

EFFECT OF FOLIAR SPRAY OF NUTRIENT AND PLANT GROWTH REGULATORS ON GROWTH AND YIELD OF GREEN GRAM (*Vigna radiata* L.)

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ABSTRACT

An experiment was carried out during Zaid season of 2019 at Crop Research Farm, NAI, SHUATS to study about the Effect of Foliar spray of Nutrient and Plant Growth Regulators on growth and yield of Greengram (*Vigna radiata* L.). The experiment consisted of 9 treatments which includes No spray (Control), Foliar spray of DAP alone, Salicylic Acid alone and combination of DAP, Salicylic Acid and NAA and the combination of DAP and Salicylic Acid. Results revealed that foliar spray of 1% DAP + 100 ppm Salicylic Acid twice at 25 and 45 days after sowing recorded the maximum Plant height (33.48 cm), dry matter accumulation (82.47 g/m²), number of pods/plant (55.60), number of grains/pod (9.93), test weight (36.84), grain yield (855.55 kg/ha), stover yield (2233.33 kg/ha) in greengram. As well as, the maximum number of nodules was obtained with 1% DAP (7.33) which was closely followed by 1% DAP+ 100 ppm Salicylic Acid (7.11) and the maximum Crop Growth Rate and Relative Growth Rate (0.99 g/m²/day and 0.006 g/g/day respectively) was obtained with 2% DAP. However, Net returns (65577.54 ¹/ha) and B:C ratio (1.69) was also obtained maximum with the application of 1% DAP + 100 ppm Salicylic Acid.

INTRODUCTION

Greengram (*Vigna radiata* L.) is originated from India and Central Asia. Greengram is one of the important pulse crop, which ranks third in area and production after pigeon pea and chickpea and is grown in almost all parts of the country over a wide range of agro-climatic condition. According to Kumar *et al.* (2013), observed that the soil application of nutrients applied at the time of sowing or 35 days after sowing often results in lower fertilizer use efficiency of all concerned nutrients which ultimately affect the growth and yield of the crop. However, soil applied nutrients undergo several changes and losses which occur through leaching and volatilization. Besides, adverse soil conditions like acidity, alkalinity, water logging, lack of adequate moisture would also results in non-availability of nutrients. In order to avoid or minimize severity of such condition, foliar application of nutrients is imperative and it is a fastest way to boost up crop growth because the nutrients are available to plants at the initial stages and at critical stages. Under the summer season, application of nutrients (Urea and DAP) and growth regulator (Salicylic acid and NAA) through foliar spray at 45 days after sowing helped to improve yield attributes like grains/pod. Pods/plant, stover yield and grain yield. Foliar application of nutrients has been proved to be an important asset in fertilizer application with a specific aim of increasing nutrient availability at the time of need especially in the later stage of plant growth (Kuepper, 2003). Though, the emphasis has been laid on for foliar fertilization of trace elements yet it has repeatedly been observed that the foliar application of macronutrients, too, has a positive impact on plant metabolisms and ultimately on

the yield (Fageria *et al.*, 2009). Keeping in view the above fact, the experiment was conducted to assess the effect of foliar application of nutrients on nodulation, yield attributes, yields of green gram.

MATERIALS AND METHODS

A field experiment as conducted during Zaid season of 2019 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj using greengram variety of Samrat(PDM-139).The crop has received 0.37 mm and 1.14 mm amount of rainfall in March first week and fourth week respectively, 0.45 mm of rainfall in April third week and 0.05 mm of rainfall in third week of May. During the crop period mean maximum temperature varies from 27.6°C-46.3°C, whereas minimum temperature from 13.9°C-25.9°C. The soil was sandy loam in texture, moderately basic in reaction (pH 7.2), medium in available N (34.6 kg/ha), medium in available phosphorus (13.4 kg/ha), medium in available potassium (233 kg/ha), and low in available Organic Carbon (0.4%). The treatments comprised of T₁- Control, T₂- 2% DAP, T₃-1% DAP, T₄- 50 ppm Salicylic Acid, T₅- 100 ppm Salicylic Acid, T₆- 1% DAP+ 100 ppm Salicylic Acid, T₇- 1% DAP+ 50 ppm Salicylic Acid+NAA40 ppm, T₈- 2% DAP+ 100 ppm Salicylic Acid, T₉-2% DAP+ 50 ppm Salicylic Acid+NAA 40 ppm. These were replicated three times in Randomized Block Design. Recommended dose of fertilizers was applied at the time of sowing in the form of Urea, SSP and MOP. Foliar application of nutrient and plant growth regulators as per treatment at recommended solutions were applied with the help of sprayer. Seeds were planted in row to row spacing

30cm and plant to plant spacing 10cm.

