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Effect of different plant growth regulators on yield parameters of cluster bean (*Cymopsis tetragonoloba* L. Taub.)

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Abstract
A study was carried out at the was carried out during summer season of year 2024-25 at the Instructional farm Khudmudi, College of Horticulture and Research Station, Sankra, Patan, Durg (C.G.), to study the "Effect of different plant growth regulators on yield parameters of Cluster bean (*Cymopsis tetragonoloba* L. Taub.)". The experiment was laid out in Randomized Block Design with ten treatments and three replications. The different treatment was, T_0-Control, T_2-NNA 60 ppm, T_2-NAA 80 ppm, T_3-100 ppm, T_4-GA3 50 ppm, T_5-GA75 ppm, T_6-GA3100 ppm T_7-CCC 500 PPM, T_8-CCC 1000 ppm, T_9-1500 ppm. Among the yield parameters pod weight(g), number of pod per plant, pod yield per plant(g), pod yield per plot (kg), total yield (q/ha) analysis and also for yield Amongst plant growth regulator CCC 1500 ppm gives beneficial better performance at yield parameters like maximum plant pod weight (1.77 g) a number of pod per plant (48.12) Pod yield per plant (85.32 g) pod yield per plot (2.30 kg) total yield (76.79 q/ha) minimum pod weight (1.58), number of pod per plant (31.60), pod yield per plant (49.85 g), pod yield per plot (1.35 kg) and total yield (44.87 q/ha) minimum was recorded in T_0 Control, Hence, treatment T_9 (CCC 1500 ppm) was considers as best performing treatment for yield peramerts of cluster bean of with foliar application of PGR (NAA, GA3, CCC).

Keywords: Cluster bean, CCC, GA_3, NAA, plant growth regulators, yield

Introduction
The cluster bean, sometimes called guar, is an associate of the papilonaceae subfamily and the leguminosae family. Cyamopsis tetragonoloba L. Taub is the botanical name for the cluster bean (2n=14). Gaur or gay, which means cow in Sanskrit, is where the name "guar" originates. The word "guar" implies "gaur," which denotes cattle feed. (Jaintibhai *et al*., 2022) [11]

Cluster bean (also known as guar) is one of the most important vegetable crops grown in India. In India, cluster bean is cultivated on about 4.603 million hectares producing approximately 1.8 million tonnes with a productivity of 551 kg/ha tonnes per hectare. In Chhattisgarh, the crop covers area 9.284 metric tonnes producing about 93.949 metric tonnes (Ministry of Agriculture, GOI, 2021-2022 and Anonymous, 2024).

Its young pods are used as vegetables, which also known for cheap source of energy (16 Kcal), protein (3.2g), fat (1.4 g), carbohydrate (10.8 g), vitamin A (65.3 IU), vitamin C (49 mg), calcium (57 mg) and iron (4. 5 mg) for every 100 g of edible portion.

The use of plant growth regulators (PGRs), or growth-promoting hormones, is a more modern method in this regard. It is well known that plant growth regulators can affect growth and development at very low concentrations while blocking it at large quantities. Such substances are having the potentially beneficial in horticulture, because suitable concentrations applied at right times will increase the yield either by altering food material distribution in the plant or by regulating growth. When growth regulators are beneficial in right concentrations, these component influence the plant architecture in a typical fashion and improve the yield potential. Therefore, an attempt has been made to. "Effect of plant growth regulators on growth and yield of Cluster Bean (*Cymopsis tetragonoloba* L.) Pusa Navbahar. (Patel *et al*., 2018) [1].

