



Effect of NPK on Vegetative Growth Characters of *Gladiolus (Gladiolus grandiflorus L.)* cv. Big Time Supreme

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ABSTRACT

The current investigation entitled “Effect of NPK on vegetative growth characters of *Gladiolus (Gladiolus grandiflorus L.)*” The field experiment was conducted at Horticultural Research Farm-I, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya-vihar, Rae Bareilly Road, Lucknow – 226 025 (UP), during the month of October - April in 2018-2019 and 2019-2020. The experiment was laid out in Randomized Block Design and replicated thrice having 23 (twenty three) treatments in each replication. The minimum days taken for plant emergence (9.15 and 9.13), The maximum height of plant (25.65 cm and 26.06 cm) at 25 DAP, (48.54 cm and 49.44 cm) at 50 DAP, (66.61 cm and 67.93 cm) at 75 DAP and (72.78 cm and 73.55 cm) at 100 DAP, highest number of leaves per plant (4.05 and 4.15) at 25 DAP, (5.99 and 6.25) at 50 DAP, (7.45 and 7.65) at 75 DAP and (8.85 and 9.05) at 100 DAP, maximum length of largest leaf (47.55 cm and 48.74 cm) and maximum width of longest leaf (5.67 cm and 5.88 cm) was recorded with the application of N 20g + P 15g + K 15g (T₁₆). Moreover, the treatment T₁₆ showed the best results for vegetative growth characters of gladiolus.

1. Introduction

Gladiolus (Gladiolus grandiflorus L.) is perennial bulbous flowering plant and belongs to the family Iridaceae. Pliny and Elder coined the term gladiolus (AD 23-79). Mediterranean Europe, South Africa, Tropical Africa and Asia and are all native to it. The centre of diversity of the genus is located in the Cape Floristic Region. *Gladiolus* gets its name from the Latin word Gladius, which refers to its sword-shaped leaves and is also known as sword lily or corn flag. It is the fourth most popular cut flower in the global market after rose, carnation and chrysanthemum. Adopting integrated nutrition management techniques improved the production and quality of flowers and corms (Singh *et al.* 2006). The United States (Florida and California), Holland, Bulgaria, France, Italy, Poland, Australia, Israel, India and Brazil are the biggest gladiolus producers. The unique spike bears a great number of florets of various sizes and shapes, each with a smooth ruffle of deeply crinkled sepals. In India, the area under bulbous crop is currently around 3500 hectares, with gladiolus reporting for more than 1200 ha. The northern Indian plains are ideal for gladiolus cultivation. It

grows on plains and hills up to an elevation of 2400 meters above sea level (Singh *et al.* 2012). *Gladiolus*' spectacular inflorescence, which comes in a variety of colors, makes it a popular choice for herbaceous borders, beddings, pots and cut flowers. It is economically valuable and has a large market in the country. It is the second most popular flower in India, after rose. For greater development and flower production, gladiolus reacts well to balanced nutrition. Inadequate plant nutrition can cause major disorders and finally result in a decrease in plant vigour and production. In gladiolus, nitrogen is one of the most essential nutrients for growth and yield responses. Leaf analysis indicates that the leaves should contain on a dry weight basis 2.5 -3.0% nitrogen or more for optimum yield. *Gladiolus* requires around one-tenth as much phosphorus as nitrogen in terms of foliar analysis. For the best flower production and quality, gladiolus needs generally 3-4 percent potassium in the leaves on a dry weight basis. In addition to soil treatment, foliar nutrition with NPK has quite a significant impact on vegetative growth and floral characteristics. The entire growth performance of the gladiolus crop is influenced by nutrition. Plant analysis has

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been discovered to be a good diagnostic tool for determining how much fertilizers should be applied (Roy *et al.* 1995).

