al*. (2023) and Khadthare *et al*. (2017).

Leaf area index

Leaf area index was significantly influenced by foliar application of crop booster. Among the different treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher leaf area index (2.95) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (2.73) (T_5). However, a lower leaf area index (1.00) was noted in the absolute control (T_1). The increase in leaf area index observed with foliar application of crop booster can be ascribed to the combined supply of essential nutrients along with the plant growth regulator naphthalene acetic acid. Potassium and magnesium play a pivotal role in chlorophyll formation, photosynthetic efficiency and carbohydrate translocation, while iron and boron are vital for enzymatic functions. In addition, naphthalene acetic acid promotes cell elongation and division, thereby enhancing leaf expansion. Consequently, the increase in leaf area index provides a larger assimilatory surface area per unit ground area, enabling more efficient interception of solar radiation and improved photosynthetic performance. These results are in accordance with Kaur *et al*. (2023) and Immanuel *et al*. (2019).

Total dry matter accumulation per plant

Foliar application of crop booster significantly influenced total dry matter accumulation per plant. Among the different treatments, RDF + 1.0 % foliar spray of crop booster (T_6) recorded significantly higher total dry matter accumulation per plant (21.95 g) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (21.83 g) (T_5). Whereas, lower total dry matter accumulation per plant(11.75 g) was recorded in absolute control (T_1). The improvement in dry matter accumulation with foliar crop booster application is attributable to the enhanced nutrient supply of potassium, magnesium, iron, boron and naphthalene acetic acid. Potassium and magnesium enhance photosynthetic activity and translocation of assimilates, while iron and boron play crucial roles in enzymatic activation and reproductive growth. NAA further stimulates cell division, elongation and differentiation, thereby, improving vegetative biomass. A higher dry matter accumulation reflects the cumulative effect of increased leaf area, greater leaf area index and improved canopy efficiency, which together promote higher photosynthate production and its partitioning towards vegetative and reproductive organs. These results are in accordance with Shingare *et al*. (2023) and Adarsha *et al*. (2019).

YIELD ATTRIBUTES OF GROUNDNUT

Number of pods per plant

Number of pods per plant was significantly influenced by foliar application of crop booster. Significantly higher number of pods per plant (49.52) was recorded with RDF + 1 % foliar spray of crop booster (T_6) which was found to be on par with RDF + 0.75 % foliar spray of crop booster (46.41) (T_5). Whereas, lower number of pods per plant (21.43) was observed in absolute control (T_1). The increase in pod number observed under foliar crop booster application can be ascribed to the combined action of essential nutrients and growth regulators supplied through the foliar spray. Potassium and magnesium enhance photosynthetic efficiency and assimilate translocation, thereby ensuring a continuous supply of carbohydrates to developing reproductive structures. Iron and boron are indispensable for pollen viability, fertilization, peg initiation and subsequent pod development, with boron also playing pivotal role in the growth of reproductive tissues. In addition, the presence of naphthaleneacetic acid (NAA) in the crop booster helps minimize flower and pod abscission by improving sink strength and maintaining hormonal balance during the critical reproductive phase. Collectively, these effects facilitate better peg to pod conversion and pod retention, ultimately resulting in a higher number of pods per plant. These results are in conformity with the finding noted by Pareek and Poonia (2011).

Pod weight per plant

Pod weight per plant at harvest was significantly influenced by foliar application of crop booster. Significantly higher pod weight per plant (21.14 g) was recorded with RDF + 1 % foliar spray of crop booster (T_6) which was statistically on par with RDF + 0.75 % foliar spray of crop booster (20.13 g) (T_5). Whereas, lower pod weight per plant (10.55 g) was seen in absolute control (T_1). The significant increase in pod weight per plant can be attributed to the synergistic action of macro and micronutrients along with growth regulators present in the crop booster. The nutrient supply enhanced photosynthetic efficiency and promoted effective assimilate partitioning towards developing pods. Furthermore, the presence of naphthalene acetic acid (NAA) reduced flower and pod abscission while strengthening sink capacity, thereby improving pod retention and filling. This combined effect ensured efficient source to sink translocation and better reproductive growth, ultimately resulting in higher pod weight per plant. Similar results reported by Ravichandra *et al.* (2015) and Nakum *et al.* (2019).

Test weight

Test weight of groundnut due to foliar application of crop booster was found non-significant. However, application of RDF + 1 % foliar spray of crop booster (T_6) had recorded numerically higher value of test weight (38.52 g). However, the lower test weight (32.24 g) was recorded with absolute control (T_1). These results are in line with Kumara *et al.* (2020).

