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Studies on effect of integrated nutrient management on growth, flowering, yield and quality of China aster (*Callistephus chinensis* L.) Cv. local pink

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Abstract
The experiment entitled "Studies on effect of integrated nutrient management on growth, flowering, yield and quality of China aster (*Callistephus chinensis* L.) cv. Local Pink." was carried out at the College of Horticulture, Rajendranagar, Hyderabad during the *rabi* season of the year 2021-2022. Among the treatments, treatment T_7 (100%N +100% P_2O_5+50%K_2O+Liquid Potassium bacteria (KSB) (10 ml L^{-1}) recorded highest plant height (53.77 cm), plant spread in North- South direction and East-West direction (1088 cm^2), Leaf area (50.89 cm^2), stem diameter (11.47 mm), number of branches (21.33), minimum days taken for 1st bud initiation (44.86 days), days taken for 50% bud initiation (55.67 days), number of flowers per plant (30.55), flower longevity on plant (14.44 days), flower weight (35.20 g), flower yield per plant (107.89 g), flower yield per plot (3.91 kg), flower yield per hectare (9.77 t), shelf life (1.69 days), vase life (7.23 days), stalk length (25.56 cm), flower diameter (6.51 cm), chlorophyll content (SPAD) (60.80).

Keywords: China aster, liquid KSB, liquid PSB, liquid azotobacter

Introduction
The scientific name for Aster, a well-known member of the Asteraceae family of flowering plants, is *Callistephus chinensis*. The names *Callistephus* and *Kalistos*, respectively meaning "most lovely" and "crown," came from the Greek language represent innocence, harmony, love, beauty, and passion. It originated in China and has since spread to tropical nations like those in Europe. It originated in China and spread to Europe and other tropical nations in the year 1731. It is a robust, freely flowering plant that is cultivated every year for its cut blooms all over the world. Asters feature flowers that come in a broad variety of colours, sizes, and shapes with excellent preserving qualities. (Desai, 1967) [11]

Material and Methods
The experiment entitled "Studies on effect of integrated nutrient management on growth, flowering, yield and quality of China aster (*Callistephus chinensis* L.) cv.Local Pink." was carried out at the College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticulture University, Hyderabad during the *rabi* season of the year 2021-2022.The experiment was laid out in Randomized Block Design with 9 treatments. The details of the experiment are T_1(RDF @ NPK 36:48:24 Kg/acre,T_2 (75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter(10 ml L^{-1}),T_3 (50% N+100% P_2O_5+100% K_2O + Liquid Azotobacter (10 ml L^{-1}), T_4 (100% N + 75% P_2O_5 + 100% K_2O + Liquid Phosphorus Solubilizing bacteria (PSB) (10 ml L^{-1}),T_5 (100% N +50%P_2O_5 +100% K_2O + Liquid Phosphorus Solubilizing bacteria PSB(10 ml L^{-1}),T_6 (100%N +100% P_2O_5+75%K_2O +Liquid Potassium Solubilizing bacteria KSB (10 ml L^{-1}),T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}),T_8 (75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid Phosphorus Solubilizing bacteria (PSB) (10 ml L^{-1}) + Liquid Potassium solubilizing bacteria KSB (10 ml L^{-1}) and T_9 (50% RDF+ Liquid Azotobacter (10 ml L^{-1}) + Liquid Phosphorous Solubilizing bacteria (PSB) (10 ml L^{-1}) + Liquid Potassium Solubilizing bacteria (10 ml L^{-1}). Azotobacter, PSB and KSB in form of liquid formulations at 10 ml L^{-1} each was applied at the time of planting by dipping the seedlings in solution for half an hour. Second application was given at 20 days after transplanting at 2 litres as drenching in the plots and the observations recorded were plant height (cm), plant spread (cm^2), leaf area (cm^2), stem diameter (mm), number of

branches at 45, 60, 75 Days After Transplanting (DAT), number of days taken for first flower bud appearance (days), days for 50% flowering (days), number of flower plant^{-1}, flower longevity (days), flower weight (g), flower yield plant^{-1} (g), flower yield plot^{-1} (kg), flower yield hectare^{-1} (kg), stalk length (cm), flower diameter (cm), shelf life (days), vase life (days), chlorophyll content (SPAD metre) and the data was statistically analysed.