2. Materials and Methods

The field experiment was conducted at Horticultural Research Farm-I in front of Gautam Buddha Central Library, Department of Horticulture, School of Agricultural Sciences and Technology (SAST), Babasaheb Bhimrao Ambedkar University (A central university), Vidya-vihar, Rae Bareilly Road, Lucknow-226 025 (UP), India. was undertaken during the month of October - April in 2018-2019 and 2019-2020. Geographically, Lucknow is situated at 26° 76' N latitude, 80° 92' E longitude and an altitude of (123) meter above mean sea level (MSL). The climate of the experimental site is subtropical with maximum temperature ranging from 19° C to 40° C in summer and 5.5° C to 19° C in winter and relative humidity ranging from 60-90% in different seasons of the year. Lucknow has a sub-tropical climate with hot, dry summers and cold winters, with an average annual rainfall of 800 to 1000 mm and 85 percent of rain fall during the monsoon season. The experimental field was laid out in Randomized Block Design and replicated thrice having twenty three treatments. The planting of corm took place on 25th October, 2018 and 25th October, 2019, in the first and second years, respectively. Planting of corms were done in the evening at a spacing 25×25 cm (row to row and plant to plant) consisting of 16 plants per plot which light irrigation was applied after 10 days. The treatments were T₁ (Control), T₂ (N 20g), T₃ (N 40g), T₄ (P 15g), T₅ (P 30g), T₆ (K 15g), T₇ (K 30g), T₈ (N 20g+P 15g), T₉ (N 20g+P 30g), T₁₀ (N 20g+K 15g), T₁₁ (N 20g+K 30g), T₁₂ (N 40g+P 15g), T₁₃ (N 40g+P 30g), T₁₄ (N 40g+K 15g), T₁₅ (N 40g+K 30g), T₁₆ (N 20g+P 15g+K 15g), T₁₇ (N 20g+P 15g+K 30g), T₁₈ (N 40g+P 15g+K 15g), T₁₉ (N 40g+P 15g+K 30g), T₂₀ (N 20g+P 30g+K 15g), T₂₁ (N 20g+P 30g+k 30g), T₂₂ (N 40g+P 30g+K 15g) and T₂₃ (N 40g+P 30g+K 30g). Appropriate management practices were adopted. Randomly five plants were selected and tagged each plot to recorded the data on the following characters viz. - days to plant emergence, height of the plant, number of leaves per plant, length of largest leaf and width of longest leaf. At the appropriate stage, observations on vegetative growth parameters were recorded and statistically analyzed Gomez and Gomez (1984).

3. Results and Discussion

3.1 Days to plant emergence:

The data pertaining the effect of different doses of NPK and their combinations on Gladiolus cv. Big Time Supreme on days to plant emergence has been presented in Table-1. During both the years (2018-19 and 2019-20) of experimentation, minimum days taken to plant emergence (9.15 and 9.13) was recorded with the application of N 20g +

P 15g + K 15g, which was at par with N 20g + P 15g + K 30g (9.48 and 9.38). However, the maximum days taken to plant emergence at (14.64 and 13.03) respectively. was recorded in control. Significant effect of NPK on sprouting of gladiolus was also reported by the Rajesh *et al.* (2016) Desai *et al.* (2017) also reported that the plant spacing of 30 x 30 cm with fertilizers levels of 250 : 250 : 250 kg NPK/ha were found to be optimum for better growth and recorded significant early sprouting of bulbs (10.85 days) as compared to control.

3.2 Height of plant (cm):

The plant height was recorded at 25, 50, 75 and 100 days after planting the corms of gladiolus cv. Big Time Supreme. The result presented in Table-1 showed that the variation in height of the plant significantly influenced by the different doses of NPK and their combination, during both the years. Maximum plant height at 25 DAP (25.65 cm and 26.06 cm) was recorded with the application of N 20g + P 15g + K 15g, which was at par with N 20g + P 15g + K 30g (25.27 cm and 26.06 cm), while the minimum plant height (21.94 cm and 22.45 cm) was recorded in control. Maximum plant height at 50 DAP (48.54 cm and 49.44 cm) was recorded with the application of N 20g + P 15g + K 15g, which was at par with N 20g + P 15g + K 30g (48.14 cm and 49.03 cm), while the minimum plant height (43.37 cm and 44.43 cm) was recorded in control. Maximum plant height at 75 DAP (66.61 cm and 67.93 cm) was recorded with the application of N 20g + P 15g + K 15g, which was at par with N 20g + P 15g + K 30g (66.32 cm and 67.50 cm), while the minimum plant height (60.49 cm and 61.51 cm) was recorded in control. Maximum plant height at 100 DAP (72.78 cm and 73.55 cm) was recorded with the application of N 20g + P 15g + K 15g, which was statistically at par with N 20g + P 15g + K 30g (72.26 cm and 73.19 cm), while the minimum plant height (67.11 cm and 68.09 cm) was recorded in control. results corroborated the finding of Bashir *et al.* (2015) present study was conducted to ascertain the effects of different combinations of NPK on growth, floral development in gladiolus was applied the NPK (10: 20: 10 g m²), N (20 g m²), P (10 g m²), K (10 g m²). The entire NPK application resulted in better growth in terms of sprouting percent, plant height, and leaf area among the treatments. who investigated the impact of different quantities of NPK (10:10:5 g/pot, 5:5:5 g/pot, 10:5:5 g/pot) on plant development and flowering characteristics after 30 and 45 days of sowing (*Gladiolus hortulanus* L.), increased vegetative growth was achieved with a high nitrogen application rate along with moderate phosphorus and potassium, Khan *et al.* (2004).