Materials and Methods

The present investigation "Effect of different plant growth regulators on yield parameters of Cluster bean (*Cymopsis tetragonoloba* L. Taub.)" was carried out at the during summer season of year 2024-25 at Instructional farm Khudmudi, College of Horticulture and Research Station, Mahatma Gandhi University of Horticulture & Forestry, Durg (C.G.). The experimental area is located in the central part of the Chhattisgarh Plains, between 20°54′ to 21°32′ N latitude and 81°10′ to 81°36′ E longitude at an altitude of 317 meters above mean sea level. The field experiment was laid out in Randomized Block Design with ten treatments and three replications. The treatment consists of three level of plant growth regulators NAA (60, 80and 100 ppm) GA_3 (50, 75 and 100 ppm), and CCC (500, 1000 and 1500 ppm) along with T_0-water spray. The seeds of the cluster bean var. Pusa Navbahar were directly sown in soil on March 13, 2025, maintaining a spacing of 45 cm x 20 cm (Row to Row and Plant to Plant). The foliar application of plant growth regulators as per the designated treatments was carried out on the evening hours at 25 DAS and 50 DAS.

Results and Discussion

Number of seed per pod

As depicted in Table 1. and fig 1, the maximum number of seeds per pod was recorded in treatment T_9 (CCC @ 1500 ppm, 10.62), which was found to be statistically superior over all other treatments. The treatments T_8 (CCC @ 1000 ppm, 10.33) and T_7 (CCC @ 500 ppm, 10.07) were found at par with T_9, along with other treatments such as T_4 (GA_3 @ 50 ppm, 9.74), T_2 (NAA @ 60 ppm, 9.67), T_5 (GA_3 @ 75 ppm, 9.63), and T_6 (GA_3 @ 100 ppm, 9.63), which also showed statistically similar performance. The minimum number of seeds per pod was observed in treatment T_0 (control, 8.25).

The superior performance of CCC treatments, particularly T_9, may be attributed to their role in suppressing vegetative growth and enhancing assimilate partitioning towards reproductive structures, thereby improving seed set per pod. Treatments at par with T_9 also exhibited comparatively higher seed numbers, reflecting the positive impact of growth regulator application. In contrast, the control (T_0) recorded the lowest value, possibly due to the absence of growth regulator intervention and complete dependence Similar results were also obtained. Dawson *et al*. (2016) [6]. (2021) in mung bean and Durge *et al*. (2021) [8] in pigeon pea. Jayantibhai *et al*. (2022) [11]. In cluster bean.

Pod weight (g)

As depicted in Table 1. and figure 1. the maximum pod weight of cluster bean was recorded in treatment T_9 (CCC @ 1500 ppm, 1.77 g), which was found to be statistically superior over all other treatments. The treatment T_8 (CCC @ 1000 ppm, 1.74 g). T_7 (CCC500 ppm1.73), T_4 (GA350 ppm 1.67), T_2 (NAA60 ppm) was found at par with T_9, while the minimum pod weight was observed in treatment T_0 (control, 1.70 g).

The superior performance of CCC treatments, particularly T_9, may be attributed to their role in restricting excessive vegetative growth and enhancing the partitioning of assimilates towards pod development, thereby improving pod weight. Treatment T_8 also exhibited higher pod weight, reflecting the positive influence of cycocel application under the present conditions. In contrast, the control (T_0) recorded the lowest value, which might be due to the absence of growth regulator application and complete reliance Similar results were also obtained by Saravaiya *et al*. (2018) [23].

Number of pods per plant

As illustrated in Table 1 and fig 1 the maximum number of pods per plant was recorded with T_9 (CCC 1500 ppm) (48.12), which was statistically significant over all other treatments. Treatments T_8 (CCC 1000 ppm) (47.34) and T_7 (CCC 500 ppm) (46.37) were statistically at par with the maximum. The minimum number of pods per plant was observed under T_0 (Control) (31.60).

The superiority of CCC treatments, particularly T_9, may be attributed to their ability to reduce vegetative growth and improve assimilate partitioning towards reproductive structures, thereby increasing the number of pods. Treatments T_8 and T_7, being statistically at par with T_9, also exhibited comparatively higher pod numbers, reflecting their effectiveness under the present conditions. In contrast, the control (T_0) recorded the lowest value, which might be due to the absence of growth regulator application and reliance solely. Patil *et al*. (2005) [17] Kalyankar *et al*. (2008) [13] Sharma and Lashkar (2009) [27] in cluster bean.