Results and Discussion

Growth Parameters

The studies on effect of integrated nutrient management on growth of China aster Cv. Local Pink and the results of the experiment were presented in the table 1 to 5.

Plant height (cm)

With respect to plant height in China aster, T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded highest plant height (28.60 cm), (40.57 cm), (53.77 cm) at 45, 60, 75 DAT respectively. The lowest plant height recorded in the treatment T_1 (RDF @ NPK 36:48:24 Kg/acre) (23.62 cm), (35.17 cm), (49.17 cm) at 45, 60, 75 DAT respectively. The increase in plant height might be due to potassium playing a significant role in stimulating many metabolic activities and promoting plant development, owing to the beneficial effect of liquid KSB in combination with the appropriate quantity of inorganic fertilisers that increased plant height. The present finding of increase in plant height is in close affirmative with observations recorded by Kumar *et al.* (2022) [3] in China aster, Slathia *et al.* (2019) [4] in zinnia.

Plant spread (cm^2)

Among the treatments, highest plant spread in observed in treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) (523.19 cm^2), (786.39 cm^2), (1088.51 cm^2) at 45, 60, 75 DAT respectively. The lowest plant spread in observed in treatment T_1 (RDF @ NPK 36:48:24 Kg/acre) (343.38 cm^2) (551.30 cm^2), (811.20 cm^2) at 45, 60, 75 DAT. The increase in plant spread might be due to ability of liquid KSB to solubilize unavailable N, P, and K and so increase their availability to plants through nutrient uptake and subsequent increased production of auxin and cytokinin, eventually increased enzyme activity. These elements could have accelerated the plant's spread. The present findings were in line with Slathia *et al.* (2019) [4] in Zinnia.

Leaf area (cm^2)

The treatment, T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded maximum leaf area (20.00 cm^2), (35.67 cm^2), (50.89 cm^2) at 45,60,75 DAT. The lowest leaf area was observed in the treatment T_1 (RDF @ NPK 36:48:24 Kg/acre) (13.79 cm^2), (25.67 cm^2), (42. 98 cm^2) at 45, 60, 75 DAT respectively. The increment in leaf area might be due to the increased availability of potassium to the plants which produced several growth hormones *viz*., auxins, cytokinins and gibberellins etc. The present findings were in accordance with Veeresh (2021) [6] in China aster.

Stem diameter (mm)

On considering stem diameter treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded highest stem diameter (6.69 mm), (10.57 mm), (11.47 mm) at 45,60,75 DAT respectively. The lowest stem diameter is observed in the treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (4.32 mm), (8.46 mm), (9.28 mm). Liquid biofertilizers stimulated growth through a number of processes, including boosting nutrient availability, expanding root biomass or area, and improving the plant ability to absorb nutrients. Nitrogen availability speeds up the production of amino acids and chlorophyll, which are essential for vegetative growth and ultimately might led to an increase in plant stem diameter. The present findings are comparable with results were reported by Jogi *et al*. (2022) [2] in China aster.

Number of Branches

Among the treatments, treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded maximum number of branches (8.30), (17.46), (21.33). The minimum number of branches (4.10) (12.67) (16.26) was observed in the treatment (T_1 (RDF @ NPK 36:48:24 Kg/acre). Increase in number of branches might be due to liquid KSB when applied with inorganic fertilizers led to better flow of micro and macro nutrients. Plant growth regulators like NAA and cytokinins might have broken the apical dominance of the plant leading to more number of branches by stimulating auxillary buds through liquid KSB. Accelerated nutrition has also taken its part by improving cell division and cell differentiation which improved branch growth. The findings were in close affirmative with Slathia *et al.* (2019) [4] in Zinnia.

Table 1: Studies on effect of integrated nutrient management on plant height (cm) in China aster Cv. Local Pink.

