The Pharma Innovation Journal 2023; 12(3): 1938-1941

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 1938-1941

www.thepharmajournal.com
Received: 08-12-2022
Accepted: 13-01-2023

KB Chaudhary
Department of Plant Physiology, BA College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

SJ Macwan
Department of Plant Physiology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

JJ Dhruv
Department of Biochemistry, B. A College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

JJ Ghadiali
Department of Plant Physiology, BA College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Saumya Shruti
Department of Plant Physiology, BA College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Corresponding Author:
KB Chaudhary
Department of Plant Physiology, BA College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Impact of plant growth regulators and chemicals on growth and quality in green gram [*Vigna radiata* L.] cv. GAM-5

KB Chaudhary, SJ Macwan, JJ Dhruv, JJ Ghadiali and Saumya Shruti

Abstract
An experiment was conducted at Department of Plant Physiology, B. A. College of Agriculture, Anand Agricultural University, Anand with a view to study the impact of plant growth regulators and chemicals on growth and quality in green gram [*Vigna radiata* L.] cv. GAM-5 during the summer 2021. The experiment was arranged in randomized block design with three replications having ten treatments which comprise of T1 (CaCl2 1%), T2 (KNO_3 0.5%), T3 (KNO_3 1%), T4 (GA_3 25 mg/l), T5 (GA_3 50 mg/l), T6 (GA_3 100 mg/l), T7 (NAA 25 mg/l), T8 (NAA 50 mg/l), T9 (NAA 100 mg/l) and T10 (control). The results revealed that significantly maximum chlorophyll content (31.99, 44.06, 58.55 and 14.90 SPAD) and leaf area ratio (42.80, 28.28, 19.10 and 12.13 $cm^2\ g^{-1}$) at 30, 45, 60 DAS and at harvest, respectively, while higher seed protein 25.23% at harvest. Significantly maximum leaf area duration (6.49, 10.48 a n d 10.46 days) and crop growth rate (8.95, 15.08 and 2.80 $g\ m^2\ day^{-1}$) at 30-45 DAS, 45-60 DAS and 60 DAS-at harvest was recorded with the foliar application of GA_3 25 mg/l. Application of plant growth regulators and chemical particularly GA_3 25 mg/l application found to be most suitable for the productivity and quality of green gram.

Keywords: Growth regulator, growth, greengram, physiological parameters

Introduction
Green gram or mungbean is botanically recognized as [*Vigna radiata* Lin Wilczek] and belongs to the family Fabaceae (leguminaceae). The genus vigna has been broadened to include about 155 species but only twenty-two species are native to India (Mishra *et al.*, 2021) [1]. One of the most important among these species is *Vigna radiata* L. with dark green foliage, spreading pods and green seeds. Green gram is the third important pulse crop in India (Anon., 2004). Green gram [*Vigna radiata* L. Wilczek] is one of the most ancient and extensively grown leguminous crops of India. It is a native of India and Central Asia and is commonly known as *mung*, *moong*, *mungo* and golden gram. Its seed is more palatable, nutritive, digestible, and non-flatulent than other pulses grown in the world. The seed of green gram contain an average of 20-24% protein, 62.5% carbohydrates, 1.4% fat, 4.2% fiber, vitamins and minerals (Sehrawat *et al.*, 2013) [3]. Pulses have great importance in Indian agriculture as they are rich source of protein as compared to that of cereals. Keeping in view many benefits of pulses for human health, United Nations has proclaimed 2016 as the International Year of Pulses. Thus, due attention is required to enhance the production of pulses for not only to meet the dietary requirement of protein but also to raise the awareness about pulses for achieving nutritional, food security and environmental sustainability. Pulses are important component to sustain the agricultural production as the pulse crops possess wide adaptability to fit into various cropping systems, being leguminous in nature improve the soil fertility and physical health of soil while, making soil more porous due to tap root system and by fixing atmospheric nitrogen (Sengupta and Tamang, 2015) [4]. The yield potential of green gram in research plot is 1000 –1200 kg per ha whereas 800 – 900 kg per ha in farmer's field. The national average yield may be still around 400 – 500 kg per hectare (Kamaraj and Padmavathi, 2013) [5].
Gibberellin generally increases cell elongation and cell division. The application of GA_3 can modify morphological and yield characteristics in soybean (Kalyankar *et al.*, 2008) [7]. Auxins are organic substances that promote the apical dominance. The important functions of auxin are cell division and root formation. NAA also play important role for the efficient transport of sugar from source to sink and facilitating nitrogen accumulation that probably increase dry matter production (Kalita *et al.*, 1995) [6].

