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ORIGINAL ARTICLE

Effect of Foliar application of Gibberellic acid and Naphthalene acetic acid on growth characters of Broad bean

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ABSTRACT
A field experiment was conducted during the rabi season of 2023-24 at the Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India, to evaluate the effect of foliar application of Gibberellic acid (GA_3) and Naphthalene acetic acid (NAA) on the growth characters of broad bean. The experiment was laid out in a randomized block design with three replications and ten treatments. The treatments included different concentrations of GA_3 and NAA: T_0 (Control), T_1 (GA_3 @ 50 ppm), T_2 (GA_3 @ 75 ppm), T_3 (GA_3 @ 100 ppm), T_4 (NAA @ 50 ppm), T_5 (NAA @ 75 ppm), T_6 (NAA @ 100 ppm), T_7 (GA_3 @ 50 ppm + NAA @ 50 ppm), T_8 (GA_3 @ 75 ppm + NAA @ 75 ppm) and T_9 (GA_3 @ 100 ppm + NAA @ 100 ppm). Plant growth regulators were applied as foliar sprays at 20 days after sowing and systematic evaluations of growth parameters were conducted at regular intervals using standardized measurement methods. The results indicated that foliar application of GA_3 @ 100 ppm + NAA @ 100 ppm resulted in the highest germination percentage (97.77%), number of branches per plant (8.40), plant spread (49.30 cm east-west and 52.83 cm north-south), fresh weight of plant (1591.33 g) and number of root nodules (103.00). However, maximum plant height (108.00 cm), number of leaves per plant (588.33) and root length (17.80 cm) were recorded with GA_3 @ 100 ppm, whereas the highest days to 50% flowering (70.67 DAS) was observed in the control.
Keywords: *Broad bean, gibberellic acid, naphthalene acetic acid, germination percentage, plant height, plant spread*

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INTRODUCTION

Broad bean (***Vicia faba*** L.) belongs to the family Fabaceae and has a chromosome number of 2n=12. It is the only bean crop that thrives as a cool season crop during winter. Some reports suggest that ***Vicia faba*** likely originated in West or Central Asia. Currently, broad beans are cultivated on a large scale in 58 countries, including those in Europe, North Africa, Central Asia, China, South America, the United States of America, Canada and Australia. It is a hardy plant capable of withstanding cold temperatures as low as 4°C. The optimal temperature for pod setting ranges between 15-20°C, while high temperatures during the rainy season can cause flower and pod drop. A well-distributed annual rainfall of 650 to 1000 mm is ideal for broad bean cultivation. In tropical and subtropical regions, broad bean can be grown at altitudes between 1200 m and 2500 m above mean sea level. Broad bean is generally considered a day-neutral plant, however, some accessions require long-day conditions for flowering. It grows best in fine-textured soils but can tolerate a wide range of soil types. The optimal soil pH for its cultivation is 7. Although sandy loams are suitable, they require more frequent irrigation. Due to its relatively shallow root system, the crop may experience drought stress in fast-drying soils. However, broad bean exhibits tolerance to short periods of waterlogging (1). The biomass production of broad bean surpasses most legume crops, with yields ranging from 20 to 40 tons per acre (2). Field preparation is commonly performed using a rotary tiller, and weeding during this stage is crucial. Weeds can significantly reduce broad bean yields, potentially causing up to an 83% loss, affecting both harvest efficiency and seed quality (3). It is recommended to incorporate well-decomposed farmyard manure at a rate of 10 tonnes per hectare.

Additionally, fertilizers high in nitrogen should be avoided, as broad bean, like other legumes, has the ability to fix atmospheric nitrogen. A balanced application of NPK at 20:50:40 kg/ha is recommended for optimal growth. Raw broad bean contains alkaloids such as vicine and convicine, which can trigger glucose-6-phosphate dehydrogenase deficiency, leading to a potentially fatal condition known as favism. Pollen grains and green pods of broad bean may cause allergic reactions in susceptible individuals, resulting in hemolytic anemia (4). Despite this, broad bean is a valuable legume primarily grown for its edible seeds, which are rich in proteins and minerals. The young pods can be consumed as a vegetable, while the dried seeds serve as a nutritious pulse (5). Dry seeds contain up to 35% protein and are an excellent source of essential nutrients, including potassium, calcium, magnesium, iron, and zinc. Gibberellic acid plays a crucial role in promoting vegetative growth by elongating internodes, increasing the number of pods, flowers and leaves; encouraging early flowering and pod development, breaking seed dormancy, accelerating maturity and managing fruit cracking in horticultural crops. Naphthalene acetic acid, a synthetic plant hormone in the auxin family, is commonly used as a rooting agent. It enhances cellulose fibre production, prevents early fruit drop and stem thinning, acts as a metabolic reservoir, promotes fruit development through cell division and elongation and improves fruit yield and quality (6,7). The present study on the effect of GA_3 and NAA on broad bean cultivation was undertaken due to the limited research available in this area. This investigation aims to provide valuable insights that can benefit local farmers and contribute to sustainable agricultural practices in the region.

