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Effect of plant growth regulators on growth parameters of garden pea (*Pisum sativum* L.) var. Kashi Nandini

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Abstract
The study entitled "Effect of Plant Growth Regulators on Growth and Yield Attributing Parameters of Garden Pea (*Pisum sativum* L.) var. Kashi Nandini" was conducted during the Rabi season of 2023-24 at the Department of Vegetable Science, Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon (C.G.), under Mahatma Gandhi Udyaniki Evam Vaniki Vishwavidyalaya, Durg (C.G.). Thirteen treatments comprising various plant growth regulators (NAA, GA_3, Ethrel, CCC, Nitrobenzene, and Triacontanol) at different concentrations were tested in a Randomized Block Design (RBD) with three replications.

Among all treatments, foliar application of GA_3 at 100 ppm (T_4) showed significantly superior performance in growth and yield parameters. It recorded the highest plant height (93.41 cm at 60 DAS), number of branches per plant (4.49), and number of nodes per plant (14.45), along with the earliest flowering (32.33 days to first flowering). This treatment also produced the highest number of pods per cluster (1.87), pods per plant (10.73), pod length (9.14 cm), pod diameter (1.76 mm), number of seeds per pod (9.03), fresh pod weight per plot (1.72 kg), and pod yield per hectare (116.15 q/ha).

Thus, GA_3 at 100 ppm is recommended as the most effective treatment for enhancing both growth and yield in Garden Pea var. Kashi Nandini.

Keywords: Garden pea, *Pisum sativum* L., Kashi nandini, plant growth regulators (PGRs), GA_3, pod yield, plant height, flowering time, foliar application

1. Introduction

Garden Pea (*Pisum sativum* L.) belongs to the family Leguminosae having chromosome 2n=14.The plant is semi-erect but tends to climb when support is available. It grows to a height of about 30-200 cm. Pea seeds germinate hypogeally, meaning the cotyledons stay below the ground. The plants develop a taproot system, and their stems are slender, hollow, and succulent. Leaves are typically pinnately compound, with each leaf having one to three pairs of leaflets and terminal branched tendrils. At the base of each leaf's petiole, there is a large pair of stipules or leaf-like bracts that are so large they can be mistaken for sessile leaves. The inflorescence is an axillary raceme, typical of legume flowers, with garden pea flowers being white. The fruit is a typical pod containing 4 to 9 seeds. The seeds vary in shape from round to angular and rough, and in color from green and yellow to grey and brown. Peas are generally self-fertilized, although cross-fertilization can also occur.

It is widely cultivated as a vegetable crop in various temperate and subtropical region of the world. Green pods of Garden Pea have unique flavor, sweetness and freshness due to this ability its local consumption and exportation increases day by day. It is an important winter vegetable in plains of north, north western and as a summer crop in high part of hills in India (Pandey *et al*., 2006) [3]. In India Pea occupies 549-thousand-hectare area with 5680 MT production Uttar Pradesh alone produces 49% of total production of pea in India. The major Garden Pea growing States are Uttar Pradesh, West Bengal, Madhya Pradesh, Bihar and Gujarat. In Chhattisgarh occupied 9.447 thousand hectare area with 126.874 MT production and in Rajnandgaon district 0.942 thousand area and 42.908 MT production. It is mainly cultivated in Surguja, Bilaspur, Rajnandgaon, Bastar and Bemetra districts of Chhattisgarh State. Garden Pea is considered as one of the most important sources of nutrition throughout the world which contains high amount of digestible protein and carbohydrates.

Nutritionally, Garden Pea contains approximately protein (5.4/100 g) carbohydrates (14.5/100 g), fiber (5.1/100 g), sugar (6/100 g), sodium (5/100 m), potassium (244/100 g), iron (1.5 mg/100 g), vitamin A (38 ug/100 g), vitamin C (40 mg/100 g), zinc (1.2 mg/100 g) and some little amount of other minerals. Beside these, it has a unique ability of biological nitrogen fixation, mobilization of insoluble soil nutrients which brings the qualitative changes in soil property. There are a number of factors which are responsible for lower growth, development and productivity of Garden Pea such as crop regulation, planting method, water and fertilizer managements. Among these, crop regulation is an important practice which enhancing the productivity of Garden Pea with higher profitability. This can be done by adopting proper application of plant growth regulators.

The plant growth regulators (PGRs) play an important role in the cultivation of Garden Pea because their small amount promote or inhibits or quantitatively modifies the growth and development of crop. Gibberellic acid has proved to be very effective in manipulating the growth, flowering and yield of Garden Pea.

Similarly, NAA enhance the cell elongation and division by promoting the DNA synthesis in the cell. It reduced the juvenile phase due to increase in photosynthesis and respiration with enhanced CO2 fixation in the plant.

It is essential to utilize environmental friendly PGRs such as gibberellic acid, naphthalene acetic acid, ethrel, cycocel, nitrobenzene and triacontanol due to the significant increase in chemical fertilizers' prices and the need to preserve the soil ecosystem. Various researchers have suggested foliar spray of PGRs for managing germination and growth, regulating flowering, and enhancing fruit setting and ripening in horticultural crops.

Gibberellins were first identified by Kurosava, a Japanese scientist, in 1926. The initial extraction was from the fungus Gibberella fujikuroi. These plant hormones are produced in young leaves, roots, and immature shoots, and they are capable of moving in all directions within the plant, reaching various tissues such as phloem and xylem.

The application of gibberellic acid through the leaves enhances the growth and development of plants by promoting cell elongation and division. This results in larger produce, extended shelf life, increased plant vigor, and improved pod set. However, the application and accurate assessments of gibberellic acid need to be carefully planned in terms of optimal concentration, stage of application, species specificity, and seasons. Stated and their study that (Mukhtar and Singh 2006) [31], the potential of gibberellic acid is great, but its usage should be judiciously planned. In a study conducted by (Kumar *et al*. 2014) [15], garden pea exhibited rapid growth, higher yield, and improved quality when treated with plant growth regulators, particularly GA3 and NAA.

NAA has primarily been observed to enhance phototropism, apical formation, respiration, and flower bud formation. The primary mechanism through which NAA exerts its effects is by its mode of action. The direct impact of cell wall constituents on the permeability of the plasma membrane (Choudhary *et al*. 2022) [32].