3.3 Number of leaves per plant:

The data recorded on the number of leaves per plant was recorded at 25, 50, 75 and 100 days after planting the corms of gladiolus cv. Big Time Supreme. The result showed in Table-2 that the variation in number of leaves per plant significantly impacted by various NPK doses and their combinations, during both the years of experimentation (2018-19 and 2019-20). The maximum number of leaves per plant (4.05 and 4.15) at 25 DAP was recorded with the application of N 20g + P 15g + K 15g, which was noted at par with N 20g + P 15g + K 30g (3.98 and 4.04), while the minimum number of leaves per plant (3.15 and 3.18) was recorded in Control. The maximum number of leaves per plant (5.99 and 6.25) at 50 DAP was recorded with the application of N 20g + P 15g + K 15g, which was noted at par with N 20g + P 15g + K 30g (5.91 and 6.05), while the minimum number of leaves per plant (5.05 and 5.30) was recorded in Control. The maximum number of leaves per plant (7.45 and 7.65) at 75 DAP was recorded with the application of N 20g + P 15g + K 15g, which was recorded at par with N 20g + P 15g + K 30g (7.35 and 6.40), while the minimum number of leaves per plant (6.35 and 6.50) was recorded in Control. The maximum number of leaves per plant (8.85 and 9.05) at 100 DAP was recorded with the application of N 20g + P 15g + K 15g, which was observed at par with N 20g + P 15g + K 30g (8.70 and 9.01), while the minimum number of leaves per plant (7.80 and 7.99) was recorded in Control. A similar results was also found that the conducted an investigation to find out the optimum NPK rates for the cultivation of gladiolus Four N rates (0, 20, 40, 60 g/m²) three P rates (0, 15 and 30 g/m²) and/or two K rates (0 and 10 g/m²) were given, who reported that the average leaf number per plant and plant height were highest with 60 g N, 30 g P and 15 g K/m² Sehrawat *et al.* (2003) and Khan *et al.* (2004) also investigated that the impact of different quantities of NPK (10:10:5 g/pot, 5:5:5 g/pot, 10:5:5 g/pot) on plant development and flowering characteristics after 30 and 45 days of sowing (*Gladiolus hortulanus* L.), increased vegetative growth was achieved with a high nitrogen application rate along with moderate phosphorus and potassium, height of the plant and the number of leaves respectively.

3.4 Length of largest leaf (cm):

The effect of NPK on the length of largest leaf of gladiolus has been presented in Table-2 during both the years (2018-19 and 2019-20). The maximum length of largest leaf (47.55 cm and 48.74 cm) was recorded with the application of N 20g + P 15g + K 15g, which was obtained at par with N 20g + P 15g + K 30g (47.12 cm and 48.34 cm). However, the minimum length of largest leaf (41.50 cm and 42.42 cm) was recorded in control. Keisam *et al.* (2014) also reported that

the number of leaves, leaf length and leaf width were significantly influenced by the application of inorganic and organic fertilizers in gladiolus.

