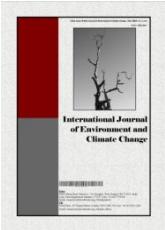

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Effect of Nipping and Plant Growth Regulator on Growth and Yield of Chick Pea *(Cicer arietinum)*

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A field experiment was carried out at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS ,Prayagraj(U.P.)in *rabi* 2021 to study the "Effect of nipping and plant growth regulator on growth and yield of Chick pea *(Cicer arietinum)*".It was consisting of three combinations of nipping and plant growth regulators. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. The experiment results revealed that the growth parameters and yield parameters such as Plant height (23.93cm),Number of Nodules (22.00cm),Dry weight (11.41cm),Number of Branches (8.20cm), crop growth rate(16.96) Recorded highest At harvest, Significantly recorded in treatment T_2 with application of Nipping and GA_3 at 100ppm. Moreover, No.of pods/plant (56.40),No.of seeds/pod (1.53),Test weight(264.82),Seed Yield (3.43t/ha),Harvest index (41.34%),Gross return (154,350.00),Net return(107,252.50),and were also recorded significantly higher in the treatment T_4 With application of Nipping and NAA at 50ppm among all treatments.

Keywords: Chickpea; nipping; plant growth regulators.

1. INTRODUCTION

Chickpea *(Cicer arietinum L.*) belongs to family Fabaceae, Gram is mostly consumed in the form of processed whole seed and dal but also used for preparing a variety of snacks, sweets and condiments, which are very useful for stomach ailments and blood purification. Pulses and their

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crop residues are major source of high quality and nutritive value of livestock feed. Chickpea contains 18-22 per cent protein, 52-70 per cent carbohydrate, 4-10 per cent fat and sufficient quantity of minerals, calcium, phosphorus, iron and vitamins.

Chickpea is the third most important Legume in the world which is grown almost all the countries except Antarctic. This crop is immense of importance in Asia which are growing more than 90 percent of chickpea mainly in the fragile and rainfed ecosystem. India is the largest producer of chickpeas approx. 80-90% supply of chickpeas to the world from India. Chana or chickpea is one of the major Rabi pulses crop grown in India. It contributes about71% to Rabi pulse production and 46% of the total pulse production in India.

“In chickpea, there is a strong apical dominance; and it is believed that apical meristem/shoot apex produces auxin, which inhibits the axillary buds into actively growing shoots. Nipping has been found to increase lateral branches of plants as a result of the removal of the apical dominance of auxin. It promotes the lateral branching, helps to have vigorous plant and produce more flowers and pods. More branches will possibly initiate more flower buds and possibly more yield” [1].

“Plant growth regulators are chemical substances that influence the growth of plant at low concentration. Plant growth regulators play key role in germination, vegetative growth, flowering, fruit development and physiological activities in crop plants. Plant growth regulators enhance source sink relationship, stimulates the translocation of assimilates, control the flower drop and increase the yield of crops. It is recognized that by application of small amount of growth regulators to foliar spray on plants the growth behaviour of many plants are controlled or modified. These are either (biochemicals that produced in plants) or synthetic which are applied exogenously. These are applied to improve the source-sink relationship, improve photosynthetic efficiency, vegetative growth and good pod development” [2].

“Plant growth regulators are majorly divided into following Groups” [3]. Gibberellin commonly available as GA3 and is known as gibberellic acid. Gibberellin generally increases cell elongation and cell division. Dormancy broken by gibberellic acid.GA_3 treatments helps to increase cell division, cell elongation and cell multiplication which might have reflected into maximum seedling growth.NAA (Naphthalene Acetic Acid) is the synthetic auxin with the identical properties to that naturally occurring auxin. It prevents formation of abscission layer and there by flower drop.

“It was observed that the growth regulators are involved in the direct transport assimilates from source to sink” [4]. Indole Acetic Acid (IAA) is one of the most physiologically active auxins. IAA is a common product of L- tryptophan metabolism produced by several micro organisms including Plant Growth-Promoting Rhizo bacteria (PGPR). Bacteria that colonize the rhizosphere and plant roots, and enhance plant growth by any mechanism are referred to as PGPR. It can exhibit a variety of characteristics responsible for influencing plant growth. The common traits include production of plant growth regulators.

2. LITERATURE REVIEW

Ashok et al. [1] reported that Nipping at 60 DAS after sowing have increased dry matter accumulation(5.24) crop growth rate (0.109) relative growth rate (0.0164)leaf area index (0.800) seed yield (1985kg/ha) and straw yield (3521kg/ha) increased.