Cycocel (CCC) is a powerful synthetic growth inhibitor. It effectively slows down the elongation of stems by inhibiting cell division in the sub-apical meristem, while typically not affecting the apical meristem in the same way. Cycocel has a significant impact on the vegetative growth of plants, without interfering with flower bud initiation, leaf and flower count, flowering duration, or flower emergence. Additionally, it promotes the development of more branches in plants (Rathod *et al*. 2015) [26].

Nitrobenzene is a blend of nitrogen and plant growth regulators derived from seaweeds, known for its ability to invigorate plants, stimulate flowering, and enhance yields. When combined with other plant growth regulators, Nitrobenzene optimizes results by promoting increased flower production and preventing premature shedding. Particularly beneficial for vegetable crops and flowering plants, Nitrobenzene is swiftly absorbed by plants, influencing their biochemical pathways to enhance nutrient uptake from the soil and improve nutrient utilization efficiency, thereby fostering robust vegetative growth. It triggers abundant flowering, facilitates flower and fruit retention, and enhances the harvestable yield across various crops (Pramoda and Sajjan 2018) [24].

Ethrel mitigates pod shattering by minimizing flower and pod abortions, thereby enhancing crop quality. Additionally, it optimizes crop performance by modulating the source/sink relationship during pod development. This study highlights numerous instances showcasing Ethrel's impact on plant growth and development, including effects on plant height, leaf number, leaf area, leaf area index, dry weight, nutrient absorption, seed yield and biological yield (Kumanan *et al*. 2020) [14].

Triacontanol, a natural saturated primary alcohol found in alfalfa hay, promotes plant growth by enhancing physiological and biochemical processes. Applied at low concentrations, it boosts growth, yield, and metabolic activities in crops. Widely used as a growth regulator, Triacontanol encourages shoot and root development and the production of secondary metabolites in various plants (Shivran *et al*. 2013) [33].

The selection of right hormones with appropriate concentration, time and method of application are most essential in effective crop production as because the same growth regulator in different concentrations brings about different results.

2. Material and methods

This study, titled "Effect of Plant Growth Regulators on Growth and Yield attributing Parameters of Garden Pea (*Pisum sativum* L.) var. Kashi Nandini," was carried out during the *rabi* season of 2023-24 at the Vegetable Science field of Pt. Kishori Lal Shukla College of Horticulture and Research Station in Rajnandgaon (C.G.) The experiment involved 13 treatments with three replications of plant growth regulators (PGRs) on Garden Pea, arranged in a randomized block design with three replications. Each plot measured 1.5 x 1 m², with a spacing of 1 m between blocks and plots. To collect data on various traits, five uniformly competitive plants were randomly selected and tagged in each plot. The average for each trait was calculated based on the observations from these five plants in every replication.

The experiment consisted of thirteen treatments with different concentrations of plant growth regulators (PGRs)- NAA @ 25 ppm & 50 ppm, GA_3 @ 50 ppm & 100 ppm, Ethrel @ 200 ppm & 250 ppm, CCC @ 500 ppm & 1000 ppm, Nitrobenzene @ 50 ppm & 100 ppm, and Triacontanol @ 500 ppm & 1000 ppm-arranged in a Randomized Block Design (RBD). The foliar application of plant growth regulators was carried out in two stages to ensure effective absorption and physiological response. The first application was done at 20 days after sowing (DAS), followed by a second application 10 days later, at 30 DAS. This schedule was designed to coincide with the early vegetative and pre-flowering stages of the crop, which are critical for influencing growth and yield parameters.

3. Result and discussion

Growth and Yield parameters

3.1 Plant height at 30 DAS, 45 DAS, and 60 DAS (cm)

At 30 days after sowing, a significant effect of foliar application of plant growth regulators on plant height was observed. The treatment T_4 (GA_3 100 ppm) recorded the maximum plant height (51.79 cm), which was statistically at par with T_3 (GA_3 50 ppm) at 50.18 cm. In contrast, the minimum plant height (28.27 cm) was observed in treatment T_8 (Cycocel 1000 ppm).

At 45 days after sowing, a significant effect of foliar application of plant growth regulators on plant height was observed. Treatment T_4 (GA_3 100 ppm) recorded the maximum plant height (70.44 cm), which was statistically at par with T_3 (GA_3 50 ppm) at 65.74 cm. In contrast, the minimum plant height (41.74 cm) was observed in treatment T_8 (Cycocel 1000 ppm).

At 60 days after sowing, a significant effect of foliar application of plant growth regulators on plant height was observed. Treatment T_4 (GA_3 100 ppm) recorded the maximum plant height (93.41 cm), which was statistically at par with T ($_3GA_3$ 50 ppm) at 89.23 cm. In contrast, the minimum plant height (56.59 cm) was observed in treatment T_8 (Cycocel 1000 ppm).

The application of GA_3 enhances the height of garden pea plants by promoting intermodal elongation through mechanisms involving cell division, cell enlargement, apical dominance, increased auxin levels, and enhanced conversion of tryptophan to IAA. These findings align with the results reported by Dhage *et al*. (2011) [34], in Garden Pea.

Cycocel inhibits the synthesis of gibberellins, which are hormones that promote stem elongation. This leads to a noticeable reduction in the height of the plants, resulting in shorter, stockier plants. Comparable results were noted by Hussain *et al*. (2012) [35].

3.2 Number of branches per plant at 30 DAS, 45 DAS and 60 DAS

At 30 DAS, the foliar application of plant growth regulators showed a significant impact on the number of branches. The highest number of branches (2.86) was recorded in T_4 (GA_3 100 ppm), which was statistically at par with T_3 (GA_3 50 ppm, 2.72). The lowest number of branches (1.20) was observed in T_0 (Control, water).

At 45 DAS, the foliar application of plant growth regulators continued to have a significant effect on the number of branches. T_4 (GA_3 100 ppm) again showed the maximum number of branches (3.46), comparable to T_3 (GA_3 50 ppm, 3.22). In contrast, the fewest branches (2.16) were observed in T_0 (Control, water).

At 60 DAS, the trend persisted, with T_4 (GA_3 100 ppm) yielding the highest number of branches (4.49), statistically similar to T_3 (GA_3 50 ppm, 4.28). The lowest number of branches (3.08) was found in T_0 (Control, water).

