Study on the impact of foliar application of growth regulators on yield parameters of green gram (*Vigna radiata* L.)

ABSTRACT

Green gram occupies one of the prominent pulse crops cultivated in india. The experiment was laid out in randomized block design with three replications. Different treatment comprising of T1 ($CaCl_2$ 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). At 30 days after sowing different plant growth regulators and chemicals were sprayed as a foliar application of the different treatments. The result indicates that number of seed per pod (12.43), pod length (8.55 cm), 100 seed weight (5.63 g), weight of seed per plant (13.52 g), seed yield per hectare (944 kg ha^{-1}), harvest index (30.92%) was highest recorded by the treatment T4 (GA_3 25 mg/l).

Keywords: Growth regulator, growth, greengram, morphophysiology

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). 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). 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). 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).

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). 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). In many leguminous crops beneficial effects of growth regulators have been studied *viz.*, mung bean (*Vigna radiata*) (Kandagal *et al.,* 1990), black gram (*Vigna mungo*) (Prakash *et al.,* 2003), cow pea (*Vigna unguilata*) (Mohandoss and Rajesh, 2003). 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).

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) 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). 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 "Study on the impact of foliar application of growth regulators on yield parameters 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 data were recorded on number of seed per pod (12.43), pod length (8.55 cm), 100 seed weight (5.63 g), weight of seed per plant (13.52 g), seed yield per hectare (944 kg ha^{-1}), harvest index (30.92%) were highest recorded by the treatment T_4 (GA_3 25 mg/l).The data recorded from the various observations were tabulated and then subjected to their statistical analysis by using the method of analysis of variance (ANOVA) as described by Panse and Sukhatme (1967).

RESULT AND DISCUSSION

The five plants selected from the net plot area were harvested at physiological maturity separately and were used for recording observations of the yield and yield attributing characters like number of pods per plant, pod length, number of seeds per pod, 100 seed weight, seed yield per plant, seed yield per hectare and harvest index were recorded at harvest.

Number of pods per plant

The data regarding number of pods per plant influenced due to different treatments were recorded in Table 1. The data indicated significant differences due to various treatments.

The significantly maximum number of pods per plant (32.35) were recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6 and T_7. Treatment T_{10} (Control) recorded minimum number of pods per plant (21.43) compared to other treatments. This is in agreement with Jadhav (2016) in black gram, Yadav and Bharud (2009) in chickpea and Ganiger *et al*. (2002) in green gram.

Number of seed per pod

The data regarding number of seed per pod influenced due to different treatments were recorded in Table 1. The data indicated significant differences due to various treatments.

The significantly highest number of seed per pod (12.43) were recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6 and T_7. Treatment T_{10} (Control) recorded minimum number of seed per pod (9.41) compared to other treatments.

Further findings suggested by Jadhav (2016) in black gram, Yadav and Bharud (2009) in chickpea and Ganiger *et al*. (2002) in green gram.

Pod length (cm)

Table 1. contains information on how different treatments affected pod length (cm). The data revealed significant differences due to different treatments.

The significantly maximum pod length (8.55 cm) was recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6, T_7, T_8 and T_9. Treatment T_{10} (Control) recorded minimum pod length (7.07 cm) compared to other treatments. Further the results reported is in harmony with the findings of Ganiger *et al*. (2002) in green gram.

Table 1. Effect of plant growth regulators and chemicals on number of pods per plant, number of seed per pod and pod length (cm)

Treat. No.	Treatment Details	Number of pods per plant	Number of seed per pod	Pod length (cm)
T_1	$CaCl_2$ 1%	25.64	10.46	7.64
T_2	KNO_3 0.5%	24.93	10.19	7.47
T_3	KNO_3 1%	22.57	10.05	7.29
T_4	GA_3 25 mg/l	32.35	12.43	8.55
T_5	GA_3 50 mg/l	31.13	11.47	8.48
T_6	GA_3 100 mg/l	29.51	11.18	8.10
T_7	NAA 25 mg/l	27.90	11.00	7.95
T_8	NAA 50 mg/l	26.58	10.86	7.89
T_9	NAA 100 mg/l	25.89	10.57	7.73
T_{10}	Control	21.43	9.41	7.07
	SEm ±	1.75	0.51	0.31
	CD at 5%	5.21	1.51	0.91
	CV%	11.34	8.17	6.78

100 seed weight (g)

The data on 100 seeds weight (g) as influenced by different treatments were reported in Table 2. The data indicated significant differences due to various treatments.