3.5 Width of longest leaf (cm):

The data recorded on the width of longest leaf was also significantly impacted by the different doses of NPK and their combination in gladiolus presented in Table-2 during both the years (2018-19 and 2019-20) of experimentation. The maximum width of longest leaf (5.67 cm and 5.88 cm) was recorded with the application of N 20g + P 15g + K 15g, which was at par with N 20g + P 15g + K 30g (5.35 cm and 5.65 cm). However, the minimum width of longest leaf (3.85 cm and 3.95 cm) was recorded in control. Application of nitrogen at 400 Kg N/ha with three equal split doses recorded significantly the leaf length and leaf width. Phosphorus also plays a significant role in improving growth parameters (Phosphorus 200 kg P₂O₅) at higher level except, number of leaves per plant. The optimum growth was obtained with application of 400 kg N/ha and 200 kg P₂O₅/ha. Kejkar and Polara (2017) and Fayaz *et al.* (2016) were also reported that similar doses of NPK could enhance vegetative as well as reproductive characters of gerbera cv. Lanceolot.

4. Conclusion

On the basis of results obtained from the present investigation, it can be concluded that the application of N 20g + P 15g + K 15g i.e., full doses of phosphorus, potassium and half dose of nitrogen at the time of field preparation and remaining the half dose of nitrogen one month after planting, was found most effective with respect to vegetative growth characters in Gladiolus (*Gladiolus grandiflorus* L.) cv. Big Time Supreme and can be recommended to farmers for commercial cultivation of Gladiolus.

5. References

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Table - 1: Effect of NPK on vegetative growth characters in Gladiolus cv. Big Time Supreme.

Treatments	Days to plant emergence		Height of the plant (cm) 25 DAP		Height of the plant (cm) 50 DAP		Height of the plant (cm) 75 DAP		Height of the plant (cm) 100 DAP	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T ₁ - (Control)	14.64	13.03	21.94	22.45	43.37	44.43	60.49	61.51	67.11	68.09
T ₂ - (N 20g)	13.78	12.11	23.12	23.07	44.05	45.31	61.56	62.65	67.25	68.67
T ₃ - (N 40g)	12.68	11.29	23.23	24.06	44.45	44.63	62.14	62.34	67.61	68.65
T ₄ - (P 15g)	11.49	10.71	23.24	24.47	44.20	44.47	61.73	62.13	68.36	69.31
T ₅ - (P 30g)	12.07	11.82	24.19	25.55	45.59	46.46	62.60	63.49	68.22	68.65
T ₆ - (K 15g)	11.41	11.13	22.39	23.43	45.15	46.57	62.69	63.57	69.39	69.86
T ₇ - (K 30g)	12.66	12.03	22.80	23.02	45.18	46.57	62.93	62.82	69.59	70.63
T ₈ - (N 20g+P 15g)	11.65	11.19	24.21	23.59	44.59	45.64	63.84	64.06	68.59	69.59
T ₉ - (N 20g+P 30g)	11.42	11.03	23.66	24.46	44.66	45.70	63.70	65.38	69.27	70.41
T ₁₀ - (N 20g+K 15g)	12.54	12.38	24.14	25.72	46.63	46.67	64.95	65.22	70.44	70.38
T ₁₁ - (N 20g+K 30g)	12.37	12.02	24.02	23.62	46.93	47.14	64.60	64.13	70.70	71.47
T ₁₂ - (N 40g+P 15g)	11.59	11.40	23.47	24.57	47.17	48.23	65.42	66.39	69.26	70.42
T ₁₃ - (N 40g+P 30g)	12.44	12.16	22.66	23.91	47.04	48.52	64.34	65.62	70.66	72.28
T ₁₄ - (N 40g+K 15g)	13.52	13.09	23.86	24.64	46.16	47.34	64.74	64.93	71.78	72.57
T ₁₅ - (N 40g+K 30g)	13.24	13.04	23.76	25.60	47.02	48.55	65.20	66.39	70.44	70.46
T ₁₆ - (N 20g+P 15g+K 15g)	9.15	9.13	25.65	26.48	48.54	49.44	66.61	67.93	72.78	73.55
T ₁₇ - (N 20g+P 15g+K 30g)	9.48	9.38	25.27	26.06	48.14	49.03	66.32	67.50	72.26	73.19
T ₁₈ - (N 40g+P 15g+K 15g)	11.17	11.07	24.34	25.53	47.09	47.84	65.38	66.15	71.59	71.82
T ₁₉ - (N 40g+P 15g+K 30g)	11.25	10.86	24.58	24.70	46.89	48.38	65.81	66.47	71.11	72.63
T ₂₀ - (N 20g+P 30g+K 15g)	11.43	11.03	24.03	24.59	47.64	47.69	65.30	65.14	70.36	71.31
T ₂₁ - (N 20g+P 30g+K 30g)	12.21	11.97	23.42	25.46	46.95	46.46	64.60	65.35	70.54	70.46
T ₂₂ - (N 40g+P 30g+K 15g)	12.15	11.82	23.80	24.36	46.91	47.20	64.74	64.66	71.27	72.15
T ₂₃ - (N 40g+P 30g+K 30g)	11.21	11.07	24.57	25.14	47.21	48.49	65.91	66.57	71.09	72.49
SE(m)±	0.471	0.251	0.252	0.222	0.257	0.225	0.263	0.219	0.268	0.289
CD at 5 %	1.348	0.718	0.721	0.636	0.736	0.643	0.752	0.627	0.765	0.826