Among all plant growth regulators, GA_3 treatments resulted in the highest number of branches, while the control group had the least. The increased number of branches under GA_3 application can be attributed to enhanced cell division, cell elongation, and metabolic activity in growth regions, coupled with improved nutrient uptake, ultimately promoting branch development. Dhage *et al*. (2011) [34], in Garden Pea, Kumar *et al*. (2018) [36] in coriander, Rajani *et al*. (2016) [37] in French bean, Rehman *et al*. (2018) [38].

3.3 Number of nodes per plant at 30 DAS, 45 DAS and 60 DAS (cm)

At 30 DAS, the foliar application of plant growth regulators significantly impacted the number of nodes. The highest number of nodes (7.16) was recorded in T_4 (GA_3 100 ppm), which was statistically on par with T_3 (GA_3 50 ppm, 7.08). The lowest number of nodes (5.12) was observed in T_0 (Control, water).

At 45 DAS, the foliar application of plant growth regulators had a significant effect on the number of nodes. T_4 (GA_3 100 ppm) again showed the maximum number of nodes (10.95), comparable to T_3 (GA_3 50 ppm, 10.42). In contrast, the fewest nodes (8.16) were observed in T_0 (Control, water).

At 60 DAS, the trend persisted, with T_4 (GA_3 100 ppm) yielding the highest number of nodes (14.45), statistically similar to T_3 (GA_3 50 ppm, 13.60). The lowest number of nodes (11.37) was found in T_0 (Control, water).

GA_3 increases the number of nodes in garden pea by promoting cell division, elongation, and activity in the shoot apical meristem. It stimulates internodal growth by regulating genes for cell wall loosening and enhancing hormonal balance, reducing inhibitors like ABA. GA_3 also improves photosynthesis and nutrient flow, supporting vigorous growth. These findings are consistent with the results reported by in Soybean, Chowdhury *et al*. (2014) [39] in garden pea.

3.4 Yield parameters

3.4.1 Day to 1st flowering

Among the applied treatments, a significant effect of plant growth regulators on the number of days to first flowering was observed. The maximum number of days to first flowering (36.67) was recorded in the control treatment (T_0, Water spray). In contrast, the minimum number of days to first flowering (32.33) was observed in T_4 (GA3 100 ppm), which was statistically at par with T_3 (GA3 50 ppm, 32.67 days).

Early flowering results from the plant completing its vegetative growth phase more rapidly, supported by improved nourishment that enhances CO_2 fixation. Additionally, GA_3 plays a key role in the synthesis of florigen, which promotes early flowering. These findings are consistent with the results reported by Thompson *et al.* (2015) [40] in garden pea.

3.5 Number of pods per cluster

"Among the treatments applied, the foliar application of plant growth regulators had a significant effect on the number of pods per cluster. The highest number of pods per cluster recorded was 1.87 in T_4 (GA_3 100 ppm), which was statistically similar to T_3 (GA_3 50 ppm) with 1.73 pods per cluster. Conversely, the control treatment (T_0) exhibited the lowest number of pods per cluster at 1.27."

The application of GA_3 increases cell division, nutrient mobilization, and flowering hormone production, leading to more pods per cluster in garden pea, especially under optimal growing conditions. These results are consistent with the findings of Singh *et al*. (2015) [17], and in garden pea.

3.6 Number of pods per plant
Among the treatments applied, a significant effect of the plant growth regulator was observed. The maximum number of pods (10.73) was recorded in T_4 (GA_3 100 ppm), followed by T_3 (GA_3 50 ppm) with 10.20 pods. In contrast, the minimum number of pods (7.06) was observed in the control treatment (T_0, Water spray).
Application of plant growth regulators, GA_3 produced the highest number of pods per plant. The increased number of pods in garden pea from GA_3 application is due to enhanced flower production, improved nutrient mobilization, and increased plant Vigor. These findings are supported by (Singh *et al*., 2015) [17] in Garden Pea.

3.7 Pod length (cm)
A significant effect of plant growth regulators on pod length was observed among the treatments. The longest pod length (9.14 cm) was recorded in T_4 with GA_3 at 100 ppm, followed closely by T_3 with GA_3 at 50 ppm (9.07 cm). The shortest pod length (7.35 cm) was noted in the T_0 control.
GA_3 was the plant growth regulator that resulted in the longest pod length compared to the others, while Control produced the shortest pod length. The application of GA_3 promoted increased pod length by enhancing individual cell elongation and accelerating cell division. Kumar *et.al*. (2022) [16] in Garden Pea.

3.8 Pod diameter (mm)
A significant effect of plant growth regulators on pod diameter was observed among the treatments. The highest pod diameter (1.76 mm) was recorded in T_4 with GA_3 at 100 ppm, followed closely by T_3 with GA_3 at 50 ppm (1.74 mm). The shortest pod diameter (1.33 mm) was noted in T_0 control.
the application of GA_3 has been reported to increase pod diameter by promoting pod expansion and improving nutrient mobilization towards the developing pods. A study by Chaudhary *et al*. (2013) [41] found that the application of GA_3 significantly increased the pod length, diameter, and number of seeds per pod in pea plants (*Pisum sativum* L.). Similarly, Singh *et al*. (2012) [18] observed that GA_3 application improved pod diameter in French beans (*Phaseolus vulgaris*), attributing this effect to enhanced cell division and elongation.

3.9 Number of seeds per pod
A significant effect of plant growth regulators on Number of seeds per pod was observed among the treatments. The highest Number of seeds per pod (9.03) was recorded in T_4 with GA_3 at 100 ppm, followed by T_3 with GA_3 at 50 ppm (8.72 cm). The lowest Number of seeds per pod (7.14) was noted in T_0 control.
GA_3 produced the highest Number of seeds per pod, while the control showed the lowest. The application of GA_3 significantly increases seed production in legume crops by enhancing flowering, improving cell division and elongation, and facilitating nutrient mobilization to developing pods. This growth regulator reduces flower and pod abortion rates, thereby increasing the overall number of seeds per pod. Studies have demonstrated that GA_3 promotes reproductive success, leading to higher seed counts, which ultimately contributes to improved yield and productivity in crops like peas and French beans. pea plants (*Pisum sativum* L.) and Patel and Singh (2012) [18] found similar results in French beans (*Phaseolus vulgaris*).

