EFFECT OF BULB SIZE ON GROWTH, FLOWERING AND BULBILS PRODUCTION OF TUBEROSE

IFTIKHAR AHMAD, TANVEER AHMAD, MUHAMMAD ASIF, MUHAMMAD SALEEM and AHSAN AKRAM

Institute of Horticultural Sciences, University of Agriculture, Faisalabad-38040, Pakistan

ABSTRACT

Studies were conducted to observe the effect of different bulb size on growth, flowering and bulbil production of tuberose (Polianthes tuberosa L. cv. Single) under agro-ecological conditions of Faisalabad during 2005-06 so as to explore the best bulb size for the best quality flower spikes production as well as maximum bulbils production. It was observed that large bulb size resulted in vigorous growth, maximum yield and more number of bulbils as compared to small and medium sized bulbs. It was concluded that large sized bulbs with 3 – 4 cm diameter are best for planting of tuberose.

Key Words: Polianthes tuberose, Cut flower, Bulb florets

Citation: Ahmad, I., T. Ahmad, M. Asif, M. Saleem and A. Akram. 2009. Effect of bulb size on growth, flowering and bulbils production of tuberose. Sarhad J. Agric. 25(3): 391-397.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.), a member of family Amaryllidacea, was originated in Mexico and is grown on large scale in Asia. It is an important cut flower crop from aesthetic as well as commercial point of view. Tuberose has unique place among the flowering plants and is easy to cultivate. Morocco, France, Hawaii, South Africa, India and China are the major producers of tuberose. There are two main flowering cultivars of tuberose viz. Mexican single having six petals and the Pearl having 12 petals. Tuberose blooms in summer/autumn and its clustered spikes are rich in fragrance; florets are star shaped, waxy and loosely arranged on spikes that can reach upto 30 to 45 cm in length. The flower is very popular for its strong fragrance and its essential oil is important component of high-grade perfumes in southern France. Raja and Palanisamy (1999) reported that in bulbous flowers, variable bulb sizes had variable effects on the production and quality of the flowers. In case of tuberose, bulbs of 2.5 to 3.0 cm diameter produced the earliest flower stem emergence (96.7 days) whereas bulbs with 3.5 to 4.0 cm diameter resulted maximum number (3.41) and heaviest (120.8 g) bulbils per clump. Aksu and Celikel (2003) stated that initial bulb size has been critical for rapid propagation of Galanthus elwesii by chipping technique. Initial bulb size significantly affected the bulb propagation ratio and harvested bulb size. As far as tuberose is concerned, very little work has been done to find out the best suitable size of bulbs to be grown under local conditions. Keeping in view the importance of the crop and availability of limited information regarding optimum bulb size, present project was undertaken to explore the optimum size of bulbs which can produce healthy plants with good quality flowers and give maximum number of bulbils to be utilized in future.

MATERIALS AND METHODS

An experiment was conducted in Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, during 2005-06 to investigate the effect of different bulb sizes on growth, yield and bulbil production of tuberose. There were four different sizes of bulbs (treatments) viz. T_1 = <1 cm diameter, T_2 = 1 - 2 cm diameter, T_3 = 2 - 3 cm diameter and T_4 = 3 - 4 cm diameter which were replicated thrice. Each replication had twenty bulbs with 15 cm spacing between plants and 45 cm spacing between ridges. Bulbs were sown at an equal depth of 5 cm. Experiment was laid out according to randomized complete block design having four treatments replicated thrice. Planting was carried out in the third week of February and first irrigation was applied immediately after sowing. All other cultural practices like fertilization, irrigation, hoeing, IPM etc., were same for all treatments during the entire period of study. Data were recorded on various growth characteristics, (sprouting percentage, plant height (cm) and number of leaves plant^{-1}), flowering characteristics, (days required for flowering in 25% plants, number of spikes plant^{-1}, thickness of spike (cm), length of spike (cm), flower longevity) and bulb characteristics (number of bulbs clump^{-1}, size (diameter) of bulbils and weight of bulbils).