Pod yield per plant (g)

As illustrated in Table 1 and fig 1 the maximum pod yield per plant was recorded with T_9 (CCC 1500 ppm) (85.32 g), which was statistically significant over all other treatments. Treatment T_8 (CCC 1000 ppm) (82.27 g) T_7 (CCC500 ppm (80.27) (was statistically at par with the maximum. The minimum pod yield per plant was observed under T_0 (Control) (49.85 g).

The higher yield in T_9 may be attributed to its effect in suppressing excessive vegetative growth, thereby enhancing assimilate translocation and partitioning towards reproductive organs, which ultimately resulted in increased pod yield. The treatment T_8, being statistically at par with T_9, also exhibited better performance, indicating the positive influence of cycocel on yield parameters. In contrast, the lowest yield recorded under control (T_0) might be due to the absence of growth regulator application and dependence Sharma and Lashkari (2009) [27] in cluster bean. Basuchaudhuri *et al*. (2016) in cluster bean.

Pod yield per plot (kg)

The data in Table 1 and fig 1 revealed significant variation in pod yield per plot due to growth regulator treatments. The maximum yield (2.30 kg) was obtained with T_9 (CCC @ 1500 ppm), which was statistically at par with T_8 (CCC @ 1000 ppm, 2.22 kg). T_7 (CCC @ 500 ppm 2.17), The next best treatment was T_2 (NAA ppm, kg). T_2 NAA treatments (1.84 kg) and T_4GA_3 treatments (1.80 kg) showed moderate effectiveness. The minimum yield (1.35 kg) was recorded in the control (T_0). Thus, CCC @ 1500 ppm proved most effective, while the control remained least effective.

"The highest pod yield with CCC @ 1500 ppm may be attributed to its growth-retarding effect, which reduces excessive vegetative growth, improves assimilate partitioning, and enhances pod development. In contrast, the lowest yield in control was due to the absence of growth regulator application."

Total yield (q/ha)

The data in Table 1 and fig 1 revealed significant variation in the total yield (q/ha) due to growth regulator treatments.

The total yield (76.79) was recorded in T_9 (CCC @ 1500 ppm), which was statistically at par with T_8 (CCC @ 1000 ppm, 74.04). Next best was T_7 (CCC @ 500 ppm, 72.24). Among NAA treatments, T_2 (60 ppm, 61.31) performed better, while higher doses reduced total yield. T_4 (GA_3 50 ppm) treatments showed moderate effect (60.00). The minimum (44.87).8wereobserved in T_0 (Control). Thus, CCC @ 1500 ppm proved most effective, whereas control remained least effective.

The higher total yield in CCC treatments, particularly T_9 (1500 ppm), may be due to suppression of excessive vegetative growth and better partitioning of assimilates towards reproductive organs, which enhanced flowering, pod setting, and retention. NAA @ 60 ppm improved yield by stimulating flower initiation, while higher doses reduced pod number due to hormonal imbalance. GA_3 showed moderate effect as excessive vegetative growth diverted assimilates from pod formation. The lowest yield in control (T_0) was due to lack of growth regulator application. Sharma and Lashkari (2009) [27] in cluster bean. Dawson *et al*. (2016) [6]. (2021) in mung bean and Durge *et al*. (2021) [8] in pigeon pea. Jayantibhai *et al*. (2022) [11]. In cluster bean.

Table 1: Effect of plant growth regulators on the mean number of pod length, pod weight, pod width and number of seeds of cluster bean.