Chemical analysis of soil

Composite soil samples were collected before layout of the experiment to determine the initial soil properties. The soil samples were collected from 0-15 cm depth and were dried under shade, were powdered with wooden pestle and mortar, passed through 2 mm sieve and were used for analysis. Available nitrogen content was determined by alkaline permanganate method as described by Subbiah and Asija (1956). Available phosphorus content was determined by Olsen's method as outlined by Jackson (1967). Available potassium content was determined by extracting with neutral normal ammonium acetate solution and estimating by using flame photometer (ELICO Model) as outlined by Jackson (1973).

Statistical analysis

Experimental data collected was subjected to statistical analysis by adopting Fishers method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (2010). Critical Difference (CD) value were calculated whenever the 'F' test was found significant at 5 % level.

RESULTS AND DISCUSSION

Plant height

At 60 DAS, Foliar spray of 1% DAP+ 100ppm Salicylic Acid recorded significantly maximum plant height (33.48 cm) over rest of the treatments which was 8% higher than control but there was no significant difference found among the treatments.

Increase in plant height might be due to the increased availability of nutrients without any harmful effect on plant through foliar application at 25 DAS and 45 DAS. Similar findings were also reported by Kuttamani and Velayutham (2009) in Blackgram.

Number of nodules/plant

In the present investigation, no. of nodules per plant was increased with increasing crop age upto 45 DAS, after that they were decreased to 60 DAS. At 45 DAS, the maximum no. of nodules were found with 1% DAP + 100 ppm Salicylic acid (11.33) which was significantly superior over rest of the treatments except with 2% DAP (10.97), 1% DAP (11.00), 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm (11.30) which were statistically at par with 1% DAP + 100 ppm Salicylic acid which was 7.3% higher than control. The increased in effective root nodules per plant might be due to increased activity of rhizobia in soil due to application of foliar spray of DAP and Salicylic acid before flowering with proper combination and due to increase in chlorophyll content in leaves, thereby increasing photosynthetic efficiency through foliar spray of salicylic acid. This might have led to provide more assimilates for better nodulation (Maity and Bera, 2009). The similar result were also reported by Dixit and Elamathi (2007)

Dry Matter Accumulation g/ m²

At 60 DAS, Foliar spray of 1% DAP+ 100ppm Salicylic Acid recorded significantly maximum dry matter accumulation (82.47g/m²) and minimum with 50 ppm Salicylic Acid (71.21 g/m²) but there was no significant difference found among the treatments. The dry matter production was increased with the

Table 1: Effect of foliar spray of nutrient and Plant growth regulators on Plant height of Greengram.

| TREATMENTS | Plant Height (cm) | | | |
|---|-------------------|--------|--------|--------|
| | 15 DAS | 30 DAS | 45 DAS | 60 DAS |
| No Spray (Control) | 6.26 | 17.42 | 28.1 | 30.76 |
| 2% DAP | 6.99 | 17.62 | 27.93 | 30.31 |
| 1% DAP | 6.29 | 17.79 | 29.63 | 32.03 |
| 50 ppm Salicylic acid | 6.27 | 14.83 | 27.33 | 29.67 |
| 100 ppm Salicylic acid | 5.81 | 18.49 | 29.83 | 32.46 |
| 1% DAP + 100 ppm Salicylic acid | 6.27 | 12.29 | 30.63 | 33.48 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 6.19 | 16.79 | 27 | 29.39 |
| 2% DAP + 100 ppm Salicylic acid | 6.89 | 18.06 | 28.33 | 30.55 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 6.42 | 16.11 | 28.23 | 30.64 |
| SEm (±) | 0.63 | 2.27 | 1.54 | 1.76 |
| CD (P=0.05) | - | - | - | - |

Table 2: Effect of foliar spray of nutrient and Plant growth regulators on Nodules of Greengram

| TREATMENTS | Number of nodule/plant | | | |
|---|------------------------|--------|--------|--------|
| | 15 DAS | 30 DAS | 45 DAS | 60 DAS |
| No Spray (Control) | 5.88 | 7.55 | 10.53 | 5.4 |
| 2% DAP | 4.89 | 5.88 | 10.97 | 5.44 |
| 1% DAP | 5 | 10.11 | 11 | 7.33 |
| 50 ppm Salicylic acid | 5.66 | 8.77 | 9.5 | 5.66 |
| 100 ppm Salicylic acid | 5.66 | 7.22 | 10.63 | 5.22 |
| 1% DAP + 100 ppm Salicylic acid | 7.33 | 9.77 | 11.33 | 7.11 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 5 | 5.88 | 9.87 | 5.44 |
| 2% DAP + 100 ppm Salicylic acid | 6.44 | 6.78 | 10.07 | 4.89 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 7.77 | 8.11 | 11.3 | 6.11 |
| SEm (±) | 1.2 | 1.05 | 0.7 | 0.93 |
| CD (P=0.05) | 3.16 | 3.57 | 2.01 | 2.81 |