Sprouting percentage was observed by counting the sprouted bulbs after 60 days of sowing. Plant height was measured in cm with the help of measuring tape when plants were fully matured. Total number of leaves of each plant was counted after the completion of vegetative growth of the plant. Days required for flowering in 25 percent plants were counted from sowing of the bulbs up to when 25 percent of sown bulbs produced flowers. Number of spikes plant^{-1} was counted when plants completed their blooming. Thickness of spikes was taken with the help of vernier caliper in centimeters at a height of 10 cm from basal end of upper leaf. The length of spike was measured in cm by placing lower end of the measuring rod touching the base of lowest floret up to top of the upper floret of the spike. Number of florets spike^{-1} was counted when all the florets of the spike were fully opened. Flower longevity (days) was counted from the opening of first floret of spike till the last floret faded in color on each sample plant. Bulbils were counted when all the florets of the spike were dropped. Size (diameter) of bulbils was measured with the help of vernier caliper from each sample and finally the bulbils were weighed on an electric balance to observe weight of bulbils in grams. Collected data were analyzed statistically by performing analysis of variance technique (Steel *et al*. 1997) and treatments were compared according to Duncan's Multiple Range test at 5% level of probability.

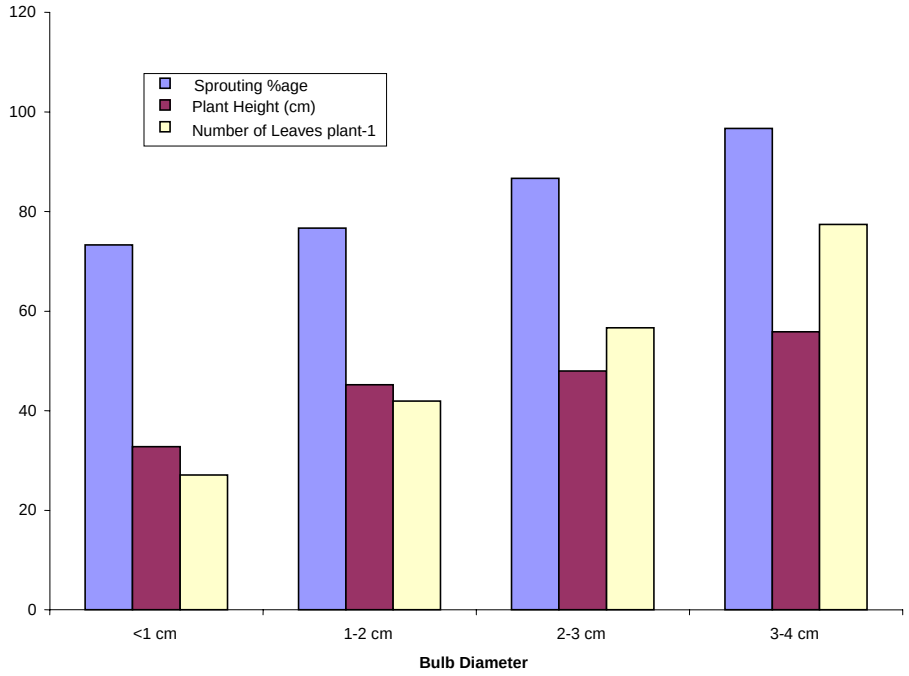

Fig. 1. Growth characteristics of tuberose as influenced by various bulb sizes

RESULTS AND DISCUSSION

Growth Characteristics

Sprouting Percentage (%)

Sprouting percentage varied significantly with the variation in bulb size. Maximum sprouting percentage was observed in T_4 (96.67%) while minimum sprouting percentage was observed in T_1 (73.33%). The results indicate that sprouting percentage increased with the increase in bulb size. Larger bulbs resulted in more sprouting which might be due to presence of more food reserves in larger bulbs. These results are supported by the findings of Satyavir and Singh (1998) who observed maximum sprouting percentage with the large sized corms than medium and small sized corms in gladiolus.

Table I. ***Growth characteristics of Polianthes tuberosa L. cv. Single as influenced by various bulb sizes***

Treatments	Sprouting %age	Plant height (cm)	Number of leaves plant^{-1}
T_1 (0-1 cm)	73.33 b	32.77 c	27.07 d
T_2 (1-2 cm)	76.67 b	45.23 b	41.93 c
T_3(2-3 cm)	86.67 ab	47.99 b	56.67 b
T_4(3-4 cm)	96.67 a	55.85 a	77.40 a

Table II ***Floral characteristics of Polianthes tuberosa L. cv. Single as influenced by various bulb sizes***