YIELD OF GROUNDNUT

Kernel yield

The research findings recorded that the foliar application of crop booster had a significant influence on kernel yield of groundnut. Among different treatments, significantly higher kernel yield was recorded with RDF + 1 % crop booster (T_6) (2589 kg ha^{-1}) which was found to be on par with RDF + 0.75 % crop booster (2516 kg ha^{-1}) (T_5). Whereas lower kernel yield (1332 kg ha^{-1}) was seen in absolute control (T_1). The increase in kernel yield can be ascribed to the enhanced partitioning of assimilates towards reproductive sinks under the influence of balanced nutrition and hormonal regulation. Adequate supply of potassium and magnesium ensured efficient carbohydrate metabolism and protein synthesis, while boron played a crucial role in enhancing seed set and embryo development. Iron improved chlorophyll contentand enzymatic activity, leading to better pod filling. These factors collectively enhanced seed development, resulting in heavier and better filled kernels and thereby significantly increasing kernel yield. The results observed here are consistent with the explanation provided by Potdar *et al.* (2025) and Madhu *et al.* (2023).

Pod yield

Foliar application of crop booster had a significant influence on pod yield of groundnut. Among different treatments, significantly higher pod yieldwas recorded with RDF + 1 % crop booster (3629 kg ha^{-1}) (T_6) which was found to be on par with RDF + 0.75 % crop booster (3528 kg ha^{-1}) (T_5). Whereas, lower pod yield (2177 kg ha^{-1}) was recorded in absolute control (T_1). The higher pod yield can be attributed to the improvement in peg initiation, peg penetration and subsequent pod development as a result of better nutrient and hormonal balance. Potassium improved translocation of assimilates to subterranean structures, while boron supported pod setting and shell hardening, thereby enhancing pod retention. Magnesium ensured efficient photosynthetic activity, which sustained assimilate supply during pod filling. In addition, the foliar application provided timely correction of micronutrient deficiencies at critical reproductive stages, preventing physiological disorder such as unfilled pods. This synergistic action nutrients with NAA led to improved peg to pod conversion efficiency, resulting in significantly higher pod yield perhectare. These results are confirmed with findings Nayak *et al.* (2023) and Shweta *et al.* (2018).

Haulm yield

The study noted that the foliar application of crop booster had a significant influence on haulm yield of groundnut. Among different treatments, significantly higher haulm yieldwas recorded with RDF + 1 % crop booster (4583 kg ha^{-1}) (T_6) which was comparable to RDF + 0.75 % crop booster (4524kg ha^{-1}) (T_5). Whereas, lower haulm yield (3010 kg ha^{-1}) was seen in absolute control (T_1). The significant increase in haulm yield is due to improved vegetative growth dynamics rather than solely reproductive effects the foliar nutrients and growth regulator promoted sustained stem and leaf growth, enhanced synthesis of structural carbohydrates and proteins in vegetative tissues and delayed senescence, thereby, extending the period of biomass accumulation. Foliar applied micronutrients also improve root vigour and soil plant nutrient uptake indirectly through healthier root systems and improved microbial interactions, which supports greater aboveground vegetative deposition. In addition, auxin like activity from NAA can stimulate cell expansion and secondary growth of stems, increasing haulm bulk and strength. Collectively, these physiological responses favour greater accumulation and retention of vegetative biomass, resulting in higher haulm yield. Rabari *et al*. (2018) and Sonawane *et al.* (2010).

Shelling percentage

Shelling percentage of groundnut due to foliar application of crop booster was found non-significant. However, application of RDF + 1 % foliar spray of crop booster (T_6) had recorded numerically higher value of shelling percentage (71.34%). However, the lower shelling percentage (61.19%) was recorded with absolute control (T_1). These results are in accordance with Nakum *et al*. (2019) and Prakash *et al*. (2013).

Harvest index

Harvest index of groundnut due to foliar application of crop booster was found non-significant. However, application of RDF + 1 % crop booster (T_6) had recorded numerically higher value of harvest index (0.44). However, the lower harvest index (0.41) was recorded with absolute control (T_1).

CONCLUSION

The study revealed that foliar application of crop booster @ 1 per cent along with recommended dose of fertilizer found beneficial in improving growth and yield parameters of groundnut. Maximum plant height (56.46 cm), number of branches per plant (6.89), number of leaves per plant (42.08), leaf area per plant (887 cm^2), total dry matter accumulation per plant (21.95 g),number of pods per plant (49.52), pod weight per plant (21.14 g), pod yield (3629 kg ha^{-1}) and haulm yield (4583 kg ha^{-1}) were recorded.

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