Treatments	40 DAT	65 DAT	90 DAT
T_1- RDF @ NPK 36:48:24 Kg/acre	23.62^f	35.17^d	49.17^d
T_2 -75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter(10 ml L^{-1})	24.79^e	36.60^d	50.00^c
T_3 -50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	24.83^e	35.63^d	50.40^c
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB 10 ml L^{-1})	25.87^c	38.10^c	51.43^b
T_5 -100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	25.67^d	37.57^c	50.67^c
T_6 -100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	26.92^b	39.23^b	53.23^a
T_7 -100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	28.60^a	40.57^a	53.77^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	26.38^c	38.17^c	51.90^b
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB (10 ml L^{-1})	26.59^b	38.50^b	52.90^a
S.E. m±	0.17	0.25	0.30
CD@ 5%	0.51	0.76	0.91

Table 2: Studies on effect of integrated nutrient management on plant spread (cm^2) in China aster Cv. Local Pink.

Treatments	40 DAT	65 DAT	90 DAT
T_1- RDF @ NPK 36:48:24 Kg/acre	343.38^g	551.30^h	811.20^i
T_2 -75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter(10 ml L^{-1})	350.67^f	574.04^g	854.46^h
T_3 -50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	376.14^e	589.46^f	863.21^g
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB 10 ml L^{-1})	411.86^d	651.97^d	916.91^e
T_5 -100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	403.86^d	594.38^e	884.17^f
T_6 -100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	492.61^b	724.65^b	1013.64^b
T_7 -100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	523.19^a	786.39^a	1088.51^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	443.24^c	683.71^c	970.21^d
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB (10 ml L^{-1})	484.30^b	710.36^b	1000.16^c
S.E. m±	4.06	5.22	0.69
CD@ 5%	12.18	15.66	2.07

Table 3: Studies on effect of integrated nutrient management on Leaf area (cm^2) in China aster Cv. Local Pink

Treatments	40 DAT	65 DAT	90 DAT
T_1- RDF @ NPK 36:48:24 Kg/acre	13.79^f	25.67^e	42.98^e
T_2 -75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter(10 ml L^{-1})	14.34^f	26.56^e	43.23^e
T_3 -50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	14.98^e	27.98^d	43.56^d
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB 10 ml L^{-1})	16.23^d	31.45^c	45.56^c
T_5 -100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	15.12^e	29.16^d	44.21^c
T_6 -100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	19.46^a	34.34^b	49.56^b
T_7 -100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	20.00^a	35.67^a	50.89^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	17.00^c	32.00^c	47.98^b
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB (10 ml L^{-1})	18.76^b	33.45^b	48.00^b
S.E. m±	0.20	0.47	0.59
CD@ 5%	0.62	1.43	1.78

Table 4: Studies on effect of integrated nutrient management on Stem diameter (mm) in China aster Cv. Local Pink.

Treatments	40 DAT	65 DAT	90 DAT
T_1- RDF @ NPK 36:48:24 Kg/acre	4.32^i	8.46^i	9.28^g
T_2 - 75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	4.67^h	8.67^h	9.46^f
T_3 - 50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	5.16^g	9.37^g	10.33^e
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	5.38^e	9.47^e	10.47^d
T_5 - 100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	5.22^f	9.38^f	10.38^e
T_6 - 100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	6.41^b	10.47^b	11.40^b
T_7 - 100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	6.69^a	10.57^a	11.47^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB(10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	6.29^d	10.24^d	11.21^c
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	6.33^c	10.37^c	11.23^c
S.E. m±	0.01	0.008	0.01
CD@ 5%	0.03	0.02	0.03

Table 5: Studies on effect of integrated nutrient management on Number of branches in China aster Cv. Local Pink.

Treatments	40 DAT	65 DAT	90 DAT
T_1- RDF @ NPK 36:48:24 Kg/acre	4.10^e	12.67^e	16.26^f
T_2 - 75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	5.26^d	14.15^d	17.15^e
T_3 - 50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	6.46^c	14.45d	17.63^d
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	7.53^b	15.38^c	18.69^c
T_5 - 100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	7.28^b	15.23^c	18.55^c
T_6 - 100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	8.17^a	17.22^a	20.91^a
T_7 - 100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	8.30^a	17.46^a	21.33^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB(10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	7.98^a	16.41^b	19.18^b
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	8.09^a	16.83^a	19.43^b
S.E. m±	0.14	0.16	0.14
CD@ 5%	0.42	0.50	0.42

Yield Parameters

The studies on effect of integrated nutrient management on yield parameters of China aster Cv. Local Pink and the results of the experiment were presented in the table 6.