3.10 Fresh pod weight per plot (kg)
The application of plant growth regulators had a significant impact on the fresh pod weight per plot. The highest fresh pod weight per plot (1.72 kg) was observed with the treatment T_4 GA_3 100 ppm, followed by T_3 GA_3 50 ppm, which yielded 1.63 kg. In contrast, the lowest fresh pod weight per plant (1.30 kg) was recorded in the control treatment (T_0), where only water was applied.

3.11 Pod yield per hectare (q)
The application of plant growth regulators had a significant impact on Pod yield per hectare. The highest Pod yield per hectare (116.15 q.) was observed with the treatment T_4 GA_3 100 ppm, followed by T_3 GA_3 50 ppm, which yielded 109.45 q. In contrast, the lowest Pod yield per hectare (86.39 q.) was recorded in the control treatment (T_0), where only water was applied.
Among the plant growth regulators, GA_3 produced the highest Pod yield per hectare, while the control showed the lowest. GA_3 likely enhanced the yield by improving photosynthesis, branching, leaf area index, and the source-sink system, leading to more and longer pods, thus increasing fresh pod weight per plant, yield per plot, and yield per hectare. Similar results were found in studies on Garden pea by, Singh *et al*. (2015) [17], in French bean.

Table 1: “Effect of Plant Growth Regulators on Growth and flowering Parameters of Garden Pea (Pisum sativum L.) var. Kashi Nandini”

Treatment	Plant height in cm			Number of branches per plant			Number of nodes per plant			Day of 1st flowering
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	
T_0 control water spray	29.45	44.80	60.31	1.20	2.16	3.08	5.12	8.16	11.37	36.67
T_1 NAA-25 ppm	31.93	50.19	68.44	1.97	2.71	3.68	6.70	9.62	12.49	34.00
T_2 NAA-50 PPM	32.67	52.41	69.78	2.17	2.97	3.82	6.82	9.84	13.48	33.67
T_3 GA3-50 ppm	50.18	65.74	89.23	2.72	3.22	4.28	7.08	10.42	13.60	32.67
T_4 GA3-100 ppm	51.79	70.44	93.41	2.86	3.46	4.49	7.16	10.95	14.45	32.33
T_5 Ethrel-200 ppm	30.91	48.58	64.36	1.36	2.36	3.16	5.67	8.41	11.97	35.67
T_6 Ethrel-250 ppm	31.13	50.05	66.72	1.44	2.44	3.32	6.12	8.57	12.01	36.00
T_7 CCC-500 ppm	29.95	43.02	57.76	1.37	2.37	3.41	6.10	8.71	12.47	35.67
T_8 CCC-1000 ppm	28.27	41.74	56.59	1.62	2.62	3.59	6.42	8.86	12.50	36.33
T_9 Nitrobenzene-50 ppm	31.00	51.85	68.25	1.80	2.20	3.47	6.22	9.32	12.52	34.67
T_{10} Nitrobenzene-100 ppm	32.70	52.65	70.23	1.98	2.86	3.64	6.68	9.48	12.77	34.33
T_{11} Triacontanol-500 ppm	31.27	50.51	67.09	1.29	2.19	3.20	5.34	8.72	11.81	36.33
T_{12} Triacontanol-1000 ppm	31.70	51.69	60.31	1.45	2.45	3.38	6.14	8.89	12.30	36.00
C.D.	4.51	6.37	8.45	0.45	0.32	0.61	1.22	1.41	1.59	1.19
SE(m)	1.55	2.18	2.90	0.15	0.11	0.21	0.42	0.48	0.55	0.41
SE(d)	2.19	3.09	4.10	0.22	0.16	0.30	0.59	0.68	0.77	0.58
C.V.	7.85	7.29	7.24	14.78	7.33	10.16	11.54	9.08	7.50	2.02

Table 2: “Effect of Plant Growth Regulators on Yield Parameters of Garden Pea (Pisum sativum L.) var. Kashi Nandini”

Treatment	Number of pods per cluster	Number of pods per plant	Pod length cm.	Pod diameter (mm)	Number of seeds per pods	Fresh pod weight per plot	Fresh pod yield q/h.
T_0 control water spray	1.27	7.06	7.35	1.33	7.14	1.30	86.39
T_1 NAA-25 ppm	1.63	8.18	8.71	1.58	7.99	1.56	101.05
T_2 NAA-50 ppm	1.67	8.60	8.91	1.64	8.13	1.61	104.18
T_3 GA3-50 ppm	1.73	10.20	9.07	1.72	8.72	1.63	109.45
T_4 GA3-100 ppm	1.87	10.73	9.14	1.76	9.03	1.72	116.12
T_5 Ethrel-200 ppm	1.44	7.67	7.78	1.34	7.26	1.38	91.71
T_6 Ethrel-250 ppm	1.50	7.87	7.83	1.44	7.41	1.40	93.05
T_7 CCC-500 ppm	1.40	7.45	8.13	1.41	7.56	1.43	95.25
T_8 CCC-1000 ppm	1.48	7.63	8.15	1.51	7.63	1.48	97.22
T_9 Nitrobenzene-50 ppm	1.47	7.53	8.12	1.54	7.40	1.45	96.34
T_{10} Nitrobenzene-100 ppm	1.60	8.03	8.35	1.56	7.62	1.52	98.79
T_{11}Triacontanol-500 ppm	1.43	7.47	7.94	1.45	7.28	1.39	92.32
T_{12} Triacontanol-1000 ppm	1.53	7.69	7.97	1.49	7.34	1.42	95.12
C.D.	0.22	1.00	1.04	NS	0.97	0.20	12.61
SE(m)	0.08	0.34	0.36	0.09	0.33	0.07	4.32
SE(d)	0.11	0.48	0.50	0.13	0.47	0.10	6.11
C.V.	8.65	7.28	7.47	10.55	7.45	7.86	7.62