MATERIAL AND METHODS

The present investigation, entitled "Effect of Foliar Application of Gibberellic Acid and Naphthalene Acetic Acid on the Growth Characters of Broad Bean" was carried out at the Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Pathri Bagh, Dehradun, Uttarakhand, India, during the *rabi* season from November 2023 to April 2024. The broad bean variety 'Bakla Komal' was used for the experiment. The study was conducted using a Randomized Block Design with three replications, each consisting of ten treatments involving different concentrations of Gibberellic acid (GA_3) and Naphthalene acetic acid (NAA). The treatments included T_0 (Control), T_1 (GA_3 @ 50 ppm), T_2 (GA_3 @ 75 ppm), T_3 (GA_3 @ 100 ppm), T_4 (NAA @ 50 ppm), T_5 (NAA @ 75 ppm), T_6 (NAA @ 100 ppm), T_7 (GA_3 @ 50 ppm + NAA @ 50 ppm), T_8 (GA_3 @ 75 ppm + NAA @ 75 ppm) and T_9 (GA_3 @ 100 ppm + NAA @ 100 ppm). The concept of variance, which reflects the degree of variability in a dataset, was assessed by averaging the squared deviations from the mean. The analysis of variance (ANOVA) was conducted following the statistical techniques introduced by Panse and Sukhatme (8).

RESULT AND DISCUSSION

The research demonstrated that varying doses of Gibberellic Acid and Naphthalene Acetic Acid had a significant effect on the growth characteristics of broad bean compared to the control. The findings, as presented in Tables 1- 3 and Fig.1-9 indicate notable improvements in plant growth parameters with different combinations of these plant growth regulators. The application of GA_3 and NAA influenced key attributes such as germination percentage, days to 50% flowering, plant height, number of leaves per plant, number of branches per plant, plant spread (East-West & North-South), fresh weight of plant, root length and number of root nodules. The results highlight the potential of these growth regulators in enhancing broad bean cultivation. A detailed discussion and analysis of these findings are presented in the following sections.

Table 1: Treatment combinations with their concentrations

Treatments	Treatment combinations	Concentration
T_0	Control	No treatment
T_1	GA_3	50 ppm
T_2	GA_3	75 ppm
T_3	GA_3	100 ppm
T_4	NAA	50 ppm
T_5	NAA	75 ppm
T_6	NAA	100 ppm
T_7	GA_3 + NAA	50 ppm + 50 ppm
T_8	GA_3 + NAA	75 ppm + 75 ppm
T_9	GA_3 + NAA	100 ppm + 100 ppm

Table 2: Effect of GA_3 and NAA on germination percentage (%), plant height (cm) and days to 50% flowering of broad bean

Treatment	Germination Percentage (%)	Plant height (cm)			Days to 50% Flowering (DAS)
		60 DAS	90 DAS	At Final Harvest	
T_0	66.67	40.83	51.13	61.50	70.67
T_1	82.22	56.83	70.00	76.47	62.00
T_2	84.44	65.53	81.83	99.00	60.33
T_3	93.33	71.30	94.93	108.00	57.00
T_4	77.77	45.03	54.67	64.33	65.00
T_5	75.55	47.70	54.50	64.10	63.33
T_6	86.66	52.10	63.27	67.67	61.67
T_7	84.44	54.83	59.03	68.60	63.67
T_8	93.33	61.00	67.97	77.00	61.00
T_9	97.78	68.67	83.33	84.00	59.67
C.D $_{0.05\%}$	13.94	7.95	7.95	8.69	4.80
SE(m) ±	4.65	2.6	2.66	2.90	1.60
SE(d) ±	6.58	3.76	3.75	4.10	2.27
C.V.	9.57	8.16	6.75	6.53	4.47

Table 3: Effect of GA_3 and NAA on number of leaves per plant, number of branches per plant and plant spread (East-West & North-South) (cm) of Broad bean

Treatment	Number of leaves per plant		No. of branches per plant	Plant spread (cm)			
	60 DAS	90 DAS	60 DAS	60 DAS		90 DAS	
				E-W	N-S	E-W	N-S
T_0	72.00	396.00	5.00	17.30	17.13	38.10	39.00
T_1	85.00	516.00	6.30	15.84	15.73	35.97	33.13
T_2	92.97	536.67	6.60	18.40	18.87	38.37	38.03
T_3	112.67	588.33	6.87	20.20	20.53	41.37	41.87
T_4	73.17	461.00	8.27	22.30	21.60	42.50	41.73
T_5	76.00	586.67	8.40	23.27	23.53	43.80	44.57
T_6	80.33	502.33	8.40	21.50	22.10	45.27	47.63
T_7	89.50	529.67	8.23	23.50	23.40	44.90	44.47
T_8	89.17	549.67	8.23	24.03	24.40	47.17	47.50
T_9	92.67	546.33	8.40	25.77	25.07	49.30	52.83
C.D $_{(0.05\%)}$	9.64	93.94	0.45	1.32	3.35	4.28	5.13
SE(m) ±	3.22	31.37	0.15	0.44	1.12	1.43	1.71
SE(d) ±	4.55	44.37	0.21	0.62	1.58	2.02	2.42
C.V.	6.46	10.43	3.49	3.60	3.13	2.81	6.88

Table 4: Effect of GA_3 and NAA on fresh weight of plant (g), root length (cm) and number of root nodules of Broad bean

