Research Article

Response of Tuberose (*Polianthes tuberosa*) to potassium and planting depth

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Abstract

A research work was carried out to find out the effect of planting depths and potassium levels on Tuberose (*Polianthes tuberosa*). The corms of tuberose were planted at a depth of 5, 10, and 15 cm and were fertilized with four levels of potassium 0, 50, 100 and 150 Kg of K₂O ha⁻¹ using K₂SO₄ as a source of K₂O. Result of the study revealed that planting depth of 15 cm significantly affect days to first and last florets opening and increased length of spike, number of florets spike⁻¹, and plant height. Planting depth of 5cm causes decreased number of days to last floret opening. Potassium level of 150 kg of K₂O ha⁻¹ increase spike length, number of florets spike⁻¹ and plant height. Planting depth of 15 cm and fertilizer application of 150 kg of K₂O ha⁻¹ proved to be superior regarding spike length, number of florets and plant height, number of florets spike⁻¹ and plant height. Hence planting tuberose at a depth of 15cm and fertilizer application of 150 kg of K₂O ha⁻¹ is recommended for commercial cultivation of tuberose.

Keywords: Tuberose; Potassium; Planting; Depth

Introduction

Tuberose has its place in Amaryllidaceae family and its origin is Mexico. The major use of tuberose is as cut flower and as it is famous for its sweet fragrance. The extract of tuberose is also used in making perfumes [1]. Their white colored floret has very potential demand in the markets [2]. Tuberose has two main problems regarding its vase life. One is sensitivity of ethylene and the other is vascular tissues blockage [3]. Germicides such as citric acid, cobalt chloride etc. is recommended for enhancing

post-harvest life of tuberose [4]. Reproduction through bulbs is the main source of asexual means of propagation [5]. Suitable planting depth for bulbous plants is vital factor in achievement of best quality of flowers [6]. Proper planting depth for tuberose is consider between 3cm and 10cm but it depends on environmental conditions and type of (medium) soil [7]. Potassium is very important for proper plant growth. It is connection with very vital physiological and bio-chemical processes. It is involved in regulation of stomata during transpiration

and photosynthesis, enzymes activation and turgor pressure maintenance [8]. Potassium is involved in limiting rotting of bulb underground. Potassium deficiency causes less number of buds, result in short stem of flowers and delaying flowering. Yellowing of older leaves and inter-venal yellowing occur as a result of potassium deficiency [9]. In bulbous plants planting depth has also a significant effect on flowering. For tuberose generally 4-7cm planting depth is recommended. Planting depth is dependent on bulb size. Bigger bulbs should be planted deeper in the soil. Similarly bulbs should be planted deeper in the sandy soil as compared to clay soil and a result of deeper planting sprouting is also delayed [10]. Keeping in view the significance of potassium and Planting depth, a research work to realize the influence of these factors on Tuberose was carried out in Horticulture Farm University of Agriculture, Peshawar during the year 2012.

Materials and methods

Experimental material

The experiment response of tuberose (*Polianthes tuberosa* cvsingle) to potassium and proper planting depth, was conducted in Horticulture Farm University of Agriculture, Peshawar, Pakistan during the year 2012.

The bulbs of tuberose were planted at different planting depths (5, 10 and 15 cm) in soil on 28th of February 2012. The field was fertilized with different level of potassium (0, 50 100, and 150 kg of K₂O ha⁻¹). All the other cultural practices such as weeding, irrigation etc. were uniform throughout the experiment. The experiment was laid out as Randomized Complete Block Design (RCBD) with split plot arrangement. Potassium was kept in Main plot and planting depth was kept in Sub-Plot. There were 3 replications in the experiment. A total of 10 bulbs were planted in each treatment.

Treatments detail

Potassium levels kg ha ⁻¹ Factor A	Planting Depths (cm) Factor B
0	5
50	10
100	15
150	

Result and discussion

Days to first floret opening

Planting depth had a significant effect on tuberose regarding number of days to first floret opening. Planting depth of 15cm for tuberose corms showed maximum number of days (193.58) to first floret opening and minimum number of days (162.33) to first floret opening were calculated when the corms were planted at depth of 5cm this is clearly due to the maximum and minimum distance of growing points to the surface of the earth [7]. There was a significant interaction between planting depth and potassium levels. Control level of potassium took maximum number of days to first floret opening (193.51) and then increased potassium level delayed the days to first floret opening as compared to the low level of potassium. These results are similar to findings of [9], [10] who stated that increase in potassium dose delay flowering in bulbous flowers. According to [11] there is a remarkable effect of planting depth in flower bulbs regarding days to sprouting.