Table 2. Effect of NPK on vegetative growth characters in Gladiolus cv. Big Time Supreme.

Treatments	Number of leaves per plant 25 DAP		Number of leaves per plant 50 DAP		Number of leaves per plant 75 DAP		Number of leaves per plant 100 DAP		Length of largest leaf (cm)		Width of longest leaf (cm)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T ₁ - (Control)	3.15	3.18	5.05	5.30	6.35	6.50	7.80	7.99	41.50	42.42	3.85	3.95
T ₂ - (N 20 g)	3.21	3.25	5.12	5.65	6.75	6.55	7.90	8.02	42.15	43.54	4.12	4.45
T ₃ - (N 40 g)	3.18	3.19	5.14	5.84	6.74	6.65	7.98	8.24	42.58	43.25	4.15	4.25
T ₄ - (P 15 g)	3.20	3.25	5.45	5.64	6.00	6.74	7.87	8.15	42.57	43.58	4.56	4.75
T ₅ - (P 30 g)	3.25	3.30	5.64	5.42	6.54	6.56	7.98	8.46	43.05	44.15	4.85	4.85
T ₆ - (K 15 g)	3.75	3.75	5.12	5.45	6.78	6.87	8.02	8.35	43.56	44.87	4.25	4.64
T ₇ - (K 30 g)	3.46	3.50	5.74	5.78	6.98	6.98	8.25	8.64	42.99	44.25	4.52	4.87
T ₈ - (N 20g+P 15g)	3.85	3.85	5.65	5.68	6.84	6.85	7.99	8.87	43.25	44.85	4.87	4.94
T ₉ - (N 20g+P 30g)	3.54	3.59	5.65	5.70	6.82	6.82	7.92	8.45	44.10	45.25	4.85	4.89
T ₁₀ - (N 20g+K 15g)	3.78	3.85	5.25	5.54	6.45	6.66	8.15	8.98	44.57	45.87	4.67	4.74
T ₁₁ - (N 20g+K 30g)	3.89	3.70	5.31	5.61	6.67	7.05	8.35	8.91	44.51	46.05	3.98	4.15
T ₁₂ - (N 40g+P 15g)	3.68	3.75	5.41	5.66	6.54	7.25	8.54	8.65	44.25	45.25	3.95	4.23
T ₁₃ - (N 40g+P 30g)	3.67	3.78	5.78	5.78	6.00	6.87	8.54	8.45	43.57	44.87	4.75	4.95
T ₁₄ - (N 40g+K 15g)	3.54	3.60	5.87	6.01	6.99	6.88	8.12	8.54	42.88	43.98	4.69	4.80
T ₁₅ - (N 40g+K 30g)	3.65	3.65	5.68	6.00	6.87	7.15	8.30	8.75	45.52	46.58	4.87	4.98
T ₁₆ - (N 20g+P 15g+K 15g)	4.05	4.15	5.99	6.25	7.45	7.65	8.85	9.05	47.55	48.74	5.67	5.88
T ₁₇ - (N 20g+P 15g+K 30g)	3.98	4.04	5.91	6.05	7.35	7.40	8.70	9.01	47.12	48.34	5.35	5.65
T ₁₈ - (N 40g+P 15g+K 15g)	3.78	3.45	5.78	5.84	6.54	6.66	8.35	8.45	45.85	46.87	5.12	5.45
T ₁₉ - (N 40g+P 15g+K 30g)	3.84	3.96	5.84	5.87	7.05	6.87	8.01	8.64	45.51	47.58	5.10	5.32
T ₂₀ - (N 20g+P 30g+K 15g)	3.69	3.75	5.86	5.54	6.98	6.84	7.99	8.25	46.58	47.58	5.05	5.25
T ₂₁ - (N 20g+P 30g+K 30g)	3.70	3.80	5.54	5.78	7.14	6.69	7.98	8.67	46.58	47.56	4.87	5.34
T ₂₂ - (N 40g+P 30g+K 15g)	3.87	3.92	5.65	5.86	6.58	7.03	7.92	8.84	44.99	45.87	4.98	5.42
T ₂₃ - (N 40g+P 30g+K 30g)	3.54	3.68	5.85	5.67	6.53	6.98	8.25	8.54	45.87	46.98	4.86	4.98
SE(m)±	0.157	0.158	0.202	0.252	0.294	0.302	0.356	0.376	0.631	0.553	0.206	0.216
CD at 5 %	0.448	0.452	0.579	0.586	0.476	0.481	0.487	0.496	1.805	1.583	0.589	0.617