In many leguminous crops beneficial effects of growth regulators have been studied *viz.*, mung bean (*Vigna radiata*) (Kandagal *et al.*, 1990) [8], black gram (*Vigna mungo*) (Prakash *et al.*, 2003) [9], cow pea (*Vigna unguilata*) (Mohandoss and Rajesh, 2003) [10]. These growth regulators when applied as foliar spray in optimum concentrations at proper growth stage play significant role in increasing crop yield. Sufficient amounts of K are required for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between proteins and carbohydrates (Singh, 2017) [11].

Nitrate (NO^{-3}) is easily absorbed by plants at high rates. Unlike urea or ammonium, it is immediately available as a nutrient. Nitrate is highly mobile in the soil and reaches the plant roots quickly (Deotale *et al.*, 2015) [12] applying nitrogen as ammonium nitrate or calcium ammonium nitrate provides an instant nutrient supply. Calcium is also known to exert important consequence on several physiological processes in plants like ion transport, translocation of carbohydrates, proteins and their storage during seed formation and other enzymatic activities. Calcium has been reported to inhibit Na^+ uptake and thereby reduce its adverse effect on seed germination as well as increase plant growth (Munns, 2002) [13]. Potassium affects respiration, photosynthesis, chlorophyll development, water content of leaves, carbon dioxide (CO_2) assimilation and carbon movement. Potassium also has an important role in the translocation of photosynthates from sources to sinks (Cakmak *et al.*, 1994).

Material and Methods

Present investigation on "Effect of plant growth substances on morphophysiological parameter of green gram (*Vigna radiata* L.)" was carried out during summer season of the year 2021-22 at Plant Physiology Farm, Department of Plant Physiology. B. A. College of Agriculture, A.

A. U., Anand. The Anand is located in middle Gujarat where agro-climatic region semi-arid and sub-tropical type. Winter is mild, cool and dry while summer is quite hot and dry. The soil of the field where experiment carried out is sandy loam and is locally known as "*Goradu*". The experiment was conducted in randomized block design with three replications, including ten treatments. The green gram variety Gujarat Anand Mungbean-5 were used for the study with different treatment inclusions of T1 (CaCl2 1%), T2 (KNO_3 0.5%), T3 (KNO_3 1%), T4 (GA_3 25 mg/l), T5 (GA_3 50 mg/l), T6 (GA_3 100 mg/l), T7 (NAA 25 mg/l), T8 (NAA 50 mg/l), T9 (NAA 100 mg/l) and T10 (control). Plant growth regulators spray solutions were prepared by dissolving in organic solvent then maintained the desired concentration in distilled water. The percent solution was prepared by dissolving a particular quantity or unit weight per volume of a substances in solvent such that resulting solution is weighty volume. Protein content from seed powder was estimated as per method described by Annonymous (1970) [15]. The foliar application of the said treatment was applied at 30 days after sowing. The observations were recorded at 30, 45, 60 DAS and at harvest. The data recorded from the various observations were tabulated and then subjected to their statistical analysis by using the method of analysis of variance as described by Panse and Sukhatme (1967) [15].

Result and Discussion

Effect on growth and quality parameters

The effect of various plant growth regulators and chemicals on growth parameters contents, chlorophyll and seed protein in green gram were evaluated at different growth stages are listed below.

Leaf Area Ratio

The leaf area ratio of green gram was reported to be decreasing after 30 days of sowing at various growth stages. The results showed that different plant growth regulator and chemical treatments had no effect on leaf area ratio ($cm^2\ g^{-1}$) at 45, 60 days after sowing and at harvest. The maximum leaf area ratio (42.80, 28.28, 19.10 and 12.13 $cm^2\ g^{-1}$) at 30, 45, 60 DAS and at harvest, respectively) recorded with treatment T4 (GA_3 25 mg/l) and it remained at par with 30 DAS (T5, T6, T8 and T9). The minimum leaf area ratio of 29.00, 23.75, 18.20 and 11.26 at 30, 45, 60 DAS and at harvest, respectively was recorded with Control treatment T_{10} (Table 1). The leaf area ratio measures photosynthetic capacity per unit of respiration and growing tissue (Wallace *et al.*, 1972). The results showed that the higher leaf area ratio was found in the beginning or early stage of the crop stage and decreased as it grew towards maturity. The current investigations are consistent with the results of Bhadane *et al.* (2021) [17] in green gram.