Spike length at first floret opening (cm)

Potassium showed significant effect on the spike length at first floret opening. Potassium at the rate of 150 kg K₂O gave maximum length of 40.133 cm at first floret opening and minimum length was recorded as 33.622 cm in the potassium level of 50 Kg of K₂O ha⁻¹. Maximum length of 44.017 cm was shown by planting depth of 15cm at first floret opening while the minimum value of the same parameter was 28.617 cm by 5cm planting depth. Significant interaction was observed between potassium and planting depth. Maximum length was noted

46.73cm by the effect of 150 kg of K₂O ha⁻¹ and 15cm planting depth while on the other hand minimum length of 28.267cm was recorded by the control level of K and planting depth of 5cm. Spike length is increased by increasing the level of Potassium. Potassium at the rate of 150 kg of K₂O ha⁻¹ gave the maximum height (40.13 cm) due to more K availability. The Potassium increases the flower stem height [9]. These results are in conformity with those of [10] who observed that increasing potassium increased plant height in dahlia. Planting depth of 15 cm resulted in superior spike length (44.02) deeper planting gives the best length for spike for as confirmed by the findings of [12] for freesia.

Days to last floret opening

The application of potassium significantly affected days to last floret opening. In the absence of potassium it took maximum

number of days to open the last florets (209.89). On the other hand when 50 kg of K₂O/ha⁻¹ was applied it took minimum number of 189.02 days to open last florets. These results are similar to the findings of [9, 10]. According to them increase in potassium dose delay flowering in bulbous flowers. Bulbs planted at 15 cm planting depth took maximum number of days (211.70) to last floret opening and last floret opened earlier after 189.02 days when bulbs planted 5cm deep. Bulbs planted at shallow depth sprouts earlier and as a result their floret also open earlier [7]. Interaction between planting depth and potassium was also significant. Combination of 15cm planting depth and potassium level of 100 kg of K₂Oha⁻¹ 216.53 days to last floret opening and minimum number of 166.67 days were taken by the combination of 5cm planting depth and 150 kg of K₂Oha⁻¹.

Table 2. Response of days to first floret opening, spike length (cm) at first floret opening and days to last floret opening, of tuberose (*Polianthes tuberosa*) to potassium and planting depth

Treatments	Days to First Floret Opening	Spike length (cm) at first floret Opening	Days to Last Floret Opening
K1	193.51a	37.04b	209.89a
K2	168.62c	33.62c	189.02b
K3	175.58bc	34.97c	192.59b
K4	179.37b	40.13a	194.33b
LSD (P ≤ 0.05)	7.27	1.91	6.18
P1	162.33c	28.61c	180.08c
P2	181.89b	36.7b	197.59b
P3	193.58a	44.02a	211.70a
LSD (P ≤ 0.05)	8.70	2.68	9.13
K1×P1	190.53	28.26	201.27
K1×P2	196.60	41.73	215.13
K1×P3	193.40	41.13	213.27
K2×P1	145.80	25.13	179.80
K2×P2	172.53	32.73	185.27
K2×P3	187.53	43.0	202.00
K3×P1	156.73	28.93	172.60
K3×P2	172.53	30.8	188.63
K3×P3	197.07	45.2	216.53
K4×P1	156.27	32.13	166.67
K4×P2	185.50	41.53	201.33
K4×P3	196.33	46.73	215.00
LSD (P ≤ 0.05)	15.94	4.78	15.94

Spike length at last floret opening

The data regarding spike length at last floret opening shows the maximum length of spike 56.96 cm was obtained when the corms were planted at 15cm planting depth and on the other hand minimum length of 39.36cm was observed at the depth of 5cm planting depth. The deeper planted showed maximum length of spike because of maximum availability of water in the deeper zone of soil. As water act as a solvent for nutrients so a result maximum length is obtained. Potassium also significantly improved the spike length at last floret opening stage. Maximum length of 55.24cm was obtained when potassium was applied at the rate of 150 kg ha⁻¹K₂O, while on the other side minimum length of 44.88cm was achieved as a result of 50 kg ha⁻¹K₂O. Potassium is the main nutrient for plant growth, its deficiency cause many abnormalities in the plant including weak root system, stunted growth of stem and yellowing of leaves [9]. Thus Potassium is the main reason for good quality growth. The two factors planting depth and potassium also significantly interacted with each other. Planting tuberose bulbs at 15cm and potassium application of 150 kg ha⁻¹K₂O gives the superior length of spike of 64.4cm.