Kapase et al. [4]reported that application of NAA at 50 ppm have increased number of pods per plant (43.59) seed yield per ha (20.66 q/ha) plant height (37.70) number of branches per plant (0.94g).

Khan et al. [5] reported that nipping and foliar application of nutrients significantly improved number of pods plant-1, biological yield (kg ha-1), harvest index (%) and final grain yield (kg ha-1). Foliar application of NPK (20:20:20)@2.5 kg /ha-1 × nipping was found to be the best interaction among others which significantly increased number of branches plant-1 (11.30), number of pods plant-1(115.36), plant height(59.48cm) and grain yield(2338.9 kg ha-1) as compared to the control treatment.

Khan et al. [6] reported that all the yield contributing parameters including flower retention ,pod setting percentage, pod number and seed weight, increased by application of GA_3 at 10 ppm, NAA at 20 ppm as foliar spray at vegetative stage of chickpea cv.C727 showed more reduction than at flower initiation stage while

length and fresh weight of root remained unaffected.

Kodhati et al . [3] reported that application of GA_3 at 50 ppm at flowering stage increased pods per plant (64.67) seed weight per plant (20.00) seed index (20.00) seed yield (2811kg/ha) Stover yield (3041kg/ha) Biological yield (5851kh/ha) and protein content in seed (22.08%).

Kumar et al. [7] reported that NAA at different concentrations (10,20 and 30) were applied. The effect of 30 ppm showed highest No of pods/plant (12.5) , No of seeds/plant (12.2), 1000 seed weight (102.4 gm), seed yield/plant (14.51 gm).

Muhammad et al. [8] concluded that application of plant growth regulator (NAA) affected different agronomic parameters such as the number of pods per plant, number of seeds per pod and 100 seed weight which ultimately contributed to increased biological yield, grain yield and harvest index. Therefore, application of NAA at 200 ml per hectare is recommended at particular growth stage (flowering) to obtain the maximum grain yield in chickpea.

Nabi et al., [9] concluded that GA_3 at 33.33 ppm response on growth and yield attributing characters, different concentration of GA3 to find out the suitable variety and optimum level of gibberellic acid (GA_3) application which would be also suitable to cultivate As a result, the tallest plant (62.33),number of leaves and branches plant-1(28.67 and 20.07,respectively),TDM (83.99 g),CGR (1.68 cm2day-1) RGR (0.729 cm2 day-1) and NAR (1.275 cm2 day-1).yield contributing characters had also higher such as pods plant-1(11.67),length of pod (17.20 cm),seeds pod-1(16.80) 100-seed weight (12.49 g), seed yield (20.16 g plant -1 and 3139.93 kg ha-1),therefore is suggested to cultivate 33.33 ppm GA3 would be also optimum level for the better production.

Nagarjuma et al. [10] reported that GA_3 at100,200 ppm and SA at 100,200 ppm are applied. The application of GA_3 at 100 ppm showed highest No of pods/plant (50.73) and seed yield/plant (19.65gm), Biological yield (154.40 kg) and salicylic acid at 100 ppm showed highest No of pods/plant (43.67),seed yield/plant (19.73 gm) and Biological yield (145.87 kg).

Syama et al. [11] revealed that among the stress mitigating PGRs, salicylic acid 2%,NAA 40 ppm and water spray during water stress period were found beneficial for mitigating water stress. Significant influence on number of leaves at 45 & 60 DAS and root length from 7 to 25%, number of leaves from 2 to 15% and number of branches from 8 to 26% compared to that which received no treatment during the crop period. At 30 DAS, the initiation was started in plants sprayed with SA 2% along with plants irrigated on alternate days of plant growth regulators could bring about 16 to 24% increase in pod yield,5 to 76% increase in stover yield and 10 to 113%.Hence,the present study revealed that foliar application of SA 2 % or NAA 40 ppm or water spray during dry spell was beneficial for mitigating water stress.

Utpal et al. [12] reported that application of IAA at 40ppm have influenced plant growth characters like crop growth rate (CGR) relative growth rate (RGR) net assimilation rate, days to flowering and days to maturity in chickpea.

Vikram et al. [13] reported that application of GA_3 at 50 ppm at flowering stage have increased plant height at harvest (45.67cm) number of branches per plant (7.50) number root nodules (10.00) dry matter accumulation (60.00g) pods per plant (64.67) seed index (20.00) seed yield (2811kg/ha) stover yield (3041kg/ha).

