Plant Archives Vol. 24, No. 1, 2024 pp. 265-269 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.1.037

INFLUENCE OF FOLIAR APPLICATION OF SALICYLIC ACID AND NAPHTHALENE ACETIC ACID (NAA) ON BIOCHEMICAL AND YIELD CONTRIBUTING TRAITS IN MUNGBEAN (*VIGNA RADIATA* L.)

Rakesh Yadav[1]*, Saurabh Singh[1], Shraddha Singh[1], Prabhat Kumar Singh[2], Deepak Tripathi[1], Niraj Yadav[1] and R. K. Yadav[1]

[1]Department of Crop Physiology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya - 224 229 (U.P.), India.

[2]Department of Molecular Biology and Biotechnology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya - 224 229 (U.P.), India.

*Corresponding author E-mail : rakeshyadav9796@gmail.com

(Date of Receiving-10-10-2023; Date of Acceptance-16-01-2024)

ABSTRACT

The present investigation was conducted during *kharif* season, 2018 at the experiment site of Student Instructional Farm (SIF) Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.), India. The experiment was conducted in randomized block design (RBD) with three replications, seven treatments and one variety Narendra mung-1 (NDM-1). The results indicated that the treatment T5 (foliar application of NAA @ 80 ppm at 30 DAS) showed significant increase on biochemical studies like total chlorophyll content in leaf (SPAD value), total nitrogen content in leaf (SPAD value), protein content (%) in mature seed and yield & yield attributes like 100 seed weight (g), seed yield (g plant^{-1}), dry biomass (kg m^{-2}), seed yield (kg m^{-2}), seed yield (q ha^{-1}) and harvest index (%) with T_5, followed by T_7 treatment (foliar application of NAA @ 80 ppm at 40 DAS), respectively over the control.

Key words : Biochemical, Foliar, Napthalene acetic acid, Salicylic acid, Yield.

Introduction

Green gram is the third most important pulse crop in India. It is quite versatile crop grown for seeds, green manure and forage and it is also considered as "Golden Bean" because of its nutritive values and suitability to increasing the soil fertility, by the way of addition of nitrogen to the soil (Anonymous, 2017). It has high nutritive value and due to this, has advantage over the other pulses. The seed contains 24.20% protein content, 1.30% fat and 60.4% carbohydrates, calcium (Ca) 118 and phosphorus (P) is 340 mg per 100 g of seed, respectively (Imran *et al*., 2016).

According to Bose (1932), green gram was classified into 40 different types based on flower color, pod colour, seed colour and seed surface. The flour colour is either light yellowish-olive or olive yellow. The ripe pod colour varies from iron grey, olive grey or snuff. The seed colour varies from green, black, brown or yellow. The seed surface is either dull or shining.

Pulses stand a strategic position in the agricultural economy of India. They contain high percentage of quality protein three times more than cereals. Pulses contain vit-B, minerals and also contain a certain quality fiber which is desirable in human diet because of medical consideration. When pulses are supplemented with cereals, they provide a perfect mix of essential amino acids with high biological values. Pulses are relatively more important in India as their contribution in nutrient supply is more than that in Asia and World (F. A. O, STAT, 2001).

Salicylic acid (SA) is a naturally occurring plant hormone of phenolic nature. Foliar application of salicylic acid exerted a significant effect on plant growth and metabolism when applied at physiological concentration and thus acted as one of the plant growth regulating substances (Kalarani *et al.*, 2002). SA plays a role during the plant response to abiotic stresses such as drought, chilling, heavy metal toxicity, heat and osmotic stress (Rivas *et al.*, 2011). It participates in regulation of physiological process in plants such as stomata closure, ion uptake and transport, inhibition of ethylene biosynthesis, transpiration, stress tolerance, membrane permeability, photosynthesis and growth. The effects of SA on physiological processes of plants depend on its concentration, type of plant, the stage of plant growth and environmental conditions; thus, it can have beneficial or inhibitory effects on plant physiological processes.

Salicylic acid was a colorless crystalline organic acid, and it was openly hired in organic compositions and functions as a plant hormone. Salicylic acid is a phenolic phytohormone and is organize in plants with roles in plant growth and development, photosynthesis, transpiration, ion uptake and transport. Salicylic acid was a signaling compound that played a vigorous role in plant restraint to biotic and abiotic stress such as heat, low temperature and salt stress. Spraying plants with salicylic acid has effective role for potential growth regulator improving plant resistance to high salinity stress.