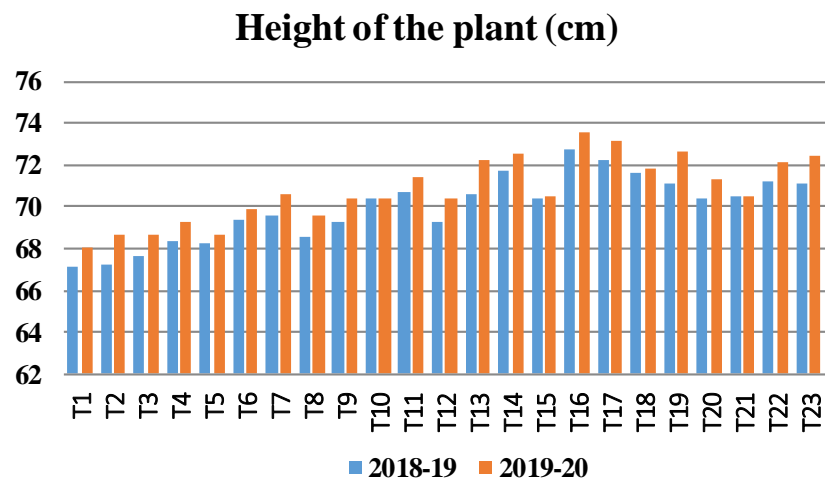
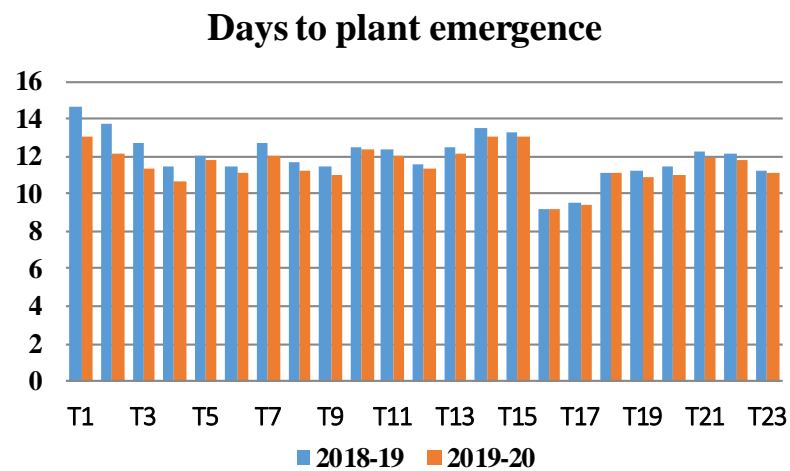


Figure 1. Effect of NPK on days to plant emergence and height of the plant (cm).

