The Bioscan 16(3): 195-198, 2021
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EFFECT OF PLANT GROWTH REGULATORS AND MICRONUTRIENTS ON GROWTH AND YIELD OF VARIETIES OF GREENGRAM (*Vigna radiata* L.)

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KEYWORDS
Greengram
Kharif
Salicylic acid
Zinc

Received on :
30.12.2020

Accepted on :
14.07.2021

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ABSTRACT
An experiment was carried out during *Kharif* season 2019 at Crop Research Farm, NAI, SHUATS to study about the Effect of plant growth regulators and micronutrients on growth and yield of varieties of Green gram (*Vigna radiata* L.). The experiment consisted of 10 treatments which includes Two varieties of green gram *i.e.* SAMRAT and VERSHA-563 was used with different concentrations of Plant Growth regulators Salicylic acid 100, 200 ppm, and micronutrients zinc 100 ppm and boron 100 ppm of each concentration and one respective control was used. The result showed that growth parameters *viz*,plant height (40.63cm) at 60DAS, Dry weight (7.93 g/ plant) at 60DAS were recorded superior with application of salicylic acid 200 ppm in variety samrat. Nodules/ plant (22.67) at 60 DAS were recorded superior with application of $ZnSO_4$ 100 ppm in variety samrat. The yield parameters *viz*, pods per plant (38.33), Grain yield (1115.15 kg/ ha), Stover yield (2465.28 kg/ha) were recorded superior with the application of salicylic acid 200 ppm in variety samrat.Growth and yield characteristics were enhanced by application of salicylic acid 200 ppm in Samrat variety. So, based on results Samrat variety with salicylic acid 200 ppm consider to be the suitable combination to increasing greengram production.

INTRODUCTION

Mungbean (*Vigna radiata* L.) commonly known as green gram is an important conventional pulse crop of India. It 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. Throughout the India, the mungbean is used for different purposes. The major portion is utilized in making dal, soup, sweets and snacks (Anonymous, 2015).

In recent years, the use of nutrients as foliar spray is gaining importance in improving the yield potential and also the quality of produce in several crops as to meet out their nutrient requirement inspite of abrupt soil conditions. During the last decades, foliar feeding of nutrients has become an established procedure in crop production to increase yield and improve the quality of crop products.

Plant growth regulators can improve the physiological efficiency including photosynthetic ability and thereby helping in effective flower formation, fruit and seed development and ultimately enhance productivity of the crops (Solamani *et al*. 2011). Foliar feeding of plants can effectively supplement soil fertilization. It has been found that element foliar application is more influential compared to soil application (Kazemi and Mohsen 2013).

Salicylic acid is a phenolic phytohormone and is found in plants with roles in plant growth and development, photosynthesis, transpiration, ion uptake and transport. Salicylic acid also induces specific changes in leaf anatomy and chloroplast structure. Salicylic acid (SA) is an endogenous plant growth of phenolic nature that possesses an aromatic ring with a hydroxyl group or its hormone plays a vital role in plant growth, ion uptake and transport (Hayat *et al.,* 2010).

Micronutrients are essential for plant growth, the foliar application of Zn modulates the plant growth and production in mungbean including straw yield and crude protein in seeds. Boron is one of the mineral nutrients required for normal plant growth. The most important functions of boron in plants are thought to be its structural role in cell wall development, cell division, seed development and stimulation or inhibition of specific metabolic pathways for sugar transport and hormone development (Ahmad *et al.,* 2009). Boron is mainly required for reproduction of plant and germination of pollen grain. It is also primarily needed to maintain the growth of apical growing point. The objective of the Research is to study the effect of Salicylic acid, Zinc and Boron on growth and yield of Greengram varieties.

MATERIALS AND METHODS

A field experiment was conducted during *Kharif* 2019 to study the ''Effect of plant growth regulators and micronutrients on growth and yield of varieties of Green gram (*Vigna radiata* L.), at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.3),