Naphthalene acetic acid (NAA) is an organic compound with the formula $C_{10}H_7CH_2CO_2H$. This colorless solid is soluble in organic solvents. NAA is a synthetic plant hormone in the auxin family and is an ingredient in many commercial plant rooting horticultural products; it is a rooting agent and used for the vegetative propagation of plants from stem and leaf cutting. It is also used for plant tissue culture.

NAA has been shown to greatly increase cellulose fiber formation in plants, when paired with another phytohormone called gibberellic acid. Because it is in the auxin family it has also been understood to prevent premature dropping and thinning of fruits from stems.

Materials and Methods

The present investigation entitled "Effect of foliar application of Salicylic acid and Naphthalene Acetic acid (NAA) on biochemical and yield contributing traits of Mungbean (*Vigna radiata* L.)" was carried out in the Student Instructional Farm (SIF), Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) under field condition during *Kharif* season of 2018. The details of materials used, experimental procedures followed and techniques used are described.

T_1 - Control: Distilled water spray at 30 and 40 DAS.

T_2 - Foliar spray of SA at a concentration of 50 ppm at 30 DAS.

T_3 - Foliar spray of SA at a concentration of 80 ppm at 30 DAS.

T_4 - Foliar spray of NAA at a concentration of 50 ppm at 30 DAS.

T_5 - Foliar spray of NAA at a concentration of 80 ppm at 30 DAS.

T_6 - Foliar spray of NAA at a concentration of 50 ppm at 40 DAS.

T_7 - Foliar spray of NAA at a concentration of 80 ppm at 40 DAS.

Biochemical parameters

Chlorophyll content in leaf (SPAD value)

SPAD values were measured with the help of SPAD Model: X55/M-PEA plant efficiency analyzer measure chlorophyll content at 35, 45 and 55 DAS.

Nitrogen content in leaf (SPAD value)

SPAD value was measured with the help of SPAD Model: X55/M-PEA plant efficiency analyzer measure nitrogen content at 35, 45 and 55 DAS.

Protein content (%) in mature seed

The total protein content was estimated in mature seed after harvesting by using method of Lowery *et al.* (1951).

Yield and Yield contributing traits

100 seed weight (g)

100 seeds were counted at random from each treatment and weighted to find out 100 seed weight.

Seed yield (g plant^{-1})

The average weight from three representative plants was recorded as grain yield per plant.

Seed yield (kg m^{-2})

Yield was calculated on the basis of m^{-2}, sample collected from the field at maturity. Pods were picked from one m^2 area and finally used for computation of grain yield of mungbean.

Seed yield (kg m^{-2})

Yield was calculated on the basis of m^{-2}, sample collected from the field at maturity. Pods were picked from one m^2 area and finally used for computation of grain yield of mungbean.

Seed yield (qha^{-1})

The individual was harvested and produce was sun-dried and seed weight was recorded kg plot^{-1} and converted into qha^{-1}.

Harvest index

The recovery of grains from the total dry matter was considered as harvest index (HI), which has expressed in percentage. It was calculated by the following formula:

$$\textbf{Harvest Index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Where,

Economic yield = Seed yield

Biological yield = Grain + Straw\

Results and Discussion

Biochemical parameters

Chlorophyll content in leaf (SPAD value)

The mean data regarding to total chlorophyll content in leaf was influenced by foliar application of various PGRs (SA & NAA) have been presented in Table 1. The maximum chlorophyll content in leaf (10.39, 12.93 & 14.13 SPAD value at 35, 45 & 55 DAS, respectively) was recorded with foliar application of NAA (80 ppm) applied at 30 DAS followed by T_4 (NAA 50 ppm) at 35 & 45 DAS and T_7 (NAA 80 ppm) at 55 DAS over the control. Among the treatments, minimum chlorophyll content recorded in T_6 (NAA 50 ppm) at 35, 45 DAS and T_2 (SA 50 ppm) at 55 DAS. Significant increase in chlorophyll content was recorded in T_2, T_3, T_4 & T_5 at 35, 45 & 55 DAS and T_6 & T_7 at 45 & 55 DAS, respectively over the control. This type of findings also be supported by Senthil *et al.* (2003) applied growth regulators (SA at 100 ppm, NAA at 40 ppm and mepiquat chloride at 125 ppm) on green gram and Kumar *et al.* (2018) reported that the foliar spray of two PGRs influenced positive effect on chlorophyll in mungbean.