Number of days taken to first flower bud appearance

It was observed that minimum days taken for first flower bud appearance in the treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) (44.86 days). The maximum days taken in treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (52.99 days). Early flower bud appearance might be due to proper uptake of nutrients and commencement of growth promoting substances like auxins, gibberellins, cytokinins, vitamins and organic acids by the biofertilizers. The presence of liquid KSB might resulted in uptake and transport of nutrients which eventually lead to flower initiation as cytokinins can be transported to the axillary buds. Hence better source-sink relation can be strengthened resulting in transition to the reproductive stage. These findings are in conformity with Kumar *et al.* (2022) [3] in China aster, Slathia *et al.* (2019) [4] in Zinnia.

Days to 50% flowering

It was noticed that treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded minimum number days for 50% flowering (55.67 days). Treatment T_1 (RDF @ NPK 36:48:24 Kg/acre) recorded maximum days for 50% flowering (64.24 days). This might be due to increased uptake of NPK might have resulted in rapid acceleration in development of vegetative growth, leading to early cessation of the vegetative growth. (It could also be due to increment in plant height, plant spread, translocation of minerals and early onset of reproductive phase. Similar findings were found in the findings of Kumar *et al.* (2022) [3] in China aster, Slathia *et al.* (2019) [4] in Zinnia.

Number of flowers plant^{-1}

On considering number of flowers plant^{-1} maximum number of flowers were recorded in the treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) (30.55). Lowest number of flowers were recorded in the treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (23.53). Appropriate assimilation of potassium, nitrogen, and phosphorus from the NPK in conjunction with liquid KSB is what caused the Liquid KSB to dissolve. The distinctive functions of liquid KSB include the secretion of amino acid fixation which allowed plants to create photosynthates might have increased the number of flowers by improving source-sink relationships. The present findings were accordance with the finding of Kumar *et al.* (2022) [3] in China aster.

Flower longevity on plant (days)

Among the treatments, treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded maximum days of flower longevity in plant (14.44 days). Whereas, minimum number days of flower longevity in plant was observed in treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (9.97 days). This could be due to liquid KSB promoted photosynthates and might be the function of potassium as a water and sugar carrier in plant tissues. Similar results have been reported by Kumar *et al.* (2022) [3] in China aster.

Flower weight (g)

Treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded highest flower weight (35.20 g). whereas, lowest flower weight was recorded in the treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (29.70 g). Biofertilizer as it accelerates uptake of N, P, K led to assimilation of carbohydrates improving vegetative growth and thereby increased flower weight. Carbohydrates produce reproductive sugars eventually leading to increase in flower size. Similar results were reported by Singh *et al.* (2015) [7] in marigold, Bohra *et al.* (2019) [1] in China aster, Kaushik and Singh (2020) [9] in marigold.

Flower yield plant^{-1}(g)

It was observed that T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded highest flower yield plant^{-1} (35.20 g). Whereas, lowest flower yield plant^{-1} was observed in treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (29.70 g). liquid KSB when applied with appropriate amount of inorganic fertilizers, it enhanced uptake of nutrients which resulted in higher root and shoot improvement amounting to increment in growth. This might have created a cause for flowering, thereby increasing number of flowers per plant. The results are in conformity with Kumar *et al.* (2022) [3] in China aster.

Flower yield plot^{-1} (kg)

On considering flower yield plot^{-1}, highest was recorded in the treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) (3.91 kg). Whereas, lowest yield was recorded in the treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (2.67 kg). This may be ascribed due to production of more growth substances that includes IAA, gibberellins, vitamin B12, thiamine etc. These factors might have improved soil fertility in association with inorganic fertilizer dose. The results were close affirmative with the results reported by Verma *et al.* (2012) [5] in China aster.