Treatment	Fresh weight of plant (g)		Root length (cm)		Number of root nodules	
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
T_0	221.00	901.33	7.57	9.73	14.00	85.33
T_1	273.33	1150.67	13.13	15.03	17.03	85.77
T_2	248.33	1211.33	14.30	16.50	17.83	89.50
T_3	256.33	1253.67	15.13	17.80	19.13	89.93
T_4	213.00	800.67	11.03	13.10	22.03	90.50
T_5	228.00	1038.67	12.17	14.17	23.63	93.37
T_6	234.33	1126.67	12.77	15.23	25.63	96.37
T_7	285.00	1494.33	13.07	15.20	26.70	99.53
T_8	283.00	1558.00	13.57	15.50	27.67	100.83
T_9	285.33	1591.33	13.73	15.13	28.67	103.00
C.D $_{(0.05\%)}$	37.48	90.97	0.87	1.27	2.79	9.31
SE(m) ±	12.52	30.38	0.29	0.42	0.93	3.11
SE(d) ±	17.70	42.97	0.41	0.60	1.32	4.40
C.V.	8.58	4.34	4.00	5.00	7.27	5.76

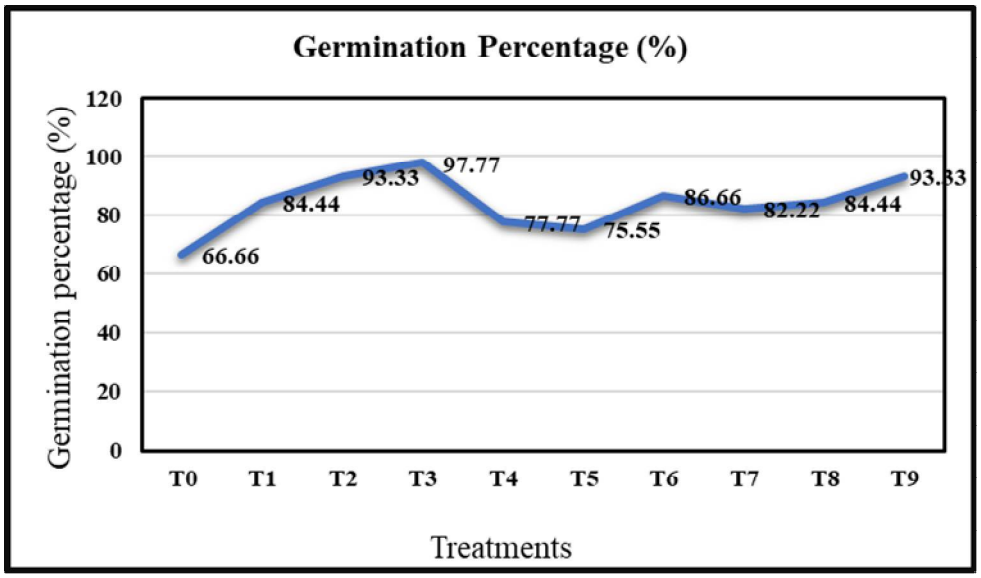

Fig.1: Germination percentage as influenced by application of GA_3 and NAA

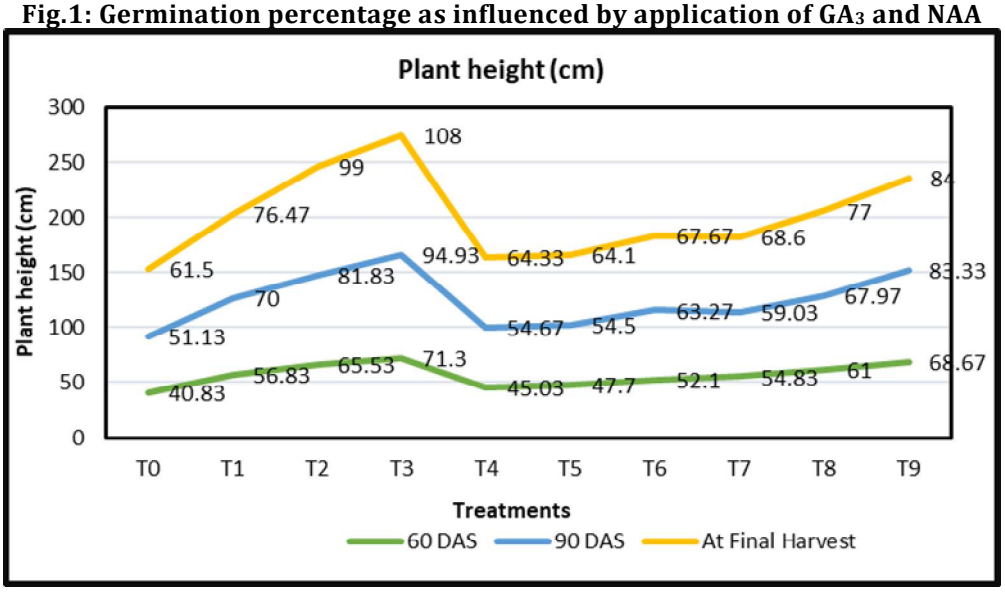

Fig. 2: Plant height (cm) as influenced by application of GA_3 and NAA

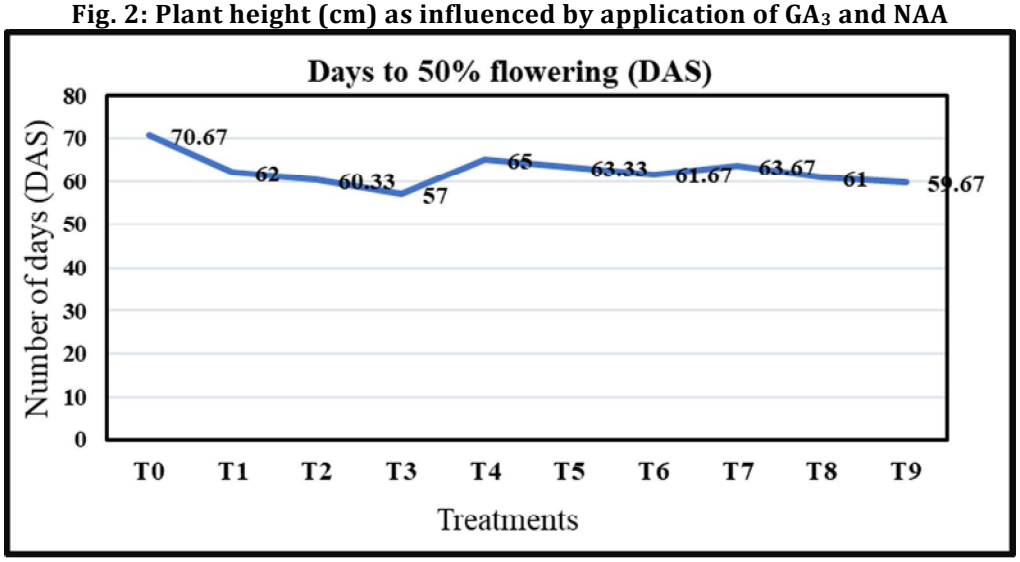

Fig. 3: Days to 50% flowering (DAS) as influenced by application of GA_3 and NAA

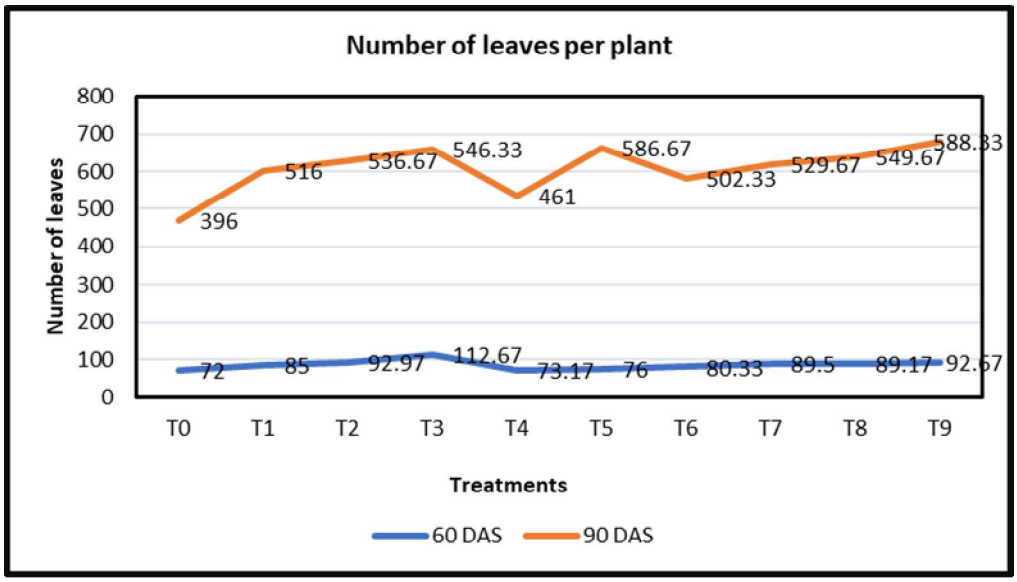

Fig. 4: Number of leaves per plant as influenced by application of GA_3 and NAA

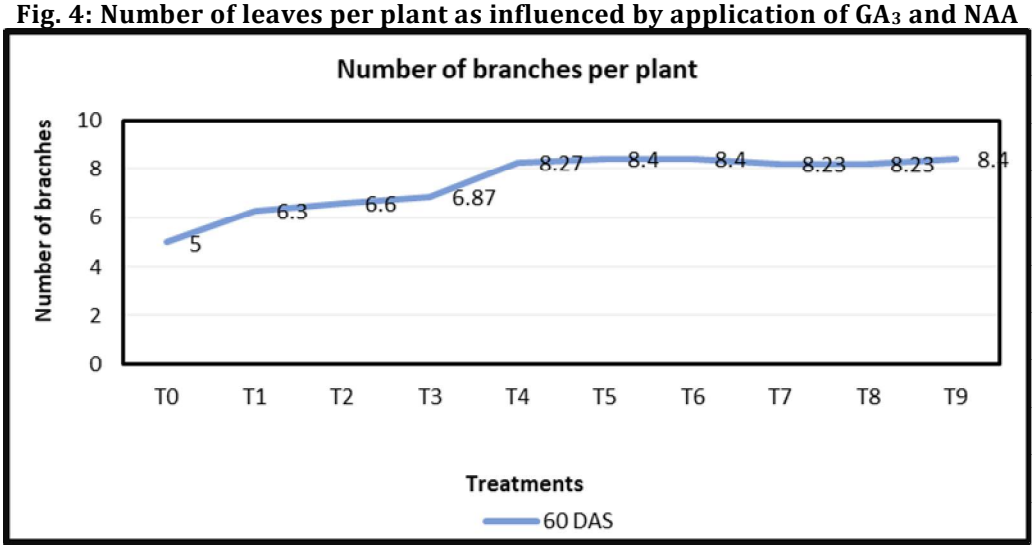

Fig. 5: Number of branches per plant as influenced by application of GA_3 and NAA