Nitrogen content in leaf (SPAD value)

The mean data of nitrogen content (SPAD value) was affected by foliar application of different treatments along with control have been represented in Table 2. The maximum nitrogen content in leaf (0.54, 0.64 & 0.67 at 35, 45 & 55 DAS, respectively) was observed with foliar application of NAA (80 ppm) applied at 30 DAS followed by T_4 (NAA 50 ppm) at 35 & 45 DAS and T_7 (NAA 80 ppm) at 55 DAS over the control. Among the treatments, minimum nitrogen content in leaf was recorded in T_6 (NAA 50 ppm) at 35, 45 DAS and T_2 (SA 50 ppm) at 55 DAS over the control. Significant increase in nitrogen

Table 1 : Effect of SA and NAA on chlorophyll content in leaf of mungbean at different growth stages.

S. no.	Treatments	Chlorophyll content (SPAD value)		
		35 DAS	45 DAS	55 DAS
T_1	Control	8.15	9.11	10.73
T_2	SA 50 ppm at 30 DAS	9.09	11.37	12.06
T_3	SA 80 ppm at 30 DAS	9.96	12.18	12.73
T_4	NAA 50 ppm at 30 DAS	10.16	12.68	13.62
T_5	NAA 80 ppm at 30 DAS	10.39	12.93	14.13
T_6	NAA 50 ppm at 40 DAS	8.13	11.23	13.18
T_7	NAA 80 ppm at 40 DAS	8.23	11.47	13.72
SEm±		0.19	0.27	0.10
CD at 5%		0.59	0.84	0.30

Table 2 : Effect of SA and NAA on nitrogen content in leaf of mungbean at different growth stages.

S. no.	Treatments	Nitrogen content (SPAD value)		
		35 DAS	45 DAS	55 DAS
T_1	Control	0.42	0.49	0.54
T_2	SA 50 ppm at 30 DAS	0.48	0.54	0.58
T_3	SA 80 ppm at 30 DAS	0.51	0.58	0.62
T_4	NAA 50 ppm at 30 DAS	0.53	0.61	0.64
T_5	NAA 80 ppm at 30 DAS	0.54	0.64	0.67
T_6	NAA 50 ppm at 40 DAS	0.43	0.52	0.63
T_7	NAA 80 ppm at 40 DAS	0.45	0.53	0.66
SEm±		0.01	0.01	0.01
CD at 5%		0.04	0.03	0.03

content was recorded in T_2, T_3, T_4 & T_5 at 35, 45 & 55 DAS over the control. T_6 & T_7 treatments showed significant effect at 45 & 55 DAS over the control. These results are in accordance with Dar *et al.* (2007) found the significantly increase the nitrogen accumulation in leaves of mungbean and Senthil *et al.* (2003) observed that foliar spray of brassinosteroids, SA, NAA, IAA and kinetin significantly increased nitrogenous activity in soybean.

Protein content in mature seed (%)

The data regarding protein content in mature seeds under foliar application of various PGRs (SA & NAA) are presented in Table 3. The maximum protein content in mature seeds (21.97 %) was recorded with foliar spray of NAA (80 ppm) applied at 30 DAS followed by foliar spray of NAA (80 ppm) applied at 40 DAS (21.90%). Among the treatment, minimum protein content (21.23%) was found in foliar application of SA (50 ppm) applied at 30 DAS over the control. Significant increase in protein content was noticed in all treatments except T_2 over the

Table 3 : Effect of SA and NAA on protein content in mature seed of mungbean.

S. no.	Treatments	Protein content in mature seed (%)
T_1	Control	20.53
T_2	SA 50 ppm at 30 DAS	21.23
T_3	SA 80 ppm at 30 DAS	21.37
T_4	NAA 50 ppm at 30 DAS	21.80
T_5	NAA 80 ppm at 30 DAS	21.97
T_6	NAA 50 ppm at 40 DAS	21.67
T_7	NAA 80 ppm at 40 DAS	21.90
SEm±		0.28
CD at 5%		0.87

Table 4 : Effect of SA and NAA on yield and yield parameters of mungbean.