Treatments	Days required for flowering in 25% plants	Number of spikes plant^{-1}	Thickness of spike (cm)	Length of spike (cm)	Number of florets	Flower longevity (days)
T_1 (0-1 cm)	107.67 a	1.20 d	0.66 d	20.44 d	20.33 c	11.00 c
T_2 (1-2 cm)	101.00 b	1.93 c	0.75 c	25.24 c	25.20 b	13.00 c
T_3(2-3 cm)	99.00 b	2.67 b	1.01 b	31.09 b	27.60 b	16.33 b
T_4(3-4 cm)	96.33 b	3.40 a	1.13 a	36.73 a	36.73 a	20.67 a

Plant Height (cm)

Data regarding plant height depicted that T_4 gained maximum height (5.85 cm), which was statistically different from rest of the treatments. On the other hand, minimum plant height was observed in T_1 (32.77) whereas T_2 (45.23 cm) and T_3 (47.9 cm) were statistically at par with each other. The results illustrate that plant height increased with the increase in bulb size. Our results are supported by Mahanta *et al*. (1998) who observed taller plants in tuberose which might be due to presence of more photosynthates in larger bulbs when larger bulbs were grown.

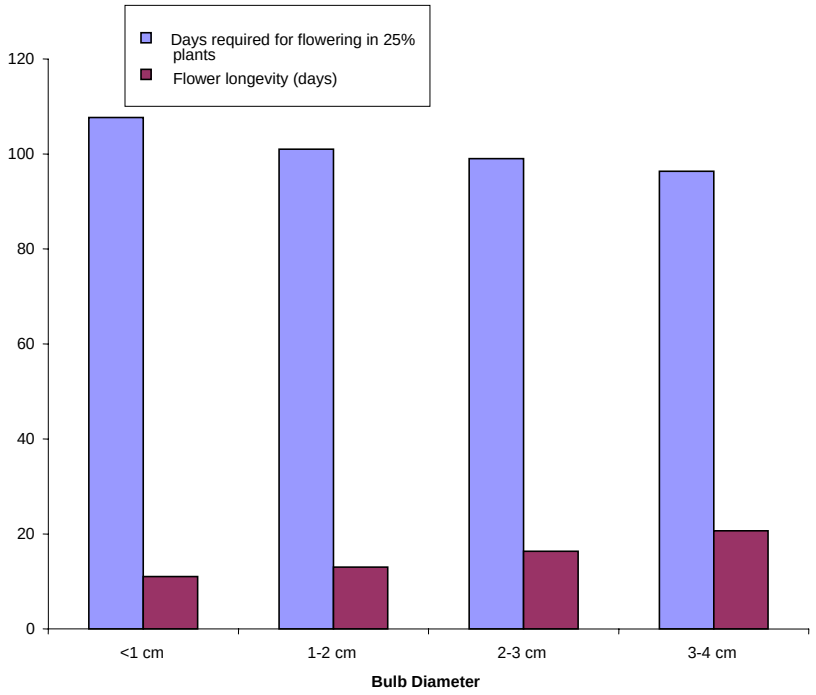

Fig. 2. Days required for flowering in 25 % plants and flower longevity (days) of tuberose as influenced by various bulb sizes.

Number of Leaves Plant^{-1}

Data regarding number of leaves plant^{-1} revealed maximum leaves plant^{-1} (77.40) in case of T_4 followed by T_3 (56.67) and T_2 (41.93) whereas minimum leaves plant^{-1} (27.07) were observed in T_1 where small sized bulbils were planted. Results indicate a trend that with the increase in the bulb size, number of leaves also increased. These

results are in alliance with the results of Rao *et al*. (1992) and Mahanta *et al*. (1998) who illustrated that increasing bulb size results in more leaves in tuberose.

Floral Characteristics

Days to Flowering

As far as number of days required for flowering in 25 percent plants was concerned, T_1 took maximum days (107.67) to initiate flowering as compared to rest of the treatments whereas T_4 took minimum days (96.33) to produce flowers in its 25 percent plants and was statistically at par with T_2 and T_3. Moreover, it is also evident from the data that as the bulb size increased, the number of days decreased to produce flowers. Regarding flower initiation, T_4 is considered the best treatment because only 96.33 days were required to produce flowering which is a desirable character to cut short the maintenance expenditures in commercial flower production. This early flowering may be due to presence of more food reserves in large sized bulbs. These results are supported by Kalasareddi *et al*. (1997) who observed that large sized corms produced flowers earlier in gladiolus as compared to small sized corms.

