AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 02, Issue: 09 (September, 2025)
Available online at http://www.agrimagazine.in

Role of Plant Growth Regulators on Pulse Production

*Dr. M. Kokila[1] and Dr. M. Sudhakaran[2]
[1]Assistant Professor (Seed Science and Technology), Kumaraguru Institute of Agriculture, Erode, India
[2]Associate Professor (Environmental Sciences), JKKM College of Agriculture Science, Erode, India
*Corresponding Author's email: kokila_sst@kia.ac.in

Black gram (*Vigna mungo* L.), also known as urad bean, is an important pulse crop widely cultivated in India and other Asian countries. It plays a vital role in sustainable agriculture due to its nitrogen-fixing ability and its use as a protein-rich food. However, productivity of black gram remains relatively low because of poor soil fertility, limited nutrient use efficiency, and susceptibility to abiotic stresses. Conventional soil application of fertilizers alone often fails to meet the crop's mid-season nutrient requirement. In this context, foliar application of nutrients combined with plant growth regulators (PGRs) has emerged as a simple, cost-effective, and efficient strategy to enhance crop growth and yield.

Foliar Nutrition and Crop Growth

Foliar spraying allows nutrients to be directly absorbed through the leaf surface, bypassing soil limitations such as fixation, leaching, and poor root activity. Micronutrients like zinc, boron, and iron, when applied as foliar sprays, improve chlorophyll content, photosynthetic efficiency, and leaf expansion. Nitrogen in the form of urea foliar spray significantly enhances vegetative growth, leading to taller plants with greater leaf area index. Studies have shown that black gram plants receiving foliar sprays recorded faster establishment and better physiological activity compared to soil-applied nutrients alone.

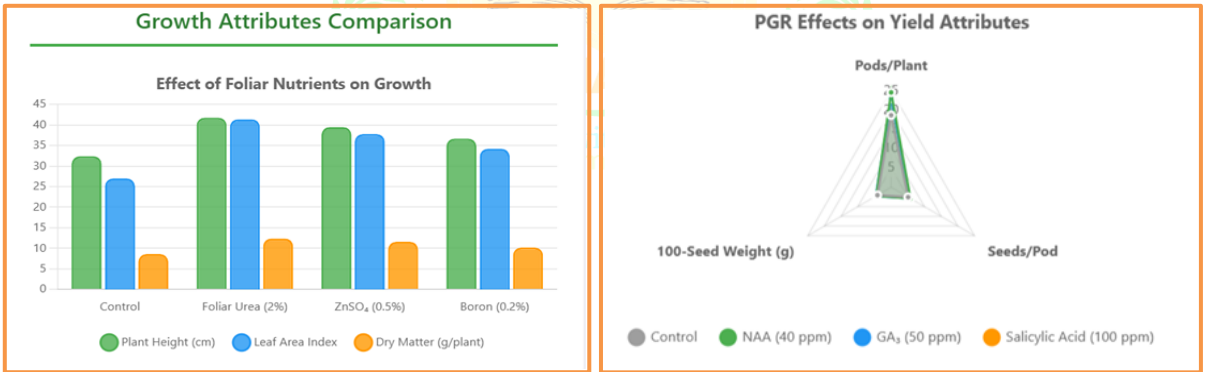

Fig1 Comprehensive Analysis of Nutrients and Plant Growth Regulators

Table 1. Effect of Foliar Nutrients on Growth Attributes of Black Gram

Treatment	Plant Height (cm)	Leaf Area Index	Dry Matter (g/plant)
Control (no spray)	32.4	1.5	8.6
Foliar Urea (2%)	41.8	2.3	12.4
$ZnSO_4$ (0.5%)	39.5	2.1	11.6
Boron (0.2%)	36.7	1.9	10.2

Role of Plant Growth Regulators

Plant growth regulators such as Naphthalene Acetic Acid (NAA), Gibberellic Acid (GA_3), and Salicylic Acid play a crucial role in enhancing physiological processes. NAA reduces flower drop and increases pod setting, while GA_3 promotes cell elongation and improves plant vigor. Salicylic Acid helps the crop to overcome stress conditions, particularly during water stress or high temperatures. Application of these PGRs through foliar sprays results in better reproductive efficiency, reduced flower abscission, and higher pod retention, ultimately increasing seed yield.

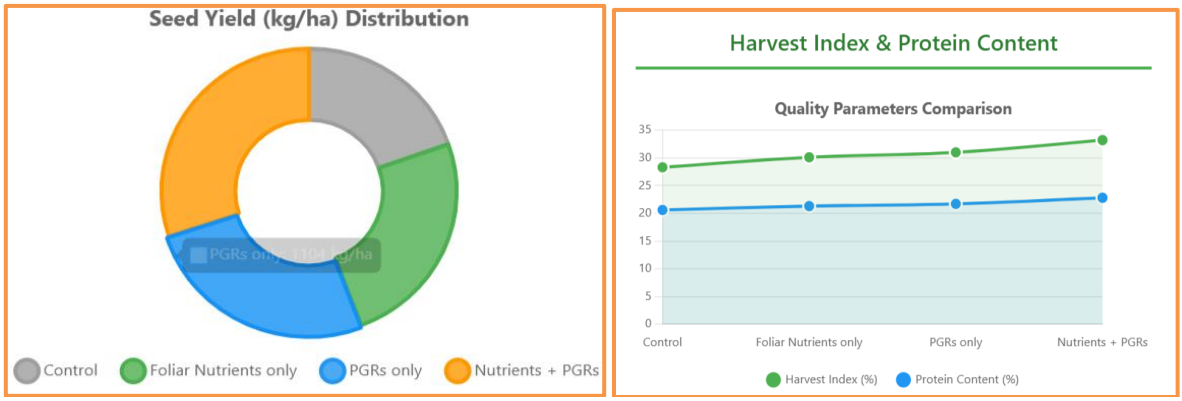

Fig 2 Seed Yield Comparison and Harvest Index & Protein Content

Table 2. Influence of Plant Growth Regulators on Yield Attributes

PGR Treatment	Pods/Plant	Seeds/Pod	100-Seed Weight (g)
Control	18.6	5.1	4.1
NAA (40 ppm)	24.5	5.8	4.5
GA_3 (50 ppm)	22.9	5.7	4.6
Salicylic Acid (100 ppm)	23.1	5.6	4.4

Combined Effect of Foliar Nutrition and PGRs

The integration of foliar nutrition and plant growth regulators produces a synergistic effect on crop performance. When black gram plants receive both micronutrient sprays (like Zn and B) and PGRs such as NAA or GA_3, they exhibit improved growth, enhanced chlorophyll content, and efficient partitioning of assimilates towards reproductive structures. This combined strategy ensures higher pod formation, reduced flower shedding, and improved seed filling, which directly contributes to yield enhancement.

Table 3. Combined Effect on Yield of Black Gram

Treatment	Seed Yield (kg/ha)	Harvest Index (%)	Protein Content (%)
Control	842	28.3	20.6
Foliar Nutrients only	1056	30.1	21.3
PGRs only	1104	31.0	21.7
Nutrients + PGRs	1289	33.2	22.8

Conclusion

The foliar application of nutrients and plant growth regulators has a remarkable impact on the growth and productivity of *Vigna mungo* L. By directly supplementing essential nutrients and regulating plant physiological processes, this approach ensures higher nutrient use efficiency, improved reproductive success, and enhanced seed yield. In particular, the combined application of micronutrients and PGRs offers a promising strategy to overcome yield limitations in pulse-based farming systems. Adopting this practice can significantly contribute to sustainable pulse production, food security, and farmer income in resource-limited regions.

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