3. MATERIALS AND METHODS

The Present examination was carried out during *Rabi* 2021-2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, which is located at 25.28^0 N latitude,81.54^0 E longitude and 98M altitude above the mean sea level. The experiment laid out in Randomized block design which consisting of nine treatments with Nipping (30DAS)+GA_3at 50ppm,Nipping (30DAS)+GA_3at 100ppm,Nipping (30DAS)+IAA at 50ppm,Nipping (30DAS)+NAA at50ppm,No nipping +GA_3 at 50ppm,No nipping +GA_3 at 100ppm,No nipping + IAA at 50ppm,No nipping +NAA at 50ppm, Control. The observations recorded on different growth parameters at harvest viz., Plant height (cm),Number of nodules, Number of branches, Plant dry weight, No. Of Pods/Plant, No. of Seeds/Pod ,Test weight, Seed Yield and Harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design. Plant Growth Regulators are applied GA_3 at vegetative growth stage with 50ppm and 100ppm,Vikram et al [13], Nagarjuma et al., [10] IAA applied at flowering

stage with 50ppm Utpal et al., [12] NAA applied at flowering with 50 ppm Syama et al., [11], Muhammad et al., [8].

4. RESULTS AND DISCUSSION

4.1 Growth Attributes

The one season data revealed that growth and yield attributes of chick pea were Significantly influenced by the treatments. Plant height (Table 2) of chickpea At 60DAS higher plant height was recorded in treatment with the application of (T_2) Nipping + GA_3 at 100ppm (23.93)was significant which is statistically at par with treatment (T_5) No nipping+GA_3 at 50ppm(23.75cm),No. of Nodules/Plant was recorded highest in treatment with application of (T_2)Nipping + GA_3 at 100ppm (22.00) was significant which is statistically at par with treatment (T_1) Nipping + GA_3 at 50ppm(21.00). No. of Branches was recorded higest in treatment with application of (T_2) Nipping + GA_3 at 100ppm (8.20) was significant which is statistically at par with treatment (T_1) Nipping + GA_3 at 50PPM (8.13).Dry weight was recorded higest in treatment with application of (T_2)Nipping + GA_3 at 50ppm (11.41) was significant which is statistically at par with treatment (T_1) Nipping + GA_3 at 100ppm(11.26). Crop Growth rate (g/m^2/day) was recorded highest in treatment with application of (T_2) Nipping + GA_3 at 50ppm (16.96)was significant which is statistically at par with treatment (T_4) Nipping + NAA at 50ppm (16.60). Relative Growth Rate(g/g/day) was recorded highest in treatment with application of (T_4) Nipping + NAA at 50ppm (0.0336),there is no significant difference among the treatments. Nabi et al [9] concluded that GA_3 at 33.33 ppm response on growth and yield attributing characters, different concentration of GA_3 to find out the suitable variety and optimum level of gibberellic acid (GA3) application which would be also suitable to cultivate As a result, the tallest plant (62.33),number of leaves and branches plant-1(28.67 and 20.07,respectively),TDM (83.99 g),CGR (1.68 cm2day-1) RGR (0.729 cm2 day-1) and NAR (1.275 cm2 day-1).yield contributing characters had also higher such as pods plant-1(11.67),length of pod (17.20 cm),seeds pod-1(16.80) 100-seed weight (12.49 g), seed yield (20.16 g plant -1 and 3139.93 kg ha-1),therefore is suggested to cultivate 33.33 ppm GA3 would be also optimum level for the better production. Utpal et al. [12] reported that application of IAA 40ppm have influenced plant growth characters like crop growth rate (CGR) relative growth rate (RGR) net assimilation rate, days to flowering and days to maturity in chickpea.

4.2 Yield Attributes

As can be seen in (Table 3) Yield parameters are summarized statistically. At the time of harvest, significantly maximum no. of Pods/Plant was recorded in treatment with application of (T_4) Nipping + NAA at 50ppm (56.40) was significant which is statistically at par with treatment (T_3) Nipping +IAA at 50ppm (55.80). Maximum no. of seeds/pod was recorded in treatment with application of (T_4) Nipping + NAA at 50ppm (1.53) was significant which is statistically at par with treatment (T_5) Nipping + IAA at 50ppm (1.47). Maximum Test weight (g)was recorded in treatment with application of (T_4)Nipping+ NAA at 50ppm(264.82) was significant which is statistically at par with treatment (T_1) Nipping + GA_3 at 50ppm (262.73).Maximum seed Yield (t/ha) was recorded in treatment with application of (T_4)Nipping + NAA at 50ppm (3.43) was significant which is statistically at par with treatment (T_3) Nipping +IAA at 50ppm(3.36).Maximum Harvest index(%) was recorded in treatment with application of (T_4) Nipping + NAA at 50ppm (41.34) was significant which is statistically at par with treatment (T_3) Nipping + IAA at 50ppm (40.62). Khan et al., [5] reported that nipping and foliar application of nutrients significantly improved number of pods plant-1, biological yield (kg ha-1), harvest index