Number of Spikes Plant^{-1}

Regarding number of spikes plant^{-1}, maximum (3.40 spikes plant^{-1}) were produced by T_4 followed by T_3 (2.67) and T_2 (1.93). Minimum number of spikes was observed in T_1 (1.20). Results indicate that with the increase in bulb size, the number of spikes also increased and similar trend was also observed by Kalasareddi *et al*. (1998), who observed maximum number of spikes (which might be due to presence of more buds on large sized corms) in gladiolus when large sized corms were used.

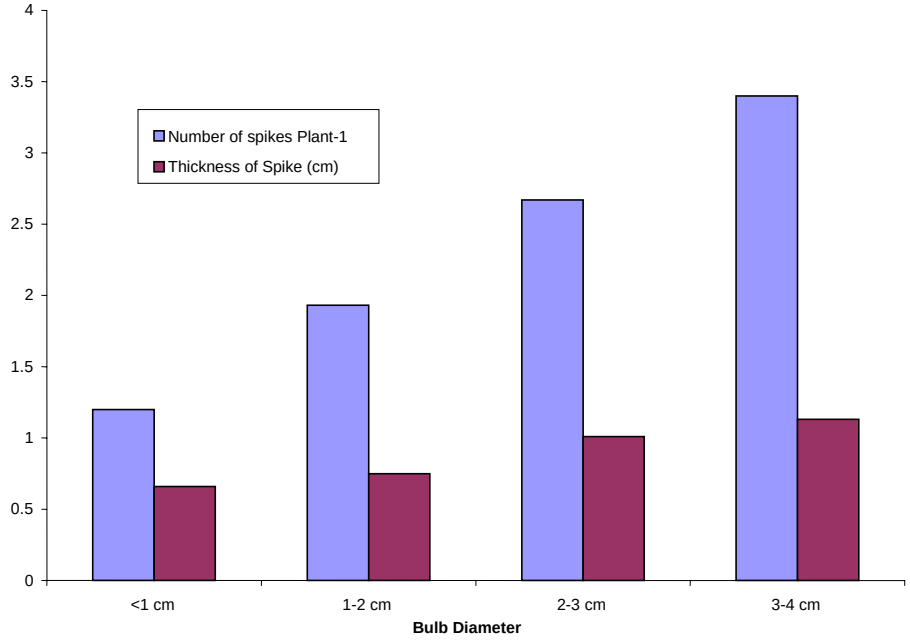

Fig. 3. Number of spikes and thickness of spike (cm) of tuberose as influenced by various bulb sizes.

Thickness of Spike (cm)

Data regarding thickness of the spike demonstrated significant superiority of T_4 over rest of the treatments which was followed by T_3 (1.01 cm) and T_2 (0.75 cm) while least spike thickness was observed in T_1 (0.66 cm). These results indicated a positive relation with the bulb size as spike thickness was increased when bulb size increased. These results were in accordance with the findings of Kariuki and Kako (1999) who observed that large sized bulbs produced thicker spikes in Ornithogalum saundersiae as compared to small sized bulbs.

Length of Spike (cm)

As far as length of spike was concerned, T_4 produced maximum spike length (34.73 cm) and excelled rest of the treatments. Moreover, a gradual increase in the length of spike was observed with the increase in bulb size. These results were confirmed by the findings of Kariuki and Kako (1999) who observed increase in length of spike with increasing bulb size in Ornithogalum saundersiae.

Number of Florets Spike^{-1}

Regarding number of florets spike^{-1}, T_4 produced 36.73 florets which were maximum as compared to rest of the treatments. There was a positive trend that with the increase in the bulb size, the number of florets was also increased. T_2 (25.20) was statically at par with T_3 (27.60), while least number of florets was observed in T_1 (20.33). It can be concluded that the large sized bulbs performed better and produced maximum number of florets spike $^{-1}$ which might be due to availability of more photosynthates. These results are in conformity with the results of Singh (2000) who observed that larger corms produced more florets in gladiolus.

Flower Longevity (days)

Information pertaining to flower longevity revealed that T_4 performed best with 20.67 days flower longevity as compared to rest of the treatments. On the other hand, shortest flower longevity (11.00 days) was observed in T_1, which was also at par with flower longevity of T_2. With increasing bulb size, the flower longevity also increased. These results are in line with the results of Sathyanarayana *et al*. (1994) who attributed that duration of flowering was shortest for plants produced from small corms in gladiolus.