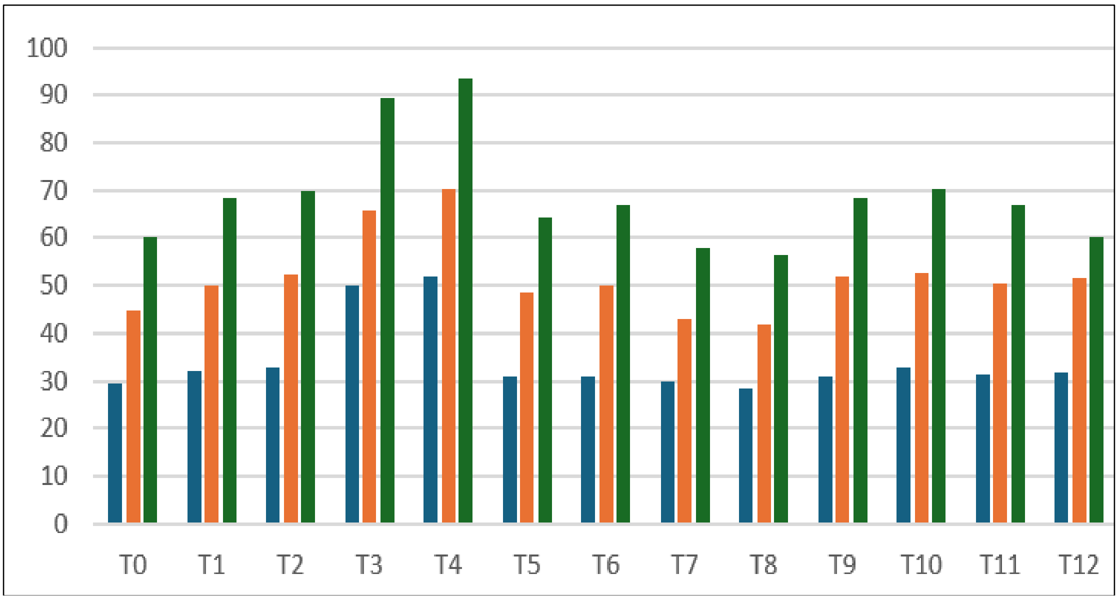

Fig 1: Plant hight at 30, 45 and 60 DAS

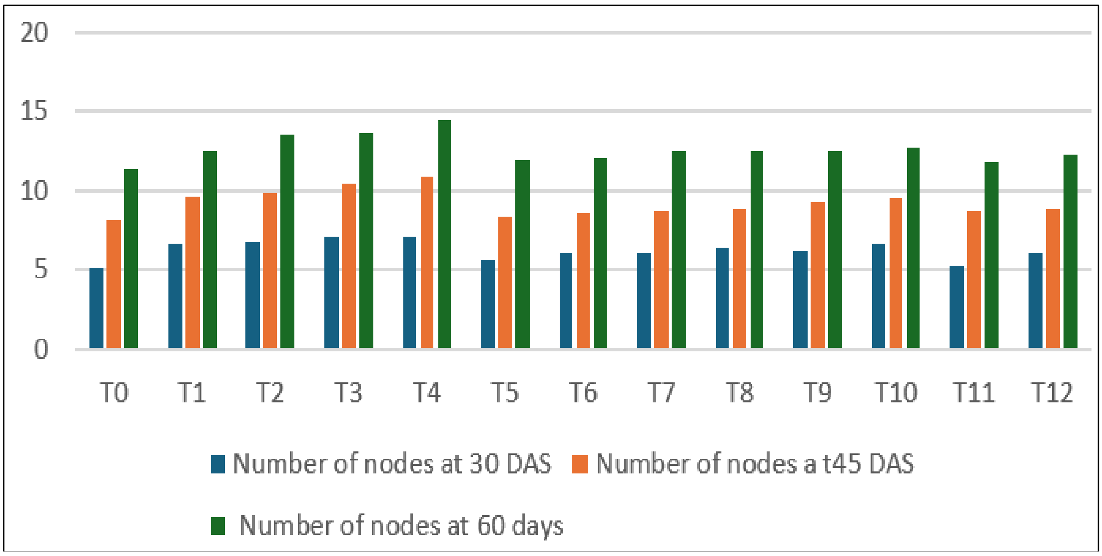

Fig 2: Number of nodes at 30, 45 and 60 DAS

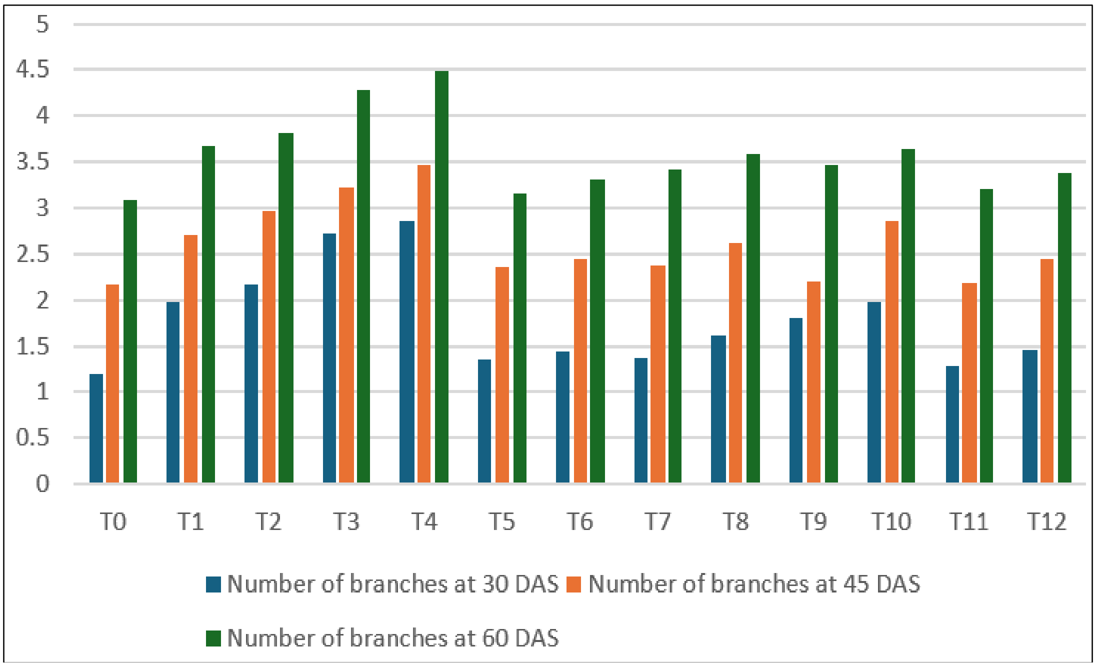