Treatments	Number of seed per pod	Pod weight (g)	Number of pods per plant	Pod yield per pod (g)	Pod yield per plot (kg)	Total yield (q/ha)
T_0-Control	8.25	1.58	31.60	49.85	1.35	44.87
T_2-NAA @ 60 ppm	9.67	1.67	40.81	68.12	1.84	61.31
T_2-NAA @ 80 ppm	9.55	1.62	35.37	57.65	1.56	51.88
T_3-NAA @ 100 ppm	9.50	1.61	34.58	55.86	1.51	50.28
T_4-GA_3 @ 50 ppm	9.74	1.68	39.67	66.67	1.80	60.00
T_5-GA_3 @ 75 ppm	9.63	1.65	37.19	61.58	1.66	55.43
T_6-GA_3 @ 100 ppm	9.63	1.60	36.49	58.81	1.59	52.93
T_7-CCC @ 500 ppm	10.07	1.73	46.37	80.27	2.17	72.24
T_8-CCC @ 1000 ppm	10.33	1.74	47.34	82.27	2.22	74.04
T_9-CCC @ 1500 ppm	10.62	1.77	48.12	85.32	2.30	76.79
S.E.(m)±	0.36	0.04	1.66	3.68	0.10	3.32
C.D. (5%)	1.08	0.13	4.96	11.03	0.30	9.93

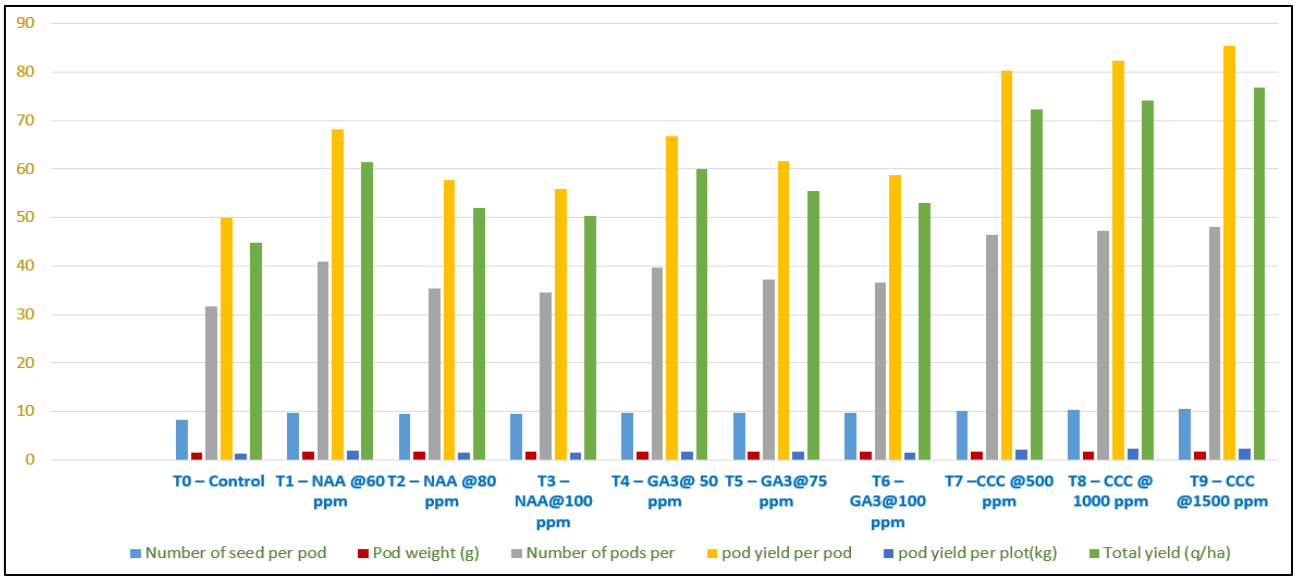

Fig 1: Effect of Plant Growth Regulators on the mean number of pod length, pod weight, pod width and number of seed of cluster bean.

Conclusion

It can be concluded based on the above results that foliar applications of plant growth regulators significantly enhance the yield attributes of cluster bean. Among all treatments, T_9 (CCC @ 1500 ppm) was identified as the most effective, leading to higher number of pod and maximum yield. of cluster bean.

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