Bulb Characteristics

Number of Bulbils Plant^{-1}

Information procured on number of bulbils plant^{-1} depicted that maximum bulbils plant^{-1} (18.70) were produced in T_4 which were significantly different as compared to all other treatments whereas minimum number of bulbils plant^{-1} (11.47) was produced in T_1 while T_2 (14.03) was statistically at par with T_3 (16.27). It was observed that with increasing bulb size, the number of bulbils increased. These results are in accordance with the findings of Startek and Wraga (1998) who found that large sized bulbs produced more bulbils than smaller sized bulbs in Oxalies deppi.

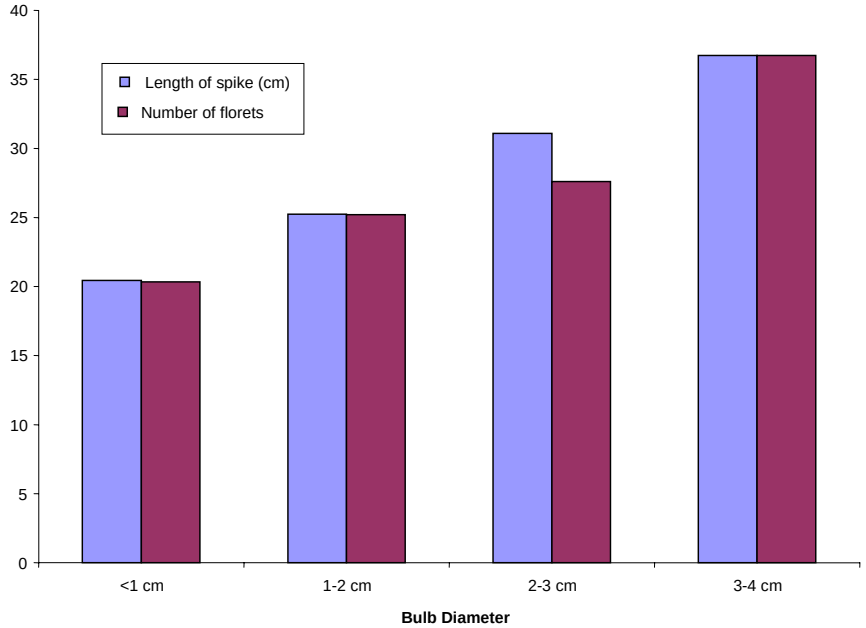

Fig. 4. Length of spike (cm) and number of florets per spike of tuberose as influenced by various bulb sizes.

Size (diameter) of Bulbils (cm)

Data related to size of bulbils illustrated that bigger sized bulbils (3.95 cm) were produced by T_4 as compared to rest of the treatments, whereas, smaller sized bulbils (1.67 cm) were produced in T_1. So, it can be concluded that bigger sized bulbs produced larger bulbils while small sized bulbs produced smaller bulbils due to less availability of photosynthates. These results are in accordance with the findings of Lone *et al*. (1999) who observed positive relation between corm size and the size of daughter cormels in gladiolus.

Table III. ***Bulbil production of Polianthes tuberosa L. cv. Single as influenced by various bulb sizes***

Treatments	Number of bulbils clump^{-1}	Size (diameter) of bulbils (cm)	Weight of bulbils (g)
T_1 (0-1 cm)	11.47 c	1.67 d	90.40 c
T_2 (1-2 cm)	14.03 b	2.43 c	99.27 bc
T_3(2-3 cm)	16.27 b	3.31 b	116.00 b
T_4(3-4 cm)	18.70 a	3.95 a	155.87 a

Weight of Bulbils (g)

Data pertaining to average weight of bulbils revealed that maximum weight of bulbils (155.87 g) was produced in T_4 which was significantly greater than all other treatments while minimum weight of bulbils (90.40 g) was produced in T_1 which was statistically at par with T_2 (99.27) and similarly T_2 was statistically at par with T_3 (116.00). This data exhibited a trend that with increase in bulb size, the weight of daughter bulbs was also increased. These results were supported by Raja and Palanisamy (1999) who observed heaviest bulbils in tuberose in response to plantation of large sized bulbs.