Fig 3: Number of branches at 30, 45 and 60 DAS

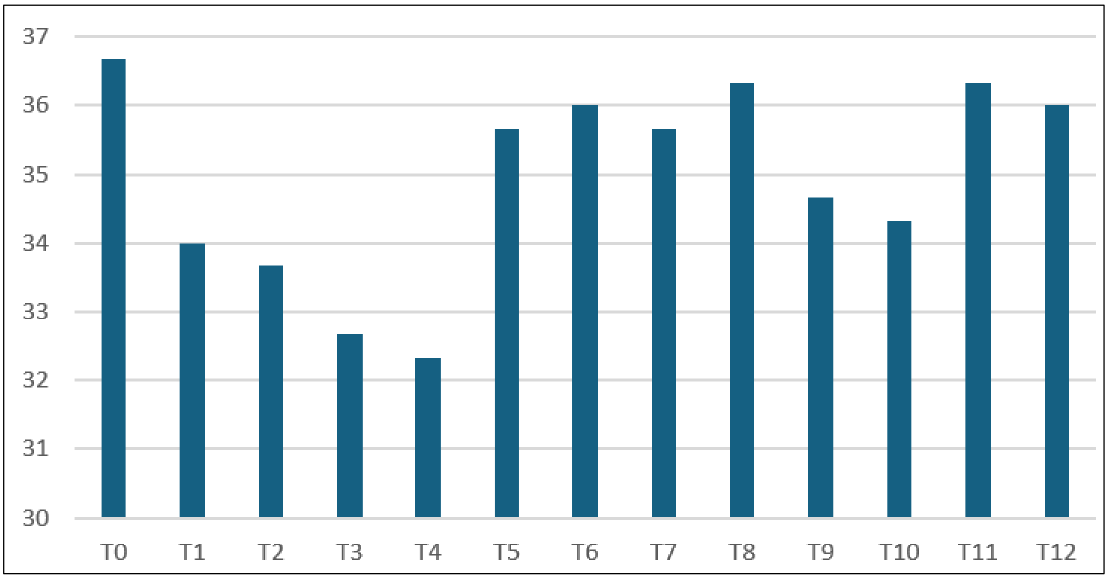

Fig 4: Days of 1st flowering

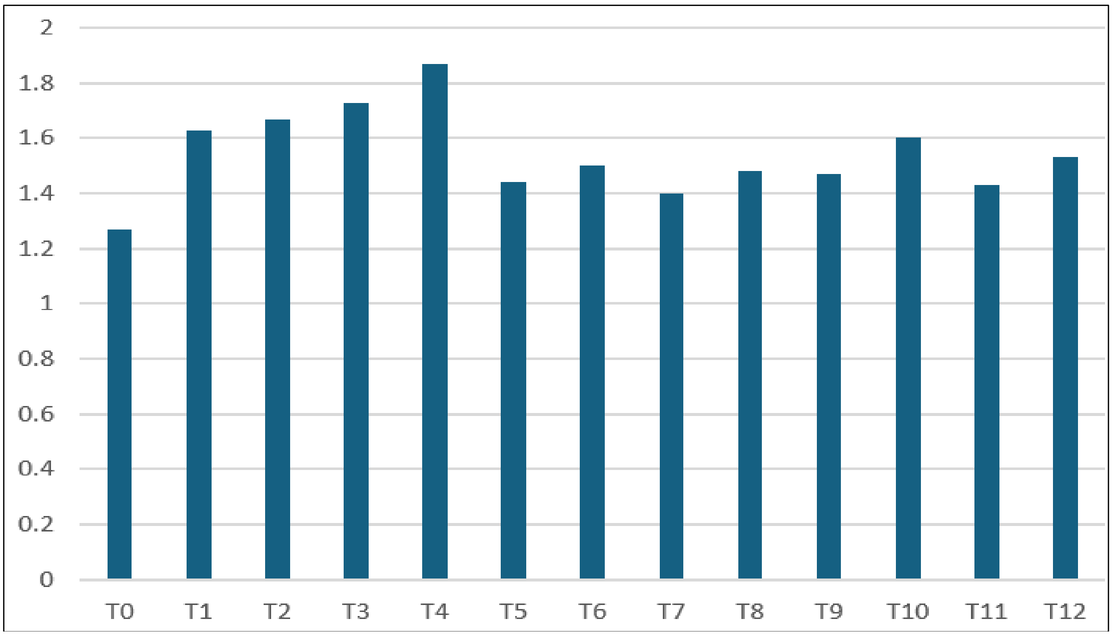

Fig 5: Number of pods/Cluster