Flower yield ha^{-1} (kg ha^{-1})

Among the treatments, treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) (9.77 kg ha^{-1}) recorded highest flower yield hectare^{-1}. The lowest yield was recorded in the treatment T_1(RDF @ NPK 36:48:24 Kg/acre) (6.67 kg ha^{-1}). The highest flower yield per hectare might be due to positive effect of liquid KSB on soil which resulted to better yield and improved the nutrient availability of the plant by addition of atmospheric nitrogen to the soil and promote vegetative growth and yield of the plant. The conversion of photosynthates into proteins resulted in more flower primordia and development of flower bud attributing to higher flower yield. The increase in number of flowers might be due to possible role of liquid KSB through better root proliferation, uptake of nutrients and water and availability of potash. The results are in accordance with the findings reported by Kaladhar babu (2018) [10].

Table 6: Studies on effect of integrated nutrient management on yield parameters in China aster Cv. Local Pink.

Treatments	Number of days taken to first flower bud appearance	Days to 50% flowering	Number of flowers plant^{-1}	Flower longevity on plant (days)	Flower weight (g)	Flower yield plant^{-1}(g)	Flower yield plot^{-1} (kg)	Flower yield ha^{-1} (kg ha^{-1})
T_1- RDF @ NPK 36:48:24 Kg/acre	52.99^c	64.24^d	23.53^f	9.97^g	29.70^d	72.63^g	2.67^h	6.67^f
T_2 - 75% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	50.87^c	62.45^c	24.77^e	10.44^f	30.50^c	80.67^f	2.92^g	7.30^e
T_3 - 50% N + 100% P_2O_5 + 100% K_2O + Liquid Azotobacter (10 ml L^{-1})	50.07^b	60.34^b	26.14^d	10.77^f	31.20^c	82.67^e	2.98^f	7.45^e
T_4- 100% N + 75% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	48.08^b	59.78^b	27.14^c	11.77^e	32.50^b	90.45^d	3.37^d	8.42^d
T_5 - 100% N + 50% P_2O_5 + 100% K_2O + Liquid PSB (10 ml L^{-1})	49.13^b	60.65^b	26.89^c	11.34^e	31.90^b	87.78^d	3.21^e	8.02^d
T_6 - 100% N + 100% P_2O_5 + 75% K_2O + Liquid KSB (10 ml L^{-1})	45.20^a	56.72^a	30.11^a	13.34^b	34.20^a	105.48^a	3.82^a	9.55^b
T_7 - 100% N + 100% P_2O_5 + 50% K_2O + Liquid KSB (10 ml L^{-1})	44.86^a	55.67^a	30.55^a	14.44^a	35.20^a	107.89^a	3.91^a	9.77^a
T_8- 75% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB(10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	47.28^a	56.23^a	28.69^b	11.55^d	32.90^b	96.42^c	3.56^c	8.90^c
T_9- 50% RDF + Liquid Azotobacter (10 ml L^{-1}) + Liquid PSB (10 ml L^{-1}) + Liquid KSB(10 ml L^{-1})	46.70^a	57.38^a	29.77^b	12.67^c	33.90^a	102.96^b	3.78^b	9.45^b
S.E. m±	0.90	0.57	0.22	0.22	0.48	1.09	0.04	0.15
CD@ 5%	2.72	1.72	0.68	0.66	1.44	3.29	0.12	0.46

Conclusion

Therefore, it may be concluded that application of treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded highest plant height (53.77 cm), plant spread (1088.51 (cm^2), Leaf area (50.89 (cm^2), stem diameter (11.47 mm), Number of branches (21.33). With respect to yield parameters, treatment T_7 (100%N +100% P_2O_5+50% K_2O+Liquid Potassium Solubilizing bacteria (10 ml L^{-1}) recorded minimum days to first flower bud appearance (44.86 days), minimum days to 50% flowering (55.67 days), highest number of flowers plant^{-1} (30.55 days), highest flower longevity on plant (14.44 days), maximum flower weight (35.20 g), maximum flower yield plant^{-1} (107.89 g), highest flower yield plot^{-1} (3.91 kg), highest flower yield per ha^{-1} (9.77 kg ha^{-1}).

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