low in organic carbon (0.57%), available N (230 kg/ha), available P (32.10 kg/ha) and available K (235 kg/ha). Two varieties of green gram *i.e.* SAMRAT and VERSHA-563 was used with different concentrations of Plant Growth regulators Salicylic acid 100, 200 ppm, and micronutrients zinc 100 ppm and boron 100 ppm of each concentration and one respective control was used. The treatments comprised of T_1- SAMRAT + Control, T_2- SAMRAT + Salicylic acid 100 ppm, T_3- SAMRAT + Salicylic acid 200 ppm, T_4- SAMRAT + $ZnSO_4$ 100 ppm, T_5- SAMRAT + Boron 100 ppm, T_6- VERSHA-563 + Control, T_7- VERSHA-563 + Salicylic acid 100 ppm, T_8- VERSHA-563 + Salicylic acid 200 ppm, T_9- VERSHA-563 + $ZnSO_4$ 100 ppm, T_{10}- VERSHA-563 + Boron 100 ppm. The experiment was laid out in randomized block design with ten treatments and replicated thrice. The recommended dose of fertilizers were applied at the time of sowing in the form of Urea, SSP and MOP. Foliar application of plant growth regulator and micronutrients as per treatment at recommended solutions were applied at 25 DAS *i.e.* before flowering with the help of sprayer. Seeds were sown 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 motar, passed through 2 mm sieve and were used for analysis. Collected soil samples were analyzed for organic carbon by rapid titration method, Available nitrogen was estimated by alkaline permanganate method by Subbiah and Asija (1956), available phosphorus by Olsen's method as outlined by Jackson (1973), available potassium was determined by extracting with neutal 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) values were calculated the 'F' test was found significant at 5% level.

RESULTS AND DISCUSSION

The growth parameters like plant height, number of nodules and Dry weight of plant were significantly affected by the foliar application of Salicylic acid, zinc and boron.

Growth attributes

Plant height

The results in (Table- 1) revealed that Foliar application of salicylic acid 200 ppm recorded significantly maximum plant height (40.63 cm) in samrat variety. However, T_2 SAMRAT + Salicylic acid 100 ppm (39.20 cm), T_8 VERSHA-563 + Salicylic acid 200 ppm (38.53 cm), T_4 SAMRAT + $ZnSO_4$ 100 ppm (37.46 cm) and T_7 VERSHA-563 + Salicylic acid 100 ppm

Table 1: Influence of Plant growth regulators and micronutrients on growth attributes of Greengram varieties (60DAS)

Treatment combinations	Plant height (cm)	Nodules/plant	Dry weight (g)
T_1: SAMRAT + Control	34.24	16.33	6.03
T_2: SAMRAT + Salicylic acid 100 ppm	39.20	16.61	6.80
T_3: SAMRAT + Salicylic acid 200 ppm	40.63	21.90	7.93
T_4: SAMRAT + $ZnSO_4$ 100 ppm	37.46	22.67	6.47
T_5: SAMRAT + Boron 100 ppm	35.39	19.78	5.48
T_6: VERSHA-563 + Control	32.12	15	5.85
T_7: VERSHA-563 + Salicylic acid 100 ppm	37.17	15.26	6.36
T_8: VERSHA-563 + Salicylic acid 200 ppm	38.53	19.78	7.22
T_9: VERSHA-563 + $ZnSO_4$ 100 ppm	35.29	21.33	6.64
T_{10}: VERSHA-563 + Boron 100 ppm	34.72	21	6.22
F test	S	S	S
SEm±	1.17	0.83	0.28
CD (P = 0.05)	3.47	2.46	0.84

Table 2 : Influence of Plant growth regulators and micronutrients on Yield attributes of Greengram varieties

Treatments combinations	No.of Pods/plant	Grain yield (Kg/ha)	Stover yield (Kg/ha)
T_1: SAMRAT + Control	32.80	860.22	2079.33
T_2: SAMRAT + Salicylic acid 100 ppm	36.50	1021.44	2357.07
T_3: SAMRAT + Salicylic acid 200 ppm	38.33	1115.15	2465.28
T_4: SAMRAT + $ZnSO_4$ 100 ppm	34.60	973.53	2175.83
T_5: SAMRAT + Boron 100 ppm	37.43	1000.67	2241.67
T_6: VERSHA-563 + Control	31.97	834.66	1966.33
T_7: VERSHA-563 + Salicylic acid 100 ppm	34.73	952.99	2185.11
T_8: VERSHA-563 + Salicylic acid 200 ppm	35.03	1080.22	2293.67
T_9: VERSHA-563 + $ZnSO_4$ 100 ppm	33.40	898	2072
T_{10}: VERSHA-563 + Boron 100 ppm	35.33	927	2216.67
F test	S	S	S
SEm±	0.62	43.08	37.23
CD (P = 0.05)	1.84	128.01	110.61

(37.17 cm) were found to be statistically at par with T_3 SAMRAT + Salicylic acid 200 ppm at 60 days after sowing. The increase in plant height due to Foliar spray of Salicylic acid enhances photosynthetic activity and plant growth under salinity (Khan *et al*., 2014). The data also indicated that the effect of salicylic acid at 200 ppm concentration was more pronounced than other concentrations as well as control. The increase in plant height may be due to the role of salicylic acid in enhancing some physiological and biochemical aspects (Maity and Bera 2009). The similar results were also reported by Muthulakshmi and Lingakumar (2016) in black gram.