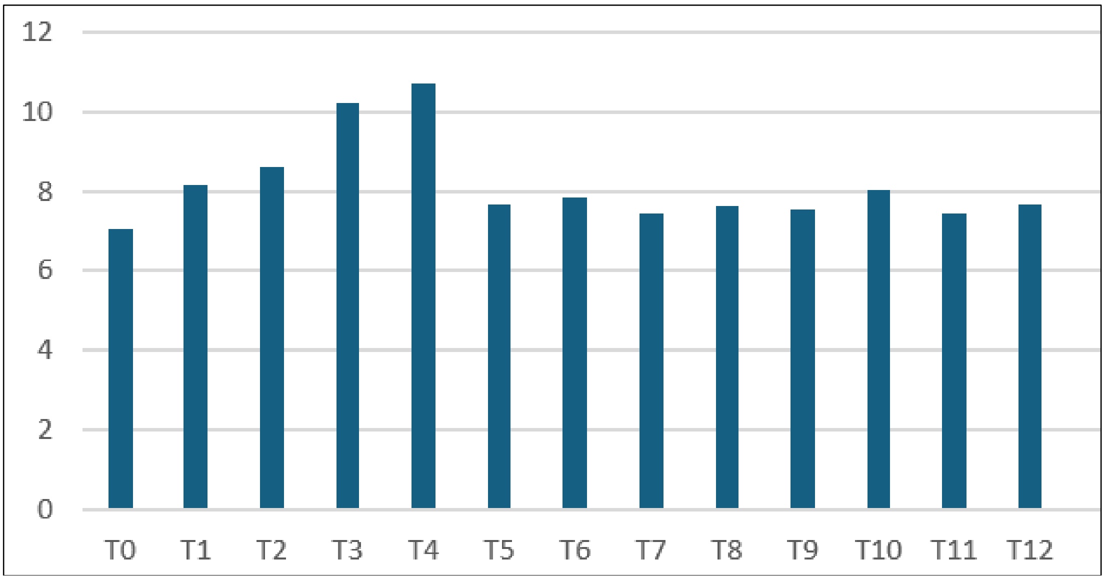

Fig 6: Number of Pods/Plant

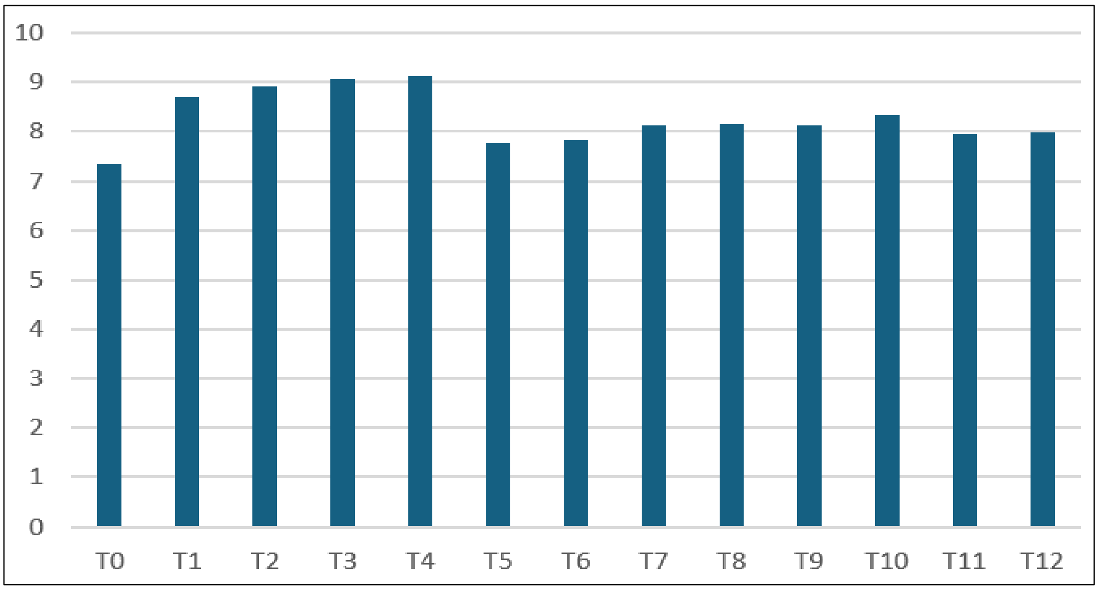

Fig 7: Pod length (cm)

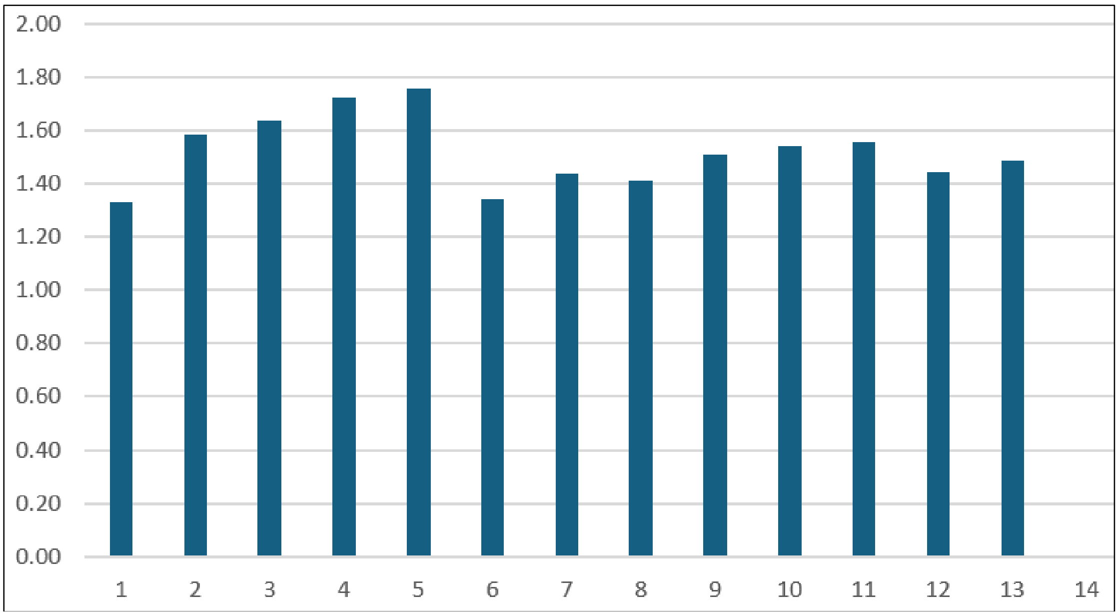

Fig 8: Pod diameter(mm)