Table 1. Treatments details

S. NO	Treatments	Treatments Grouping
1.	T 1	Nipping(30DAS) + GA_3 at 50ppm
2.	T 2	Nipping (30DAS) +GA_3 at 100ppm
3.	T 3	Nipping (30DAS) +NAA at 50ppm
4.	T 4	Nipping (30DAS) +IAA at 50ppm
5.	T 5	No nipping + GA_3 at 50ppm
6.	T 6	No nipping +GA_3 at 100ppm
7.	T 7	No nipping + NAA at 50ppm
8.	T 8	No nipping +IAA at 50ppm
9.	T 9	Control

Fig. 1. Over all view of chick pea field in crop research farm at SHAUTS

Table 2. Effect of nipping and Plant growth regulator on growth attributes of chickpea

Treatments	Plant height (cm)	No. of nodules/ plant	No. of branches/ plant	Dry weight (g)	Crop growth rate (g/m^2/day)	Relative growth rate (g/g/day)
1.Nipping (30DAS)+GA_3 at 50ppm	17.00	21.00	8.13	11.26	14.25	0.0284
2.Nipping (30DAS)+GA_3 at 100ppm	23.93	22.00	8.20	11.41	16.96	0.0294
3.Nipping (30DAS)+IAA at 50ppm	16.60	19.93	8.00	10.80	15.17	0.0334
4. Nipping (30DAS)+NAA at 50ppm	16.80	20.93	8.07	11.11	16.60	0.0336
5. No nipping + GA_3 at 50ppm	23.75	15.80	6.87	9.68	10.91	0.0259
6. No nipping +GA_3 at 100ppm	17.20	16.17	6.93	9.76	11.19	0.0262
7. No nipping + IAA at 50ppm	22.93	14.20	6.60	9.25	12.57	0.0299
8. No nipping + NAA at 50ppm	23.29	14.40	6.73	9.42	12.63	0.0296
9. Control	23.17	14.80	6.80	9.54	9.77	0.0241
sem±	0.71	0.37	0.06	0.14	0.84	0.0015
CD at 5%	2.12	1.12	0.17	0.42	2.52	-----

Table 3. Effect of nipping and plant growth regulator on yield attributes of chickpea

Treatments	No. of pods/plant	No. of seeds/pod	Test weight(g)	Seed yield (t/ha)	Harvest index (%)
1.Nipping +GA_3 at 50ppm	54.60	1.272	2359.80	3.27	39.41
2.Nipping +GA_3 at 100ppm	55.40	1.40	260.27	3.30	39.93
3.Nipping +IAA at 50ppm	55.80	1.47	262.73	3.36	40.62
4.Nipping +NAA at 50ppm	56.40	1.53	264.82	3.43	41.34
5.No nipping +GA_3 at 50ppm	42.40	1.00	221.63	2.69	32.27
6.No nipping +GA_3 at 100ppm	44.27	1.07	233.58	2.71	32.97
7.No nipping +IAA at 50ppm	46.27	1.07	237.46	2.75	33.25
8.No nipping +NAA at 50ppm	48.33	1.20	240.04	2.96	34.55
9. Control	38.60	1.00	216.87	2.35	31.00
Sem ±	1.05	0.06	2.26	0.05	0.93
CD at 5%	3.14	0.19	6.77	0.14	2.80

(%) and final grain yield (kg ha-1). Foliar application of NPK (20:20:20) @2.5 kg ha-1 × nipping was found to be the best interaction among others which significantly increased number of branches plant-1 (11.30), number of pods plant-1(115.36), plant height(59.48cm) and grain yield(2338.9 kg ha-1) as compared to the control treatment. Kumar et al. [7] reported that NAA at different concentrations (10,20 and 30) were applied. The effect of 30 ppm showed highest No of pods/plant (12.5), No of seeds/plant (12.2), 1000 seed weight (102.4 gm), seed yield/plant (14.51 gm).

4. CONCLUSION

It is concluded that, treatment (T_4)Nipping +NAA at 50ppm has performed better in growth and yield parameters .As it is was productive it can be recommended to farmers after further trails [6].

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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