S. no.	Treatments	100 seed weight (g)
T_1	Control	2.67
T_2	SA 50 ppm at 30 DAS	3.02
T_3	SA 80 ppm at 30 DAS	3.06
T_4	NAA 50 ppm at 30 DAS	3.12
T_5	NAA 80 ppm at 30 DAS	3.17
T_6	NAA 50 ppm at 40 DAS	3.12
T_7	NAA 80 ppm at 40 DAS	3.16
SEm±		0.10
CD at 5%		0.30

control. This type of findings also be supported by Singh (2004) found that the foliar spray of NAA (50, 100 and 200 ppm) and (25, 50 and 100 ppm) on urdbean plant, highest protein content was increased in seed.

Yield and yield contributing traits

100 seed weight (g)

The data regarding on 100 seed weight (g) have been presented in Table 4. The mean data revealed that the foliar application of various PGRs (SA & NAA) significantly increased the 100 seed weight (g) over the control. Among the treatments, maximum weight (3.17 g) was recorded with T_5 (NAA 80 ppm) followed by T_7-NAA 80 (3.16 g). However, minimum weight (3.02 g) was recorded in T_2 (SA 50 ppm) over the control *i.e.*, NAA (0, 20, 40 and 60 ppm) and three different spacing (20 cm × 10 cm, 30 cm × 10 cm and 40 cm × 10 cm) significantly improved of 1000 seeds weight, grain yield due to plant growth regulator (NAA).

Seed yield (g plant^{-1})

The data regarding on seed yield (g plant^{-1}) have been presented in Table 5. Statistical analysis of variance indicated that effect of treatment was found significant increase in seed yield (g plant^{-1}). Among the treatments, maximum seed yield (10.9 g plant^{-1}) was recorded with foliar application of NAA (80 ppm) applied at 30 DAS followed by foliar application of NAA (80 ppm) applied at 40 DAS (10.8 g plant^{-1}). However, minimum seed yield (8.3 g plant^{-1}) was recorded in foliar application of SA (50 ppm) applied at 30 DAS. At par value was recorded in T_7 with T_5 over the control. These findings are in close conformity to Rajesh *et al.* (2014) reported that the seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroids (20 ppm) and chlormequat chloride.

Dry biomass (kg m^{-2})

The data regarding on dry biomass (kg m^{-2}) have been presented in Table 5. The mean data revealed that the foliar application of various PGRs (SA & NAA) significantly increased the dry biomass (kg m^{-2}) in all treatments over the control. Among the treatments, maximum dry biomass (0.932 kg m^{-2}) was recorded with foliar application of NAA (80 ppm) applied at 30 DAS followed by foliar application of NAA (80 ppm) applied at 40 DAS (0.929 kg m^{-2}). However, minimum (0.774 kg m^{-2}) was recorded with foliar application of foliar application of SA (50 ppm) applied at 30 DAS over the control. These findings are in close conformity to Rajesh *et al.* (2014) reported that the seed yield increased

Table 5 : Effect of SA and NAA on yield and yield parameters of mungbean.

S. no.	Treatments	Seed yield (g) plant^{-1}	Dry biomass (kg m^{-2})	Seed yield (kg m^{-2})
T_1	Control	7.6	0.714	0.246
T_2	SA 50 ppm at 30 DAS	8.3	0.774	0.268
T_3	SA 80 ppm at 30 DAS	8.6	0.790	0.278
T_4	NAA 50 ppm at 30 DAS	10.2	0.886	0.330
T_5	NAA 80 ppm at 30 DAS	10.9	0.932	0.352
T_6	NAA 50 ppm at 40 DAS	10.1	0.893	0.327
T_7	NAA 80 ppm at 40 DAS	10.8	0.929	0.349
SEm±		0.12	0.01	0.00
CD at 5%		0.37	0.02	0.01

Table 6 : Effect of SA and NAA on yield and yield parameters of mungbean.

S. no.	Treatments	Seed yield (q ha^{-1})	Harvest index (%)
T_1	Control	12.2	34.46
T_2	SA 50 ppm at 30 DAS	12.7	34.58
T_3	SA 80 ppm at 30 DAS	12.9	35.20
T_4	NAA 50 ppm at 30 DAS	13.6	37.30
T_5	NAA 80 ppm at 30 DAS	14.6	37.77
T_6	NAA 50 ppm at 40 DAS	13.4	36.61
T_7	NAA 80 ppm at 40 DAS	14.2	37.58
SEm±		0.10	
CD at 5%		0.30	

significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroids (20 ppm) and chlormequat chloride.