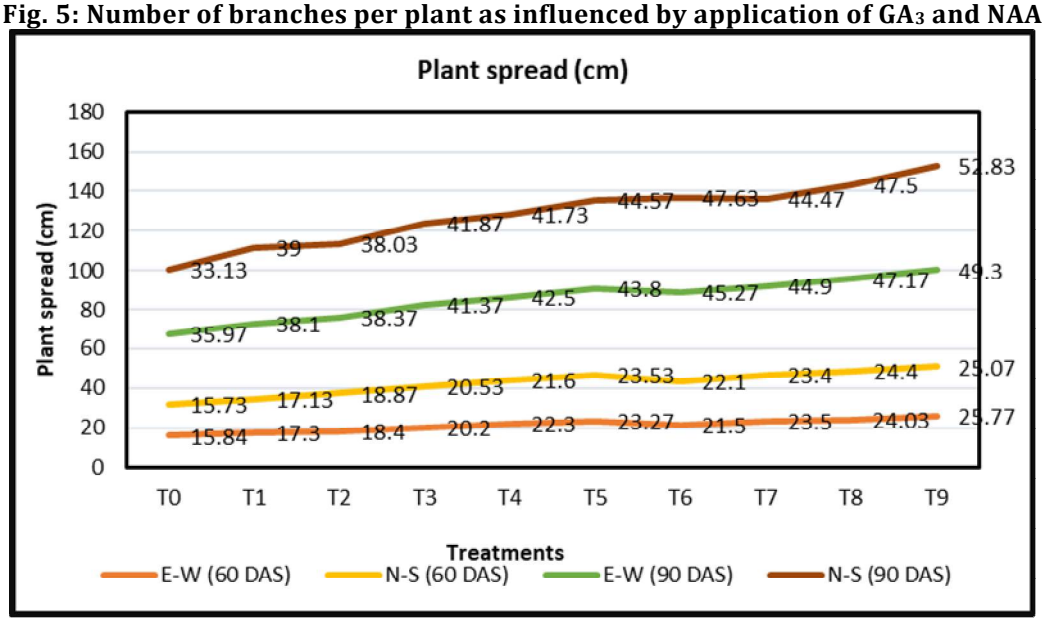

Fig. 6: Plant spread (E-W & N-S) (cm) as influenced by application of GA_3 and NAA