Leaf Area Duration

The results of leaf area duration were gradually increased up to 45-60 days after sowing and then decreased. The maximum leaf area duration (6.49, 10.48 and 10.46 days) at 30-45 DAS, 45-60 DAS and 60 DAS-at harvest, respectively) recorded with treatment T_4 (GA_3 25 mg/l) and it remained at par with at 30-45 DAS, 45-60 DAS and 60 DAS-at harvest (T5). The minimum leaf area duration (3.83, 6.78 and 6.80) at 30-45 DAS,

45-60 DAS and 60 DAS-at harvest, respectively was recorded with control treatment T_{10} (Table 1). The foliar application of plant growth regulators and chemicals resulted in the maximum leaf area duration. The leaf area index growth indices between two consecutive growth phases are leaf area duration, which are important to know the yield or accumulation of photosynthates was discussed by Bhadane *et al.* (2021) [17]. Leaf area duration denotes leafiness or maturity assimilatory surface area over time, which is critical for productivity. Similar results were also reported by Singh and Jambukiya (2020) [18] in green gram.

Crop Growth Rate

Crop growth rate was shown to increase up to 45-60 days after sowing and then decrease during the 60 DAS-harvest periods, indicating that crop growth rate declines from the reproductive stage to the maturity phase of growth. The effect of plant growth regulators and chemicals differs significantly between treatments at all stages of growth. The maximum crop growth rate (8.95, 15.08 and 2.80 $g\ m^{-2}\ day^{-1}$) at 30-45 DAS, 45-60 DAS and 60 DAS-at harvest, respectively) recorded with treatment T4 (GA_3 25 mg/l) and it remained at par with at 30-45 DAS (T_5, T6 and T7), 45-60 DAS (T5, T6, T7, T8 and T9).

The minimum crop growth rate (6.17, 10.39 and 2.44) at 30-45 DAS, 45-60 DAS and 60 DAS-at harvest, respectively was recorded with control treatment T_{10} (Table 2). Crop growth rate is a character used to estimate crop stand production efficiency. It is influenced by leaf area index, photosynthetic rate, and leaf angle and is an index of light interception. CGR was highest in T4 at 45-60 DAS due to more available sunshine hours for photosynthetic activity, and temperature was highest in the standard week of 18th to 20th. Crop growth increased at pick period 60 DAS and then remained stable due to photosynthate transport towards the reproductive phase. Further findings suggested by Singh and Jambukiya (2020) [18] in green gram and Kunjammal and Sukumar (2019) [19] in green gram.

Chlorophyll content

The chlorophyll content was obtained by soil plant analytical development meter in which various plant growth regulator treatments showed their significant effect on total chlorophyll content in SPAD value at 30, 45 and 60 DAS and at harvest. Significantly the maximum chlorophyll content at 30, 45, 60 DAS and at harvest (31.99, 44.06, 58.55 and 14.90 SPAD respectively) recorded with treatment T4 (GA_3 25 mg/l) and it was at par with 30 DAS (T5, T6 and T7), 45 DAS (T5 and T6), 60 DAS (T5) and at harvest (T5, T6, T7, T8, T9 and T1). The minimum chlorophyll content of 25.44, 34.04, 45.58 and 11.52 SPAD at 30, 45, 60 DAS and at harvest, respectively was recorded with control treatment T10 (Table 2). The results indicates that chlorophyll content was increased from 30 to 45 DAS there after towards the maturity it was found decrease. In our work the photosynthetic pigment chlorophyll increase due to application of plant growth regulators may help in assimilation of photosynthesis which altimately increase the yield of crop. Gomathinayagan *et al.* (2009) [20] also reported at GA_3 and growth retardants are responsible for increasing chlorophyll content with compared to Control. Further the results reported is in harmony with the findings of Baliah *et al.* (2018) [21] in green gram, Das *et al*. (2009) [22] in sesamum, Dheeba *et al*. (2015) [23] in black gram and Kumar *et al.* (2018) in mungbean.

Seed protein content

The highest seed protein *i.e.*, crude protein 25.23% at harvest, respectively was recorded with treatment T_4 (GA_3 25 mg/l) and it remained at par with T5, T6, T7, T8 and T9. The lowest seed protein 21.16 at harvest, respectively was recorded with control treatment T_{10} (Table 2). Further the results reported is in harmony with the findings of Baliah *et al.* (2018) [21] in green gram, Dheeba *et al*. (2015) [23] in black gram and Kumar *et al.* (2018) [24] in mungbean.