The significantly maximum 100 seed weight (5.63 g) was recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5. Treatment T_{10} (Control) recorded minimum 100 seed weight (4.97 g) compared to other treatments. Further the results reported is in harmony with the findings of Yadav and Bharud (2009) in chickpea.

Weight of seed per plant (g)

The data on the weight of seed per plant (g) as influenced by different treatments were reported in Table 2. The data indicated significant differences due to various treatments.

The perusal of data indicated that the differences for the weight of seed per plant (g) as influenced by different treatment. The significantly maximum weight of seed per plant (13.52 g) was recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6, T_7, T_8, T_9 and T_1. Treatment T_{10} (Control) recorded minimum weight of seed per plant (8.71 g) compared to other treatments. Further the results reported is in harmony with the findings of Yadav and Bharud (2009) in chickpea and Jadhav (2016) in black gram.

Table 2. Effect of plant growth regulators and chemicals on 100 seed weight (g) and Weight of seed per plant (g)

Treat. No.	Treatment Details	100 seed weight (g)	Weight of seed per plant (g)	Seed yield per hectare (kg ha^{-1})	Harvest index (%)
T_1	$CaCl_2$ 1%	4.90	11.80	862	27.74
T_2	KNO_3 0.5%	4.87	11.33	855	27.31
T_3	KNO_3 1%	4.75	10.95	847	26.58
T_4	GA_3 25 mg/l	5.63	13.52	944	30.92
T_5	GA_3 50 mg/l	5.48	12.94	936	30.68
T_6	GA_3 100 mg/l	5.06	12.82	920	30.30
T_7	NAA 25 mg/l	5.02	12.63	906	29.83
T_8	NAA 50 mg/l	4.99	12.40	895	29.43
T_9	NAA 100 mg/l	4.95	12.25	874	28.79
T_{10}	Control	4.67	8.71	810	25.92
	SEm ±	0.14	0.60	27.75	1.13
	CD at 5%	0.42	1.80	81.26	3.35
	CV%	4.91	8.77	5.35	6.79

Seed yield per hectare (kg ha^{-1})

The data regarding seed yield per hectare (kg ha^{-1}) as influenced due to different treatments during the year were recorded. The statistically analyzed data are presented in Table 2.

In the present investigation, significant differences were found for seed yield per hectare due to different treatments. It was observed that plant growth regulators (GA_3, NAA) increased seed yield per hectare as compared to absolute Control treatment. The significantly highest seed yield per hectare (944 kg ha^{-1}) was recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6, T_7, T_8 and T_9. Treatment T_{10} (Control) recorded lowest seed yield per hectare (810 kg ha^{-1}). Further the results reported are in harmony with the findings of Yadav and Bharud (2009) in chickpea, Jadhav (2016) in black gram and Ganiger *et al*. (2002) in green gram.

Harvest index (%)

The data regarding harvest index as influenced due to different treatments were recorded in Table 2. The data indicated significant differences due to various treatments.

In the present investigation, significant differences were found in harvest index due to different treatments. It was observed that plant growth regulators (GA_3, NAA) increased harvest index as compared to Control treatment. The significantly highest harvest index (30.92%) was recorded by the treatment T_4 (GA_3 25 mg/l) and remained at par with the treatments T_5, T_6, T_7, T_8, T_9 and T_1. Treatment T_{10} (Control) recorded lowest harvest index (25.92%) compared to other treatments.

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