Number of nodules/plant

The results suggested that nodule initiation in the roots started at 9 days after sowing seeds, reached the peak at 45 DAS and thereafter started reducing in numbers until 60 DAS due to spontaneous degeneration.

(Table No.1) showed that significantly maximum number of nodules per plant (22.67) was recorded with Foliar application of $ZnSO_4$ 100 ppm in samrat variety. However, T_3 SAMRAT + Salicylic acid 200 ppm (21.90), T_9 VERSHA-563 + $ZnSO_4$ 100 ppm (21.33), and T_{10} VERSHA-563 + Boron 100 ppm (21.00) were found to be statistically at par with T_4 SAMRAT + $ZnSO_4$ 100 ppm at 60 days after sowing. Foliar applied nutrients play a vital role in acceleration the root growth, contributing to better absorption of nutrients from the soil. The results are in agreement with the report of (Shashikumar *et al*., 2013 and Shivesh *et al*., 2000). Application of Zn has shown good response on nodulation in Black gram. The increase in nodulation might be due to the enhanced rooting system with the application of Zn (Pavadai *et al.,* 2004). Foliar spray of 1 % DAP + 100 ppm Salicylic acid significantly increases number of nodules per plant in greengram. This might be due to increased activity of rhizobia in soil due to application of foliar spray of 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. The similar results were also reported by (Sruthi *et al.,* 2020).

Dry weight (g)

At 60 DAS, Foliar spray of salicylic acid 200 ppm recorded significantly maximum dry weight (7.93 g) in samrat variety. However, T_8 VERSHA-563 + Salicylic acid 200 ppm (7.22 g) is found to be statistically at par with T_3 SAMRAT + Salicylic acid 200 ppm at 60 days after sowing. The highest total dry weight/plant was recorded with foliar sprayed salicylic acid 200 ppm, followed by foliar sprayed GA_3 100ppm. (Prakash *et al*., 2019). This might be due to increased availability of nutrients to plant leading to maximum plant growth in terms of plant height and leaf area which in turn contributed higher Dry matter production. These findings were similar to that of (Nagasubramaniam *et al.,* 2007).

Yield attributes and yield

Number of pods/plant

The yield attributes and yield of greengram varieties at harvest markedly influenced with foliar application of salicylic acid, zinc and boron. (Table No- 2) represent that Foliar application of salicylic acid 200 ppm recorded significantly superior number of pods per plant (38.33) in samrat variety. However, T_5 SAMRAT + Boron 100 ppm (37.43), T_2 SAMRAT + Salicylic acid 100 ppm (36.50), were found to be statistically at par with T_3 SAMRAT + Salicylic acid 200 ppm. This is due to The flower and pod drop may be reduced to some extent by spraying various growth regulators on foliage (Ramesh and Thirumuguran, 2001).

Grain yield (kg/ha)

Foliar spray of salicylic acid 200 ppm recorded significantly superior Grain yield (1115.15 kg/ha) in samrat variety. However, T_8 VERSHA-563 + Salicylic acid 200 ppm (1080.22 kg/ha), T_2 SAMRAT + Salicylic acid 100 ppm (1021.44 kg/ha) and T_5 SAMRAT + Boron 100 ppm (1000.67 kg/ha) were found to be statistically at par with T_3 SAMRAT + Salicylic acid 200 ppm. Ananthi and Gomathy (2011) Reported that flowering and yield components were significantly increased by the application of Salicylic acid 200 ppm. The flower and pod drop may be reduced to some extent by spraying various growth regulators which increases the yield (Ramesh and Thirumuguran, 2001) have also confirmed the results of present study.

Stover yield (kg/ha)

Foliar spray of salicylic acid 200 ppm recorded significantly superior stover yield (2465.28 kg/ha) in samrat variety. However, T_2 SAMRAT + salicylic acid 100 ppm (2357.07 kg/ha) is found to be statistically par with T_3 SAMRAT + Salicylic acid 200 ppm. salicylic acid induced positive influence on yield and yield attributes in greengram, foliar spray of salicylic acid, @ 150 ppm increases stover yield yield in greengram over the control Kumar *et al*. (2018).

Based on results, the influence of salicylic acid 200 ppm has positively enhanced the growth and yield characteristics of variety SAMRAT in kharif season, this information may useful to Prayagraj region farmers to adopt the time and amount of salicylic acid application particularly in SAMRAT variety to increasing greengram production.

ACKNOWLEDGEMENT

The authors are thankful to Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University Of Agriculture ,Technology and Sciences, Prayagraj, (U.P.) India for providing field, facilities and assistance in conducting this research.

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