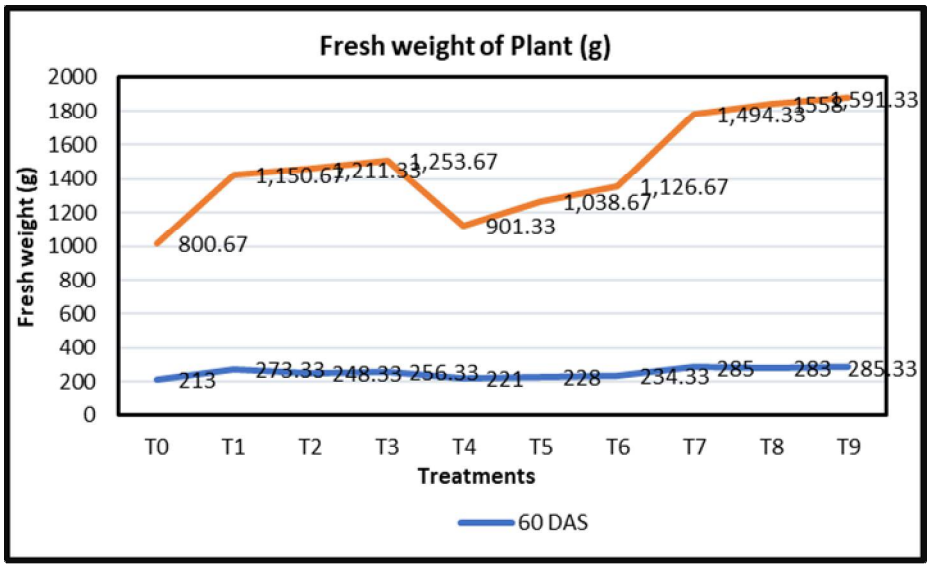

Fig. 7: Fresh weight of plant as influenced by application of GA_3 and NAA

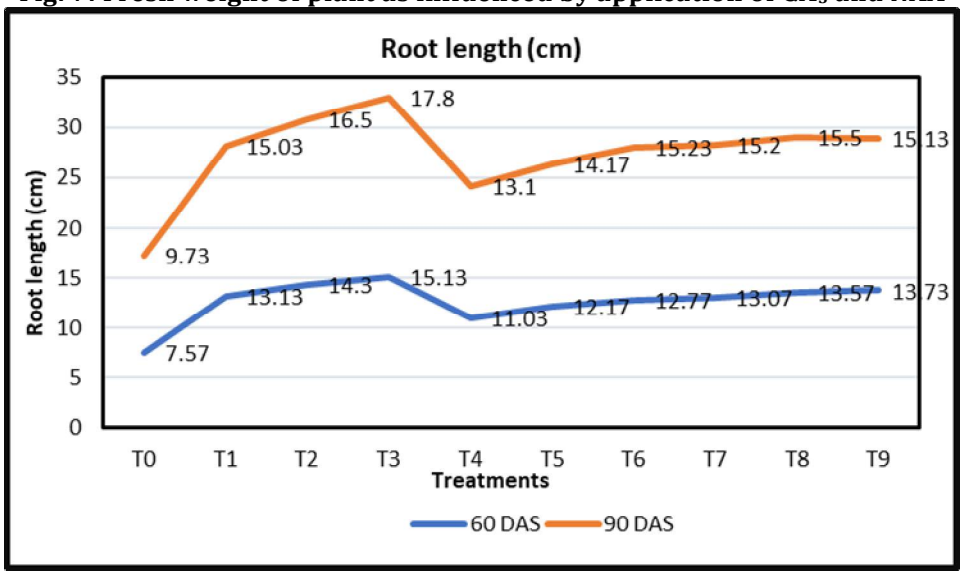

Fig. 8: Root length as influenced by application of GA_3 and NAA

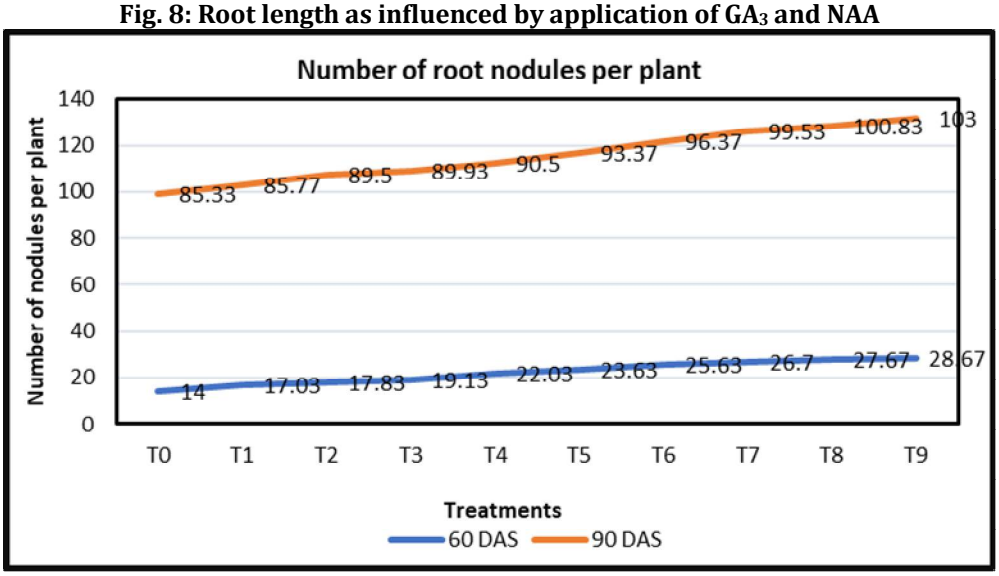

Fig. 9: Number of root nodules per plant as influenced by application of GA_3 and NAA

GROWTH ANALYSIS

Germination percentage (%)

The data presented in Table 2 and Fig.1 indicates significant variation in germination percentage among different plant growth regulator treatments. At 30 days after sowing, the highest germination percentage (97.78%) was recorded in T_9 (GA_3 @ 100 ppm + NAA @ 100 ppm), while the lowest (66.67%) was observed in T_0 (control). Treatments T_3 (93.33%) and T_8 (93.33%) were statistically at par with each other, whereas T_1 (82.22%), T_2 (84.44%), and T_7 (84.44%) also exhibited similar germination percentages. However, significant differences were observed in T_4 (77.77%), T_5 (75.55%) and T_6 (86.66%). The higher germination percentage in T_9 suggests the effectiveness of GA_3 @ 100 ppm + NAA @ 100 ppm in promoting seed germination. Gibberellic acid plays a crucial role in breaking seed dormancy by overcoming inhibitory effects, stimulating embryo expansion and weakening seed coat constraints, thereby facilitating germination. Similar findings were reported by (9) in pea.

Days to 50% flowering

The data presented in Table 2 and Fig. 3 indicates significant variation in days to 50% flowering among different plant growth regulator treatments. The maximum days to 50% flowering (70.67 Days after sowing) was recorded in T_0 (Control), whereas the minimum (57.00 DAS) was observed in T_3 (GA_3 @ 100 ppm). Treatments T_1 (62.00 DAS), T_2 (60.33 DAS), T_6 (61.67 DAS) and T_8 (61.00 DAS) were statistically at par with each other. Similarly, T_5 (63.33 DAS) and T_7 (63.67 DAS) were also found to be at par with each other. However, a significant difference was observed in T_4 (65.00 DAS) and T_9 (59.67 DAS) for days to 50% flowering. The earlier flowering observed in T_3 (GA_3 @ 100 ppm) could be attributed to the role of gibberellic acid in stimulating floral bud development and enhancing the production of florigen hormone, which promotes early flowering. These findings are in agreement with the results reported by (5) in broad bean.