Number of florets spike⁻¹

Planting depth has a significant effect on number of florets per spike. Maximum numbers of florets i.e. 54.83 were produced when the bulbs were planted 15 cm deep in the soil. On the other hand potassium application of 150 kg ha⁻¹ resulted in maximum number of florets per spike (49.2-). The interaction of planting depths and potassium levels was also significant. Maximum number of florets per spike (62.2) was observed when the corms were planted 15 cm deep in the soil and treated with 150 kg K₂O ha⁻¹. While on the other hand minimum number of florets per spike (34.0) were obtained as result of interaction of 5cm

planting depth and control level of potassium. Increasing potassium level increases the florets per spike. 150 kg K₂O ha⁻¹ gave the maximum number of florets per spike (40.13). Potassium is involved in formation of chlorophyll as stated by Carroll and [9, 10] quoted that increased number of florets per spike is the result of manufacturing of amino acids, chlorophyll synthesis and swift carbohydrates conversion, which outcome as better growth and maximum number of florets. These results are alike with [10].

Plant height

Plant height is significantly affected by planting depth. Maximum height of 103.13 cm is obtained when the corms were planted 15 cm deep in the soil while on the other hand 88.3 cm plant height was obtained when planting corms 5 cm deep in the soil. Deeper planting results in maximum length of spike. These results are confirmed by [12] for freesia, and [13] for tuberose. Maximum plant height 100.29 cm was obtained when corms were treated with 150 kg of K₂O ha⁻¹. Maximum plant height is the outcome of better food intake as result of strong root system caused by optimum potassium present in soil. Interaction of planting depth and potassium also turns out to be significant. Treatment of 150 kg of K₂O ha⁻¹ gives the maximum plant height of 106.2 cm when the bulbs were planted at 10 and 15 cm. It is confirmed from the data above the planting Tuberose bulbs at a depth of 15cm results in the enhancing of Tuberose floral characteristics like spike length, number of florets per spike and final plant height. On the other hand potassium also significantly increased number of florets per spike and Plant height. Thus it is recommended to plant tuberose bulbs at a depth of 15cm and potassium (K₂O) application at the rate of 150 Kg of K₂O ha⁻¹ for the agro-ecological conditions of Peshawar, Pakistan.

Table 3. Response of spike length (cm) at last floret opening, number of florets spike⁻¹ and plant height (cm) of tuberose (*Polianthes tuberosa*) to potassium and planting depth

Treatments	Spike length (cm) at last floret opening	Number of Florets Spike ⁻¹	Plant Height (cm)
K1	37.04b	47.2ab	97.87ab
K2	33.62c	43.8b	93.49c
K3	34.97c	43.73b	95.56bc
K4	40.13a	49.2a	100.29a
LSD (P ≤ 0.05)	1.91	4.01	1.72
P1	28.61c	35.7c	88.30c
P2	36.7b	47.41b	98.97b
P3	44.02a	54.83a	103.13a
LSD (P ≤ 0.05)	2.68	3.47	1.78
K1×P1	28.26	34.0	186.47
K1×P2	41.73	49.4	102.47
K1×P3	41.13	58.2	104.67
K2×P1	25.13	35.86	87.60
K2×P2	32.73	48.26	92.73
K2×P3	43.0	47.26	100.13
K3×P1	28.93	38.86	90.67
K3×P2	30.8	40.66	94.47
K3×P3	45.2	51.33	101.53
K4×P1	32.13	34.06	818.47
K4×P2	41.53	51.33	106.20
K4×P3	46.73	62.2	106.20
LSD (P ≤ 0.05)	4.78	7.37	3.38

Conclusion

It is concluded from the above experiment that planting tuberose bulbs at the depth of 15 cm and potassium dose of 150 Kg of K₂O ha⁻¹ gave excellent results in agro-ecological conditions of Peshawar, Pakistan. So using such practices yield of tuberose can be achieved to its maximum potential.

Authors' contributions

Conceived and designed the experiments: NU Amin & AM Khattak, Performed the experiments: MA Hussain, Analyzed the data: GI Hussain, Contributed reagents/materials/ analysis tools: F Naeem & A Rashid, Wrote the paper: M Ilyas & IH Khan.

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