Table 3: Effect of foliar spray of nutrient and Plant growth regulators on Dry matter accumulation of Greengram

| Treatments | Dry matter accumulation (g/m ²) | | | |
|---|---|--------|--------|--------|
| | 15 DAS | 30 DAS | 45 DAS | 60 DAS |
| No Spray (Control) | 1.05 | 22.15 | 59.25 | 74.25 |
| 2% DAP | 3.72 | 27.67 | 63.88 | 77.53 |
| 1% DAP | 1.29 | 26.85 | 75.47 | 79.01 |
| 50 ppm Salicylic acid | 1.52 | 23.83 | 64.13 | 71.21 |
| 100 ppm Salicylic acid | 2.34 | 24.46 | 72.77 | 78.19 |
| 1% DAP + 100 ppm Salicylic acid | 2.1 | 29.7 | 79.27 | 82.47 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 1.69 | 23.29 | 69.5 | 71.74 |
| 2% DAP + 100 ppm Salicylic acid | 2.49 | 28.11 | 63.27 | 76.39 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 1.81 | 30.11 | 68.37 | 80.67 |
| SEm (±) | 0.72 | 1.32 | 4.75 | 4.61 |
| CD (P=0.05) | 2.18 | 3.9 | 14.24 | 13.84 |

Table 4: Effect of foliar spray of nutrient and Plant growth regulators on Crop Growth Rate of Greengram

| Treatments | CGR (g/m ² /day) | | |
|---|-----------------------------|-------|-------|
| | 15-30 | 30-45 | 45-60 |
| No Spray (Control) | 1.4 | 2.47 | 0.48 |
| 2% DAP | 1.59 | 2.56 | 0.99 |
| 1% DAP | 1.7 | 3.24 | 0.2 |
| 50 ppm Salicylic acid | 1.48 | 2.63 | 0.47 |
| 100 ppm Salicylic acid | 1.47 | 3.22 | 0.36 |
| 1% DAP + 100 ppm Salicylic acid | 1.84 | 3.3 | 0.72 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 1.43 | 3.08 | 0.47 |
| 2% DAP + 100 ppm Salicylic acid | 1.7 | 2.34 | 0.87 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 1.88 | 2.55 | 0.81 |
| SEm (±) | 0.1 | 0.32 | 0.3 |
| CD (P=0.05) | 0.32 | 0.97 | - |

Table 5: Effect of foliar spray of nutrient and Plant growth regulators on Relative Growth Rate of Greengram

| Treatments | RGR (g/g/day) | | |
|---|---------------|-------|-------|
| | 15-30 | 30-45 | 45-60 |
| No Spray (Control) | 0.08 | 0.028 | 0.003 |
| 2% DAP | 0.52 | 0.6 | 0.006 |
| 1% DAP | 0.53 | 0.61 | 0.001 |
| 50 ppm Salicylic acid | 0.5 | 0.58 | 0.003 |
| 100 ppm Salicylic acid | 0.5 | 0.6 | 0.002 |
| 1% DAP + 100 ppm Salicylic acid | 0.53 | 0.61 | 0.003 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 0.52 | 0.61 | 0.002 |
| 2% DAP + 100 ppm Salicylic acid | 0.49 | 0.61 | 0.005 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 0.54 | 0.6 | 0.004 |
| SEm (±) | 0.15 | 0.19 | 0.001 |
| CD (P=0.05) | 0.45 | 0.57 | NS |

foliar nutrition of 2% DAP and it was comparable with foliar spray of 1% KCl and 1% boron at flowering and pod setting stage of pulse crop (Uma and Karthik, 2017). This might be due to increased availability of nutrients to plants leading to maximum plant growth in terms of plant height and leaf area which in turn contributed higher DMP production. During this study we examined that these results also resemble the findings of Nazir *et al.* (2011).