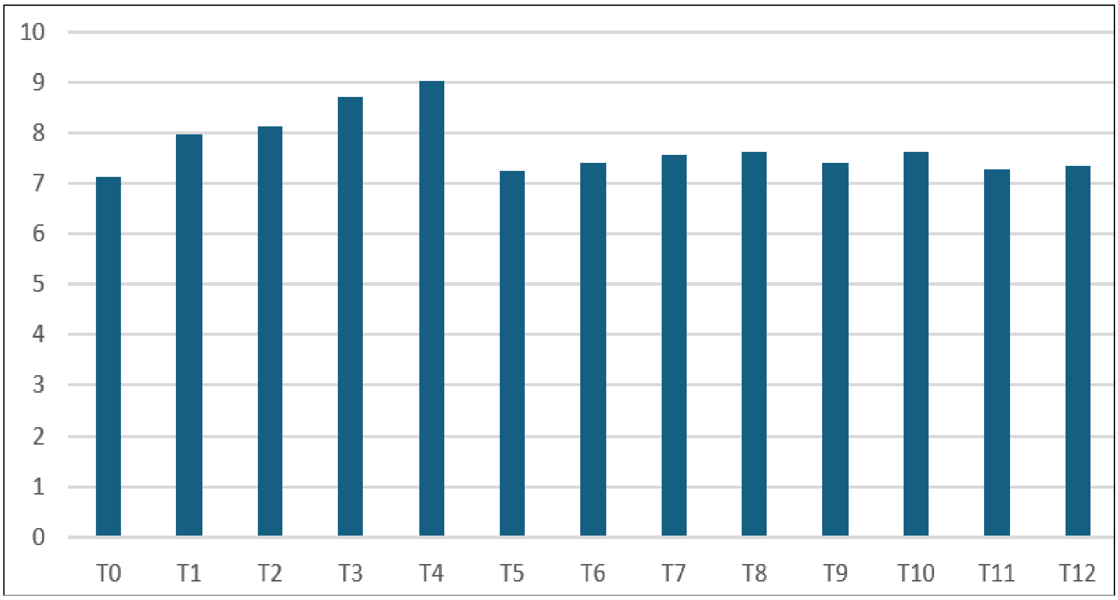

Fig 9: Number of seeds/pods

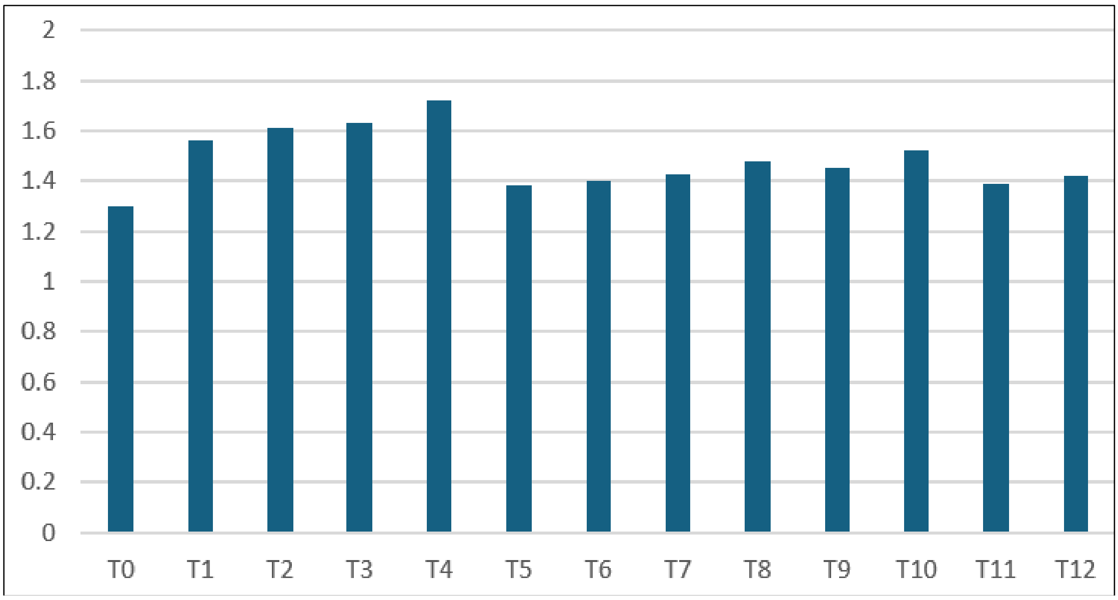

Fig 10: Fresh pod weight/Plot (kg)

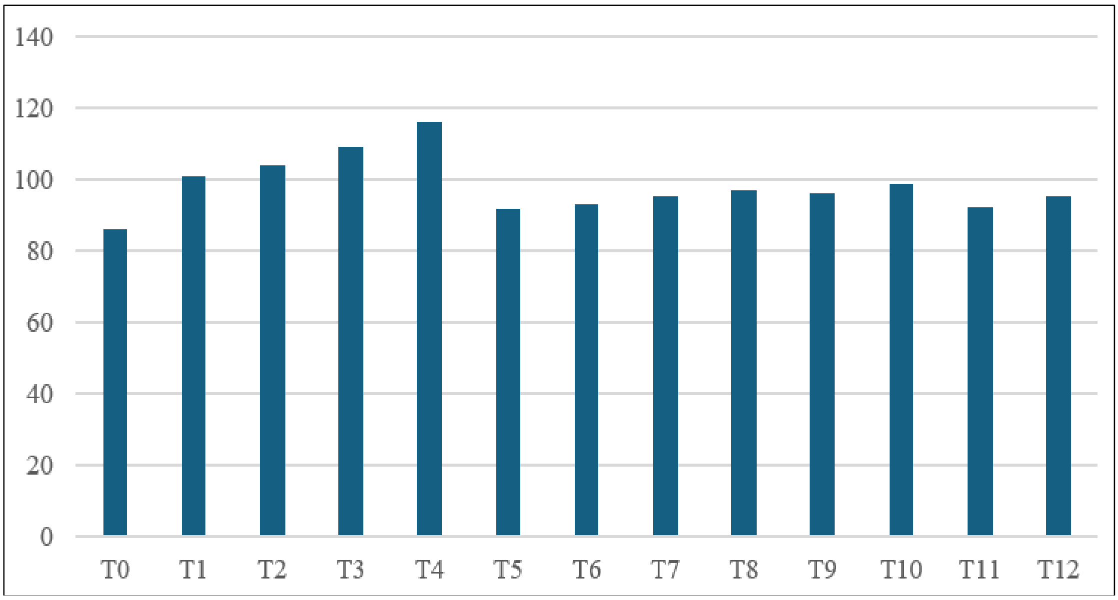

Fig 11: Yield q/ha.

Conclusion

The present study demonstrated that different concentrations of NAA, GA_3, Ethrel, Cycocel, Nitrobenzene, and Triacontanol significantly enhanced the growth, yield, and economic performance of garden pea. Among them, GA_3 at 100 ppm showed the most remarkable improvement in growth and yield parameters.

- Foliar application of GA_3 100 ppm significantly increased plant height, number of branches, nodes, pods, fresh pod weight, pod diameter, seed count, seed weight, compared to other treatments.
- Flowering parameters, days to first were significantly improved with GA_3 100 ppm (T_4), performing similarly to GA_3 50 ppm (T_3) and NAA 50 ppm (T_2).
- Overall, GA_3 100 ppm (T_4) was identified as the best treatment for maximizing pod yield.

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