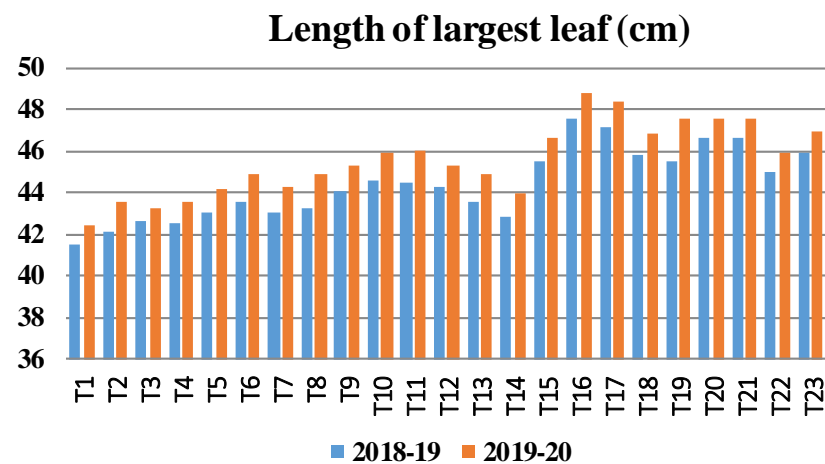
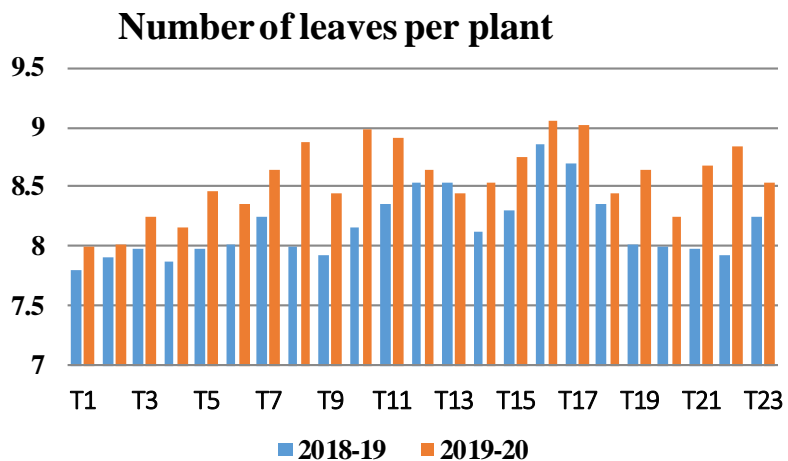


Figure 2. Effect of NPK on number of leaves per plant and length of largest leaf (cm).

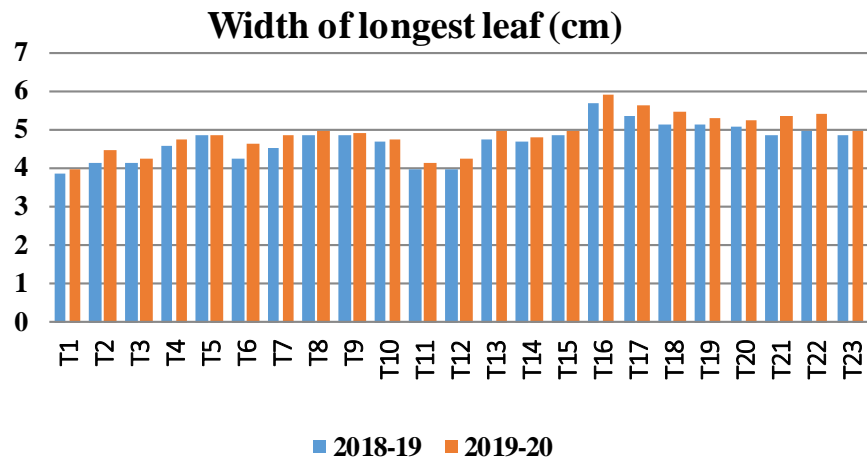


Figure 3. Effect of NPK on width of longest leaf (cm).