CGR and RGR

At 60 DAS, the maximum Crop growth rate and Relative growth rate was recorded maximum with 2% DAP (0.99 g/m²/day and 0.006 g/g/day respectively) but there was no significant difference found among the treatments of greengram crop. Foliar application of salicylic acid might mitigate the adverse effects of drought stress levels and significantly increases (CGR) Crop Growth Rate and (RGR) Relative Growth Rate. (Majeed *et al.*, 2016)

Yield attributes and Yield

Foliar spray of 1% DAP+100ppm Salicylic Acid recorded significantly maximum pods/plant (55.60) which was 9.26% over control, grains/pod (9.93) which was 11.95% higher over control, test weight (36.84 g) which was 23% higher than control, grain yield (855.55 kg/ha) which was 46% higher than control and stover yield (2233.33 kg/ha) which was 9.85% higher over control. The increase in yield was due to the increase in the number of flowers per plants and higher fertility coefficient imparted by the foliar application of nutrient chemicals and plant growth regulators as reported by Chandrasekhar and Bangaruswamy (2003), Sharma and Dey (1986). The increase in yield attributes might be due to supplementation of nutrients at the critical stage without physiological stress. Foliar application of nutrients enhanced the number of floral buds, prevented the floral shedding by maintaining optimum bio-physiological conditions in plants. Adequate and continuous nutrient availability through soil and foliar nutrition promotes the supply of assimilates to sink or yield container, thus enlarging the size of the yield structure (Uma and Karthik 2017). have also confirmed the results of present study.

Economics

Foliar spray of 1% DAP+100ppm Salicylic Acid recorded significantly maximum Net returns (65577.54 ¹/ha) and Benefit-Cost Ratio (1.69) which was significantly superior over other treatments except with 2% DAP (53405.18 ¹/ha and 1.29 respectively) and 100 ppm Salicylic acid (49246.68 ¹/ha and 1.36 respectively). It may be because spray of 2% DAP supplied both nitrogen and phosphorous and also helped in effective translocation of the nutrients from one part to another part of the plant. These findings were similar to that of Kumar *et al.* (2013).

Table 6: Effect of foliar spray of nutrient and Plant growth regulators on Yield attributes and Yield of Greengram

| Treatments | Pods/ Plant (No). | Grains/ Pod (No.) | Test weight (g) | Seed Yield (kg/ha) | Stover Yield (kg//ha) | Harvest Index (%) |
|---|----------------------|----------------------|--------------------|-----------------------|--------------------------|----------------------|
| No Spray (Control) | 50.87 | 8.87 | 29.91 | 588.75 | 2030.00 | 22.47 |
| 2% DAP | 51.47 | 9.33 | 30.63 | 775.37 | 2093.33 | 27.27 |
| 1% DAP | 49.4 | 8.93 | 30.91 | 485.44 | 2216.67 | 17.96 |
| 50 ppm Salicylic acid | 48.27 | 8.53 | 28.96 | 661.99 | 1326.67 | 33.3 |
| 100 ppm Salicylic acid | 51.33 | 9.53 | 34.73 | 698.81 | 1983.33 | 26.05 |
| 1% DAP + 100 ppm Salicylic acid | 55.6 | 9.93 | 36.84 | 855.55 | 2233.33 | 27.64 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 46 | 8.43 | 31.84 | 538.69 | 1416.67 | 27.5 |
| 2% DAP + 100 ppm Salicylic acid | 51.13 | 8.2 | 34.24 | 632.01 | 1910 | 24.73 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 51.4 | 9 | 32.47 | 695.39 | 1863.33 | 27.14 |
| SEm (\pm) | 1.39 | 0.23 | 0.37 | 47.15 | 77.38 | 1.69 |
| CD (P=0.05) | 4.17 | 0.86 | 1.38 | 141.38 | 231.98 | 5.08 |

Table 7: Effect of foliar spray of nutrient and plant growth regulators on Economics of Greengram

| Treatments | Costof Cultivation | GrossReturns (₹ /ha) | Net Returns (₹ /ha) | B:C Ratio |
|---|--------------------|----------------------|---------------------|-----------|
| No Spray (Control) | 35528.1 | 72173.14 | 36645.04 | 1.03 |
| 2% DAP | 41210.1 | 94615.28 | 53405.18 | 1.29 |
| 1% DAP | 38544.1 | 59916.22 | 21372.12 | 0.55 |
| 50 ppm Salicylic acid | 35988.1 | 80434.04 | 44445.94 | 1.23 |
| 100 ppm Salicylic acid | 36098.1 | 85344.78 | 49246.68 | 1.36 |
| 1% DAP + 100 ppm Salicylic acid | 38764.1 | 104341.6 | 65577.54 | 1.69 |
| 1% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 39454.1 | 65705.98 | 26251.88 | 0.66 |
| 2% DAP + 100 ppm Salicylic acid | 41430.1 | 77273.78 | 35843.68 | 0.86 |
| 2% DAP + 50 ppm Salicylic acid + NAA 40 ppm | 42120.1 | 84844.58 | 42724.48 | 1.01 |
| SEm (\pm) | — | 5642.264 | 5642.264 | 0.14 |
| CD (P=0.05) | — | 16915.5 | 16915.5 | 0.43 |

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