Plant height (cm)

The data presented in Table 2 and Fig. 2 indicates significant variation in plant height among different plant growth regulator treatments. At 60 DAS, the maximum plant height (71.30 cm) was recorded in T_3 (GA_3 @ 100 ppm + NAA @ 100 ppm)**,** while the minimum (40.83 cm) was observed in T_0 (control)**.** Treatments T_4 (45.03 cm) and T_5 (47.70 cm) were statistically at par with each other, whereas a significant difference was observed among T_1 (56.83 cm), T_6 (52.10 cm) and T_7 (54.83 cm)**.** At 90 DAS, plant height followed a similar trend, with the highest value (94.93 cm) recorded in T_3 (GA_3 @ 100 ppm + NAA @ 100 ppm) and the lowest (51.13 cm) in T_0 (control)**.** Treatments T_4 (54.67 cm) and T_5 (54.50 cm) were at par with each other, while T_1 (70.00 cm), T_6 (63.27 cm) and T_7 (59.03 cm) exhibited significant differences. At final harvest**,** T_3 (GA_3 @ 100 ppm + NAA @ 100 ppm) maintained the maximum plant height (108 cm), whereas T_0 (control) recorded the minimum (61.50 cm). Treatments T_4 (64.33 cm) and T_5 (64.10 cm) as well as T_1 (76.47 cm) and T_8 (77.00 cm), were at par with each other. Similarly, **T_6** (67.67 cm) and T_7 (68.60 cm) exhibited no significant difference, while T9 (84.00 cm) showed a notable increase compared to other treatments. The maximum plant height observed in T_3 (GA_3 @ 100 ppm + NAA @ 100 ppm) which might be due to the role of GA_3 in enhancing growth functions, accelerating cell division, elongation as well as promoting internode and stem elongation. Increased plant height due to GA_3 application were also been reported by (10) in broad bean and (11) in mung bean.

Number of leaves per plant

The data presented in Table 3 and Fig. 4 indicates significant variation in the number of leaves per plant among different plant growth regulator treatments. At 60 days after sowing, the maximum number of leaves per plant (112.00) was recorded in T_3 (GA_3 @ 100 ppm), while the minimum (72.00) was observed in T_0 (Control). Treatments T_7 (89.50) and T_8 (89.17) were statistically at par with each other, as were T_2 (92.97) and T_9 (92.67). However, significant differences were observed in number of leaves per plant among T_4 (73.17), T_5 (76.00) and T_6 (80.33). At 90 days after sowing, the highest number of leaves per plant (588.33) was recorded in T_3 (GA_3 @ 100 ppm), whereas the lowest (396.00) was observed in T_0 (control) and treatment T_8 (549.67) and T_9 (546.33) were statistically at par with each other. While a significant difference was found between T_2 (536.67) and T_4 (461.00). The increase in the number of leaves per plant in T_3 might be attributed to the role of GA_3 in promoting cell enlargement and division, leading to enhanced vegetative growth. Similar findings were reported by (12) in French bean.

Number of branches per plant

The data depicted in Table 3 and Fig. 5 indicates significant variation in the number of branches per plant among different plant growth regulator treatments. At 60 days after sowing, the maximum number of branches per plant (8.40) was recorded in T_5, T_6 and T_9. Whereas, minimum number of branches per plant (5.00) was observed in T_0 (control). Treatments T_4 (8.27), T_7 (8.23) and T_8 (8.23) were found to be at par with each other, while a significant difference was observed in T_1 (6.33), T_2 (6.60) and T_3 (6.87).

The increase in the number of branches per plant in T_9 may be attributed to the role of GA_3 in promoting rapid cell growth and elongation, along with enhanced photosynthesis and efficient utilization of photosynthates, leading to better vegetative growth. Similar findings were reported by (11) in mung beans.

Plant spread (East-West & North-South) (cm)

The data presented in Table 3 and Fig. 6 revealed that there was significant variation in plant spread among different plant growth regulators. At 60 DAS, the maximum (25.77 cm) Plant spread (E-W) was recorded in T_9 (GA_3 @100ppm + NAA @100ppm) and minimum (15.84 cm) plant spread (E-W) was recorded in T_1 (GA_3 @50ppm. The plant spread in T_4 (22.30 cm), T_5 (23.27 cm), T_7 (23.50 cm) and T_8 (24.03) were statistically at par with each other. However, the significant difference was observed in T_2 (18.40 cm) and T_3 (20.20 cm) for Plant spread (E-W). At 60 DAS, for (N-S) direction the maximum Plant spread (25.07 cm) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm and minimum plant spread (15.73 cm) was recorded in T_1 with GA_3 @50ppm. The plant spread in T_5 (23.53 cm) and T_7 (23.40 cm) were at par with each other. However, the significant difference was observed in T_2 (18.87 cm), T_3 (20.53 cm) and T_4 (21.60 cm). At 90 DAS, for (E-W) direction the maximum Plant spread (49.30 cm) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm and minimum plant spread (35.97 cm) was recorded in T_1 with GA_3 @50ppm. The plant spread in T_0 (38.10 cm) and T_2 (38.37 cm) were at par with each other. Whereas, T_6 (45.27 cm) and T_7 (44.90 cm) were also at par with each other. However, the significant difference was observed in T_3 (41.37 cm) and T_4 (42.50 cm). At 90 DAS, for (N-S) direction the maximum Plant spread (52.83 cm) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm and minimum plant spread (33.13 cm) was recorded in T_1 with GA_3 @50ppm. The plant spread in T_3 (41.87 cm) and T_4 (41.73 cm) were at par with each other. Whereas T_5 (44.57 cm) and T_7 (44.47 cm) were also at par with each other. Also, T_6 (47.63 cm) and T_8 (47.50 cm) were at par with each other. However, the significant difference was observed in T_0 (39.00 cm) and T_2 (38.03 cm). The maximum Plant spread for (East-West) direction was recorded in T_9 and minimum plant spread was recorded in T_0. The maximum Plant spread for (North-South) direction was recorded in T_9 and minimum plant spread was recorded in T_0. Quick cell division and elongation seem to be the reasons why the plant spreads, promoting its vegetative growth. (13) noted similar findings in French bean.