Table 1: Impact of plant growth regulators and chemicals on growth and quality in green gram [*Vigna radiata* L.] cv. GAM-5

Treatment		Leaf area ratio ($cm^2 g^{-1}$)				Leaf area duration (Days)		
		30 DAS	45 DAS	60 DAS	At harvest	30-45 DAS	45-60 DAS	60 DAS-At harvest
T1	$CaCl_2$ 1.0%	30.84	24.73	18.32	10.57	4.74	8.27	8.24
T2	KNO_3 0.5%	30.44	24.11	18.52	10.52	4.52	7.97	7.99
T3	KNO_3 1.0%	31.07	24.06	18.31	10.47	4.20	7.52	7.57
T4	GA_3 25 mg/l	42.80	28.28	19.10	12.13	6.49	10.48	10.46
T5	GA_3 50 mg/l	40.56	28.22	18.89	12.04	6.12	9.83	9.92
T6	GA_3 100 mg/l	39.05	27.78	18.58	11.71	5.83	9.44	9.52
T7	NAA 25 mg/l	36.32	26.95	18.35	11.18	5.46	9.10	9.09
T8	NAA 50 mg/l	39.20	28.10	18.68	11.36	5.24	8.86	8.86
T9	NAA 100 mg/l	37.11	27.04	18.63	11.26	4.98	8.53	8.56
T10	Control	29.00	23.75	18.20	10.38	3.83	6.78	6.80
	SEm ±	2.12	1.70	0.86	0.53	0.13	0.24	0.21
	CD at 5%	6.29	NS	NS	NS	0.39	0.72	0.62
	CV (%)	10.29	11.17	8.04	8.16	4.46	4.83	4.13

Table 2: Impact of plant growth regulators and chemicals on growth and quality in green gram [*Vigna radiata* L.] cv. GAM-5

Treatment		Crop growth rate ($g m^{-2} day^{-1}$)			Chlorophyll content (SPAD)				Seed protein (%)
		30-45 DAS	45-60 DAS	60 DAS - At harvest	30 DAS	45 DAS	60 DAS	At harvest	
T1	CaCl2 1.0%	7.39	22.32	2.57	27.17	37.22	50.22	13.00	22.32
T2	KNO3 0.5%	7.15	23.27	2.49	27.11	36.45	48.75	12.10	23.27
T3	KNO3 1.0%	6.93	22.90	2.45	25.72	35.46	48.09	11.81	22.90
T4	GA3 25 mg/l	8.95	25.23	2.80	31.99	44.06	58.55	14.90	25.23
T5	GA3 50 mg/l	8.00	24.71	2.76	29.76	41.83	53.63	14.75	24.71
T6	GA3 100 mg/l	7.76	24.69	2.74	28.51	40.34	52.01	14.02	24.69
T7	NAA 25 mg/l	7.66	24.22	2.66	28.43	39.55	51.05	13.63	24.22
T8	NAA 50 mg/l	7.50	23.94	2.60	27.49	37.81	50.55	13.37	23.94
T9	NAA 100 mg/l	7.45	24.08	2.59	27.33	37.54	50.29	13.02	24.08
T10	Control	6.17	21.16	2.44	25.44	34.04	45.58	11.52	21.16
	SEm ±	0.45	0.51	0.16	1.23	1.48	2.18	0.70	0.51
	CD at 5%	1.35	1.50	NS	3.65	4.38	6.47	2.07	1.50
	CV (%)	10.51	3.70	10.69	7.62	6.65	7.41	9.14	3.70

Conclusions

The present investigation it can be concluded that foliar spray of GA3 25 mg/l is better treatment to improve the growth and quality in green gram [*Vigna radiata* L.] cv. GAM- 5.

Acknowledgement

The authors thankful to Department of plant physiology and Department of biochemistry, Anand Agricultural University, Anand for providing required facilities to carry out the research experiment and helpful suggestions during research work.

