

# Assessment of Foliar Nutrient Management Strategies for Enhancing Cowpea Performance

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## Abstract

Field trials were carried out at the ICAR Krishi Vigyan Kendra, Perambalur district, Tamil Nadu, during the Kharif seasons of 2022–2023 to evaluate the impact of foliar nutrient application on the phenotypic performance of cowpea variety CO 7. The experiment was structured using a Randomized Block Design (RBD) with three replications. Observations revealed that growth and yield parameters of cowpea, including plant height, leaf area index, dry matter accumulation, number of pods per plant, pod length, seeds per pod, and grain yield, were significantly improved with foliar application of 1% Pulse Wonder at 30 and 45 days after sowing (T2). In contrast, the control treatment (T1) exhibited the lowest values for these traits. The treatment involving Pulse Wonder spray (T2) also recorded superior physiological growth indices such as nodule number, nodule biomass, dry matter production, Absolute Growth Rate (AGR), Crop Growth Rate (CGR), and Leaf Area Duration (LAD) during the Kharif season.

**Keywords:** Cowpea, Foliar spray, Nano urea and Pulse wonder.

## Introduction

Cowpea (*Vigna unguiculata*) is an important annual legume crop known for its high nutritional value and adaptability to drought conditions. Commonly referred to as black-eyed pea or southern pea, it originated in Africa and is now widely cultivated across tropical and subtropical regions. The crop is rich in protein (about 22–24%), dietary fiber, and essential vitamins, making it a vital component of human diets. In addition to its food value, cowpea contributes to soil fertility through biological nitrogen fixation and is also used as fodder for livestock. Despite its importance, pulse production is often constrained by physiological and nutritional limitations. Reduced translocation of assimilates to reproductive parts, inadequate partitioning, flower drop, and nutrient deficiencies during critical growth stages significantly affect yield. Along with genetic factors, these physiological constraints play a major role in limiting productivity. In Tamil Nadu, pulses are cultivated over approximately 2.76 lakh hectares, producing about 2.18 lakh tonnes with an average productivity of 943 kg per hectare. However, pulse consumption in India (30–35 g per person per day) remains below the recommended levels of 45 g by ICMR and 80 g by WHO. Furthermore, the productivity of pulses in India is comparatively lower than in many other countries. Conventional cultivation practices mainly rely on basal soil application of fertilizers, with limited emphasis on foliar nutrition. In short-duration crops like cowpea, which exhibit continuous flowering and fruiting, there is ongoing competition between vegetative and reproductive growth for assimilates. Soil-applied nutrients alone may not adequately meet crop demand during critical stages. In such situations, foliar application offers a practical and efficient alternative, as nutrients sprayed on leaves are rapidly absorbed through the cuticle and stomata, ensuring quick utilization and minimizing losses due to leaching

or fixation. Foliar feeding is particularly advantageous in conditions where soil fertilization is difficult, such as rice fallow systems, where pulses are sown before the harvest of the preceding crop. Under these conditions, foliar nutrition becomes an effective, economical, and feasible approach to improve crop performance. Enhancing cowpea productivity requires the adoption of improved agronomic practices, including the use of quality seeds, high-yielding varieties, balanced nutrient management, and innovative techniques. Among these, foliar application of both organic and inorganic nutrient sources holds significant promise in maximizing the crop's genetic potential. Therefore, the present study was undertaken to evaluate the effect of foliar application of nutrients on the phenotypic performance of cowpea.

### Materials and Methods

A field experiment was carried out at the ICAR Krishi Vigyan Kendra, Perambalur district, during the Kharif season of 2022–2023 to evaluate the influence of foliar application of organic and inorganic nutrients on the phenotypic performance of cowpea variety CO 7. The experimental soil was clay loam in texture. The study was conducted using a Randomized Block Design (RBD) with three replications. The cowpea variety CO 7 was selected as the test crop. The experiment included seven treatments comprising different foliar nutrient applications: T<sub>1</sub> – control (no foliar spray); T<sub>2</sub> – 1% Pulse Wonder applied at 30 and 45 days after sowing (DAS); T<sub>3</sub> – 2% Nano DAP at 30 and 45 DAS; T<sub>4</sub> – NAA at 50 ppm at 30 and 45 DAS; T<sub>5</sub> – 0.5% 19:19:19 (NPK) at 30 and 45 DAS; T<sub>6</sub> – 2% Nano urea at 30 and 45 DAS; and T<sub>7</sub> – 0.5% KNO<sub>3</sub> applied at 30 and 45 DAS. This design enabled comparison of different nutrient sources and formulations for their effectiveness in improving crop performance.

### Crop management practices

The experimental plots were laid out with dimensions of 5 m × 4 m, and seeds of cowpea variety CO 7 were sown at a spacing of 30 × 15 cm. Irrigation was applied uniformly across all treatments at regular intervals to avoid moisture stress throughout the crop growth period. Biometric observations, including plant height, leaf area index (LAI), number of nodules, and nodule biomass, were recorded at relevant growth stages. Dry matter production (DMP) was determined by oven-drying plant samples at 80°C for 48 hours. Growth parameters such as Absolute Growth Rate (AGR), Crop Growth Rate (CGR), and Leaf Area Duration (LAD) were computed following standard procedures. The collected data were subjected to statistical analysis based on established methods, and treatment differences were evaluated using the critical difference at the 5% level of significance.