Fresh weight of plant (g)

The data presented in Table 4 and Fig.7 indicates that there was significant variation in fresh weight of plant among different plant growth regulators. At 60 DAS, the maximum fresh weight of plant (285.33 g) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm which is at par with T_7 (285.00 g) and T_8 (283.00 g) and the minimum fresh weight of plant (213.00 g) was recorded in T_4 with NAA @50ppm. Whereas, T_0 (221.00 g) and T_5 (228.00 g) were at par with each other. However, significant difference was observed in T_3 (256.33 g) and T_6 (234.33 g). At 90 DAS, the maximum fresh weight of plant (1591.33 g) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm which were at par with T_8 (1558.00 g) and the minimum fresh weight of plant (800.67 g) was recorded in T_4(NAA @50ppm). Whereas, T_1 (1150.67 g) and T_6 (1126.67 g) were at par with each other. The treatment T_2 (1211.33 g) and T_3 (1253.67 g) were also at par with each other. However, the significant difference was observed in T_0 (901.33 g) and T_5 (1,038.67g). The maximum fresh weight of plant was recorded in T_9 with GA_3 @100ppm + NAA @100ppm and the minimum fresh weight of plant was recorded in control. There was a substantial increase in photosynthetic activity in both lines during the vegetative stage. This enhancement caused the buildup of specific biomolecules that are key for cell division, which ultimately resulted in thicker and larger leaves which leads to increase in fresh weight of plant. (14) noted similar findings in broad bean

Root length (cm)

The data presented in Table 4 and Fig. 8 revealed that there was significant variation in root length among different plant growth regulators. At 60 DAS, the maximum root length (15.13 cm) was recorded in T_3 with GA_3 @100ppm and the minimum root length (7.57 cm) was recorded in T_0 at control. Whereas, T_5 (12.17 cm) and T_6 (12.77 cm) were at par with each other. The treatment T_1 (13.13 cm), T_7 (13.07 cm), T_8 (13.57 cm) and T_9 (13.73 cm) were also at par with each other. However, the significant difference was recorded in T_2 (14.30 cm) and T_4 (11.03 cm). At 90 DAS, the maximum root length (17.80 cm) was recorded in T_3 with GA_3 @100ppm and the minimum root length (9.73 cm) was recorded in control. Whereas, T_6 (15.23 cm), T_1 (15.03 cm), T_7 (15.20 cm), T_8 (15.50 cm) and T_9 (15.13 cm) were at par with each other. However, the significant difference was found in T_2 (16.50 cm), T_4 (13.10 cm) and T_5 (14.17 cm). The maximum root length was recorded in T_3 with GA_3@100ppm and the minimum root length was recorded in control. This might occur because of enhanced cell division and elongation, which supports vegetative growth in broad beans and contributes to reducing genetic dwarfism. (15) noted similar findings in strawberry.

Number of root nodules per plant

The data presented in Table 4 and Fig 9. revealed that there was significant variation in number of root nodules per plant among different plant growth regulators. At 60 DAS, the maximum number of root nodules per plant (28.67) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm which was at par with T_8 (27.67) and the minimum number of root nodules per plant (14.00) was recorded in control. Whereas, T_1 (17.03), T_2 (17.83) and T_3 (19.13) were at par with each other. The treatment T_4 (22.03) and T_5 (23.63) were also at par with each other. However, the significant difference was found in T_6 (25.63) and T_7 (26.70). At 90 DAS, the maximum number of root nodules per plant (103.00) was recorded in T_9 with GA_3 @100ppm + NAA @100ppm which was at par with T_7 (99.53) and T_8 (100.83) and the minimum number of root nodules per plant (85.33) was recorded in T_0 at Control which was at par with T_1 (85.77). Whereas, T_2 (89.50), T_3 (89.93) and T_4 (90.50) were statistically at par with each other. However, the significant difference was recorded in T_5 (93.37) and T_6 (96.37). The maximum number of root nodules per plant was recorded in T_9 with GA_3 @100ppm + NAA @100ppm and the minimum number of root nodules per plant was recorded in control. The highest root nodules were result of applying GA_3 to the leaves, boosting plant vigour and reinforcing the stalk. (16) noted similar findings in mung beans.

CONCLUSION

On the basis of present experimental research on "Effect of Foliar application of Gibberellic Acid and Naphthalene Acetic Acid on the Growth characters of Broad bean" in cultivar Bakla Komal, it can be concluded that among different Gibberellic acid (GA_3) and Naphthalene acetic acid (NAA) treatments, the combination of GA_3 @100ppm + NAA @100ppm i.e., T_9 was found to be most effective for increasing germination percentage (%), number of branches per plant, plant spread (East-West & North-South) (cm), fresh weight of plant (g), number of root nodules. However, plant height (cm), number of leaves per plant, root length (cm) was found maximum in T_3 (GA_3@ 100ppm). However, days to 50% flowering was observed maximum under control.

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