References

1. Mishra B, Yadav RK, Singh SP, Singh AK, Singh AK. Effect of foliar application of plant growth regulators on growth and development, biochemical changes and yield of mung bean (*Vigna radiata* L.). Journal of Pharmacognosy and Phytochemistry. 2021;10(1):2789-2794.
2. Anonymous. All India coordinated research project on mullarp crop annual group meet kharif; c2004.
3. Sehrawat N, Jaiswal PK, Yadav M, Bhat KV, Sairam RK. Salinity stress restraining mung bean (*Vigna radiata* L. Wilczek) production: Gateway for genetic improvement. International Journal of Agricultural Crop Sciences. 2013;6(9):505-509.
4. Sengupta K, Tamang D. Response of green gram to foliar application of nutrients and brassinolide. Journal of Crop and Weed. 2015;11(1):43-45.
5. Kamaraj A, Padmavathi S. Influence of pre-sowing seed hardening treatment using botanical leaf extract on growth and yield parameters in green gram. International Journal of Current Agricultural Research. 2013;1(6):30-33.
6. Kalita P, Deyand SC, Chandra K. Influence of foliar application of phosphorus and naphthalene acetic acid on nitrogen, dry matter accumulation and yield of green gram (*Vigna radiate* L. Wilczek) cv. AAU- 34). Indian Journal Plant Physiology. 1995;38(3):197-202.
7. Kalyankar SV, Kadam GR, Borgaonkar SB, Deshmukh DD, Kadam BP. Effect of foliar application of growth regulators on seed yield and yield components of soybean [*Glycine max* (L.) Merrill.]. Asian Journal of Bio Science. 2008;3(1):229-230.
8. Kandagal SS, Panchal YC, Manjunath S. Effects of growth regulators and nutrients on yield components of mung bean genotypes. Journal of Maharashtra Agricultural Universities. 1990;15(2):199-200.
9. Prakash M, Kumar JS, Kannan K, Kumar MS, Ganesan J. Effect of plant growth regulators on growth, physiology and yield of blackgram. Legume Research: An International Journal. 2003;26(3):183-187.
10. Mohandoss M, Rajesh V. Effect of GA3 and 2, 4-D on growth and yield of cowpea (*Vigna unguiculata* L.). Legume Research: An International Journal. 2003;26(3):229-230.
11. Singh DP. Effect of potassium and sulphur on performance of green gram (*Vigna radiata* L.) in alluvial soil. Annals of Plant and Soil Research. 2017;19(2):223-226.
12. Deotale RD, Mahale SA, Patil SR, Sahane AN, Sawant PP. Effect of foliar sprays of nitrate salts on morpho-physiological traits and yield of green gram. Journal of oils and Crops. 2015;25(2):392-392.
13. Munns R. Comparative physiology of salt and water stress. Plant, cell and Environment. 2002;25(2):239-250.
14. Cakmak I, Hengeler C, Marschner H. Changes in phloem export of sucrose in leaves in response to phosphorus, potassium and magnesium deficiency in bean plants. Journal of Experimental Botany. 1994;45(9):1251-1257.
15. Anonymous. Association of Official Analytical Chemist, XI (Edn). Washington D.C. Panse, V. G., & Sukhatme, P. V. (1967). Statistical methods for agricultural workers; c1970.
16. Wallace DH, Ozbun JL, Munger HM. Physiological genetics of crop yield. Advances in Agronomy. Academic Press. 1972;24:97-146.
17. Bhadane RS, Prajapati KR, Rajput SD, Patil K. Influence of Seed Hardening and Foliar Spraying of PGRs on Morpho-physiological Parameters in Green gram (*Vigna radiata* L.). Indian Journal of Agricultural Research. 2021;1:9.
18. Singh C, Jambukiya H. Effect of foliar application of plant growth regulators on growth and yield attributing characters of green gram (*Vigna radiata* L. Wilczek). Journal of Crop and Weed. 2020;16(2):258-264.
19. Kunjammal P, Sukumar J. Effect of foliar application of nutrients and growth regulator on growth and yield of green gram (*Vigna radiata* L.). Madras Agricultural Journal. 2019;106(10/12):600-603.
20. Gomathinayagan PP, Lokhande DP, Dhumal KN. Role of plant growth regulators for improving andrographolide in Andrographis paniculata. Phcog. Mag. 2009;5(19):249-253.
21. Baliah NT, Sheeba PC, Mallika S. Encouraging effect of gibberellic acid on the growth and biochemical characters of green gram (*Vigna radiata* L.). Journal Global Bioscience. 2018;7:5522-5529.
22. Das MR, Sarma CM, Das BK. Interaction between GA3 and CCC on growth, chlorophyll content, yield and oil content of sesamum (*Sesamum indicum* L.). International Journal of Plant Sciences. 2009;4(2):392-95.
23. Dheeba B, Selvakumar S, Kannan M, Kannan K. Effect of gibberellic acid on black gram (*Vigna mungo*) irrigated with different levels of saline water. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2015;6(6):709-20.
24. Kumar R, Yadav RK, Sharma N, Yadav A, Nehal N. Influence of plant growth regulators on biochemical changes of mungbean (*Vigna radiata* L. Wilczek). Journal Pharmacog. Phytochem. 2018;1:386-389.