Seed yield (kg m^{-2})

The data regarding on seed yield (kg m^{-2}) have been presented in Table 5. The mean data revealed that the foliar application of various PGRs (SA & NAA) significantly increased the seed yield (kg m^{-2}) in all treatments over control. Among the treatments, maximum seed yield (0.352 kg m^{-2}) was recorded with foliar application of NAA (80 ppm) applied at 30 DAS followed by foliar application of NAA (80 ppm) applied at 40 DAS (0.349 kg m^{-2}). However, minimum seed yield (0.268 kg m^{-2}) was recorded with foliar application of SA (50 ppm) applied at 30 DAS over the control. These findings are in close conformity to Rajesh *et al*. (2014) reported that the seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroids (20 ppm) and chlormequat chloride.

Seed yield (q ha^{-1})

Data pertaining to seed yield (q ha^{-1}) was recorded and presented in Table 6. Statistical analysis of variance indicated that the effect of treatment was found significant on seed yield (q ha^{-1}). Maximum seed yield (14.6 q ha^{-1}) was recorded with foliar application of NAA (80 ppm) applied at 30 DAS followed by foliar application of NAA (80 ppm) applied at 40 DAS (14.2 q ha^{-1}). However, minimum seed yield (12.7 q ha^{-1}) was recorded with foliar application of SA (50 ppm) applied at 30 DAS over the control. At par value was recorded in T_7 treatment with T_5 treatment. These findings are in close conformity to Rajesh *et al*. (2014) reported that the seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroids (20 ppm) and chlormequat chloride.

Harvest index

The data clearly indicates that statistically significant variations due to various treatments were observed in terms of harvest index and presented in Table 6. Maximum harvest index (37.77 %) was calculated with foliar application of NAA (80 ppm) applied at 30 DAS followed by foliar application of NAA (80 ppm) applied at 40 DAS (37.58 %). However, minimum harvest index (34.58%) was recorded in foliar spray of SA (50 ppm) over the control. These findings are in close conformity to Rajesh *et al*. (2014) reported that the seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroids (20 ppm) and chlormequat chloride.

References

Anonymous (2017). All India coordinated research project on MuLLaRP crop annual group meet *kharif*.

Dar, Z.M., Hemantaranjan A. and Pandey S.K. (2007). Effects of salicylic acid on growth, nitrate reductase activity and mineral uptake by mungbean (*Vigna radiate* L.) under induced salinity. *Legume Res*., **30(2)**, 133-136.

FAO (2001). *The state of food and agriculture 2001* (No. 33). Food & Agriculture Org..

Imran, Khan A.A., Inam I. and Ahmad F. (2016). Yield and yield attributes of Mungbean (*Vigna radiata* L.) cultivars as affected by phosphorus levels under different tillage system. *Soil Crop Sci. Res*., **2**, 1151.

Kalarani, M.K., Thangaraj M., Sivakumar R. and Mallika V. (2002). Effects of salicylic acid on tomato (*Lycopersicon esculentum* Mill) productivity. *Crop Research-Hisar*, **23(3)**, 486-492.

Kumar, R., Yadav R.K., Sharma N. and Nehal N. (2018). Influence of plant growth regulators on yield and yield attributes of mungbean (*Vigna radiata* L. Wilczek). *J. Pharmacog. Phytochem*., **2**, 98-100.

Rajesh, K., Reddy S.N., Reddy A.P.K. and Singh B.G. (2014). A comparative study of plant growth regulators on morphological, seed yield and quality parameters of green gram. *Int. J. Appl. Bio. Pharmaceut. Tech*., **5(3)**.

Rivas-San Vicente, M. and Plasencia J. (2011). Salicylic acid beyond defence: its role in plant growth and development. *J. Exp. Bot*., **62(10)**, 3321-3338.

Senthil, A., Pathmanaban G. and Thangaraj M. (2003). Effect of growth regulators on certain physiological and biochemical aspect to green gram (*Vigna radiata*). *Legume Res*., **26(3)**, 200- 203.

Singh, N. and Singh R.P. (2004). Effect of phytohormone on some biochemical characteristics of black gram (*Vigna mungo* L. Hepper) seed. *Indian J. Agric. Biochem*., **17(1)**, 35-36.