### Results and Discussion

#### Growth attributes

The findings from the field experiment conducted during the Kharif season of 2022–2023 (Tables 1 and 2) revealed that foliar application of Pulse Wonder at 30 and 45 DAS significantly improved the growth attributes of cowpea. Timely application of micronutrients and growth regulators through foliar spray enhanced crop growth, development, and metabolic activity. This practice facilitated efficient nutrient absorption and translocation within the plant, leading to improved photosynthetic efficiency and a consequent increase in plant height. The improvement in growth may also be associated with the role of zinc in promoting auxin synthesis, which enhances cell wall plasticity and promotes cell elongation through osmotic adjustments. Leaf area index (LAI) was notably higher under foliar nutrition treatments,

which could be attributed to enhanced cell division and elongation, resulting in better canopy development. Increased dry matter production (DMP) was observed due to improved nutrient availability, which supported cellular processes such as division, differentiation, and translocation of photosynthates from source to sink. Enhanced nutrient use efficiency and better light interception further contributed to higher biomass accumulation. Foliar feeding also had a significant effect on growth indices such as Absolute Growth Rate (AGR), Crop Growth Rate (CGR), and Leaf Area Duration (LAD) at different growth stages (Table 2). Among the treatments, foliar application of Pulse Wonder at 1% (T<sub>2</sub>) recorded the highest AGR, CGR, and LAD values (0.86, 0.27, and 26.20, respectively) at 55 DAS, followed by NAA at 50 ppm (T<sub>4</sub>), which showed slightly lower but comparable values. Similar trends were observed across other growth parameters. Crop productivity is closely linked to CGR, which depends on effective light interception by the crop canopy and is influenced by LAI, photosynthetic efficiency, and leaf orientation. The combined effect of nutrients and plant growth regulators likely contributed to enhanced growth rates. Increased leaf area duration prolonged the functional activity of leaves, allowing sustained photosynthesis and greater accumulation of dry matter. In addition, foliar treatments positively influenced nodulation, with higher nodule numbers per plant (27.38) and greater nodule biomass (49.79 mg plant<sup>-1</sup>) observed. This improvement may be due to the continuous supply of nutrients and growth-promoting substances that supported root development and nodulation processes throughout the crop growth period.

**Table 1: Effect of Foliar Application of Inorganic Nutrients on Growth Attributes of Cowpea**

Treatments	Kharif season 2022-23					
	Plant height (cm)	LAI @Flower	DMP (kg ha <sup>-1</sup> )	No.of branches plant <sup>-1</sup>	No.of Nodule plant <sup>-1</sup>	Nodule biomass mg/plant
T <sub>1</sub> - Without foliar application (control)	33.80	0.92	1838.58	4.46	9.07	33.80
T <sub>2</sub> - Foliar application of 1% pulse wonder spray on 30 and 45 DAS	49.79	2.45	3255.17	7.26	27.38	49.79
T <sub>3</sub> - Foliar application of 2 % Nano DAP on 30 and 45 DAS	35.96	1.23	2474.79	5.15	11.60	35.96
T <sub>4</sub> - Foliar application of NAA 50 ppm on 30 and 45 DAS	46.95	2.21	3132.42	6.76	24.80	46.95
T <sub>5</sub> - Foliar application of 0.5 % 19:19:19 on 30 and 45 DAS	38.16	1.43	2597.20	5.52	12.31	38.16
T <sub>6</sub> - Nano Urea @ 2% on 30 and 45 DAS	40.54	1.52	2652.27	5.74	13.39	40.54
T <sub>7</sub> - KNO <sub>3</sub> @ 0.5%	44.29	1.89	2966.22	6.27	20.42	44.29
<b>S.Em</b>	1.06	0.09	56.81	0.18	1.06	1.06
<b>CD(P=0.05)</b>	2.19	0.18	118.31	0.37	2.20	2.19

**Table 2: Effect of Foliar application of inorganic nutrients on AGR, CGR and LAD of Cowpea**

Treatments	Kharif season 2022-23					
	AGR@ 35-55 DAS	AGR@ 55-Har DAS	CGR@ 35-55 DAS	CGR@ 55-Har DAS	LAD@ 35-55 DAS	LAD@ 55- DAS
T1- Without foliar application (control)	0.13	0.22	0.03	0.04	19.19	13.69
T2- Foliar application of 1% pulse wonder spray on 30 and 45 DAS	0.31	0.86	0.11	0.27	31.59	27.81
T3- Foliar application of 2 % Nano DAP on 30 and 45 DAS	0.18	0.42	0.06	0.11	24.90	19.84
T4- Foliar application of NAA 50 ppm on 30 and 45 DAS	0.29	0.77	0.10	0.25	30.40	26.20
T5- Foliar application of 0.5 % 19:19:19 on 30 and 45 DAS	0.17	0.34	0.06	0.07	23.72	16.28
T6- Nano Urea @ 2% on 30 and 45 DAS	0.15	0.33	0.05	0.06	22.31	15.42
T7- KNO <sub>3</sub> @ 0.5%	0.27	0.71	0.09	0.22	29.65	25.33
<b>S.Em</b>	0.01	0.04	0.00	0.02	0.45	0.57
<b>CD(P=0.05)</b>	0.02	0.08	0.01	0.03	0.94	1.29

**Conclusion**

Based on the results, it can be concluded that foliar application of 1% Pulse Wonder at 30 and 45 days after sowing (T<sub>2</sub>) is an effective and sustainable nutrient management practice for enhancing cowpea productivity. This approach not only improves yield performance but also offers a cost-efficient solution while supporting the maintenance of soil fertility over time.

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