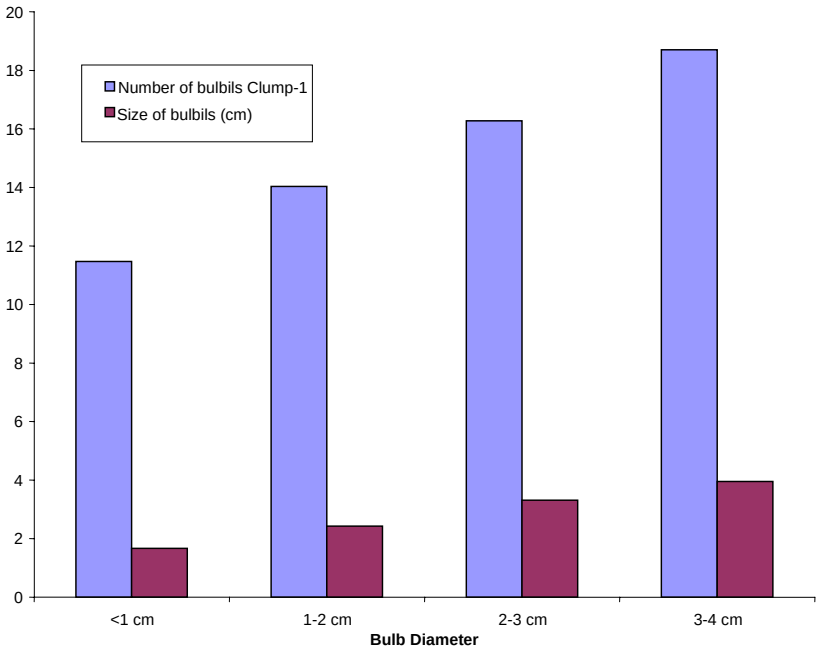

Fig. 5. Number of bulbils per clump and size of bulbils (cm) of tuberose as influenced by various bulb sizes.

CONCLUSION AND RECOMMENDATIONS

Large sized bulbs with 3–4 cm diameter should be preferred for vigorous growth, maximum flowering of good quality and bulbil production and are better to use for tuberose cultivation.

REFERENCES

Aksu, E. and F.G. Celikel. 2003. The effect of initial bulb size on snowdrop (Galanthus elwesii Hook.) bulb propagation by chipping. Acta Hort. 598:69-71.

Kalasareddi, P.T., B.S. Reddy, S.R. Patil, Y.H. Ryagi and P.M. Gangadharappa. 1997. Effect of corm size on flowering and flower yield of gladiolus cv. Snow White. Krnataka J.Agric. Sci. 10: 1228–1230.

Kalasareddi, P.T., B.S. Reddy, S.R. Patil, Y.H. Ryagi and P.M. Gangadharappa. 1998. Effect of corm size on growth and spike yield of gladiolus cv. Snow White. Krnataka J. Agric. Sci. 11: 1133–1135.

Kariuki, W. and S. Kako. 1999. Growth and flowering of Ornithogalum saundersiae Bak. 81: 57 – 70.

Lone, S.U.D., S.A. Wani, G.H. Zargarand and F.A. Nehvi. 1999. Correlation and path coefficient analysis for some important traits in different gladiolus cultivars grown under Kashmir valley conditions. Flora and Fauna Jhansi. 5: 104–106.

Mahanta, P., L. Paswan and A.B. Siddique. 1998. Effect of bulb size on growth and flowering of tuberose (Polianthes tuberosa L). cv. Single. Annal Agric. Biol. Res. 3: 35–38.

Raja, K. and V. Palanisamy. 1999. Effect of bulb size on growth, flowering and bulb yield in tuberose (Polianthes tuberosa L.) cv. "Single". South Indian Hort. 47: 322-324.

Rao, D.V.R., K.B. Reddy and L. Naidu. 1992. Effect of bulb size and depth of planting on growth and flowering of tuberose cv. Single. South Indian Hort. 40: 298-300.

Satyavir, S. and S. Singh. 1998. Effect of corm size on flowering and corm production. J. Ornament. Hort. 1: 79–80.

Sathyanarayana, R.B., K. Singh and B.S. Reddy. 1994. Studies on effect of bulb size in tuberose. II. Influence of bulb size on flowering flower yield and quality of flower spikes. Adv. Agric. Res. 2: 123–130.

Singh, K.P. 2000. Growth, flowering and corm production in gladiolus as affected by different corm sizes. J. Ornament. Hort. 3: 26–29.

Startek, L. and K. Wraga. 1998. Possibilities of producing bulbs of some species of Oxalis in the open field. Folia-Universitatis-Agriculturae-Stetinensis,-Agricultura. 69: 85–90.

Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and Procedures of Statistics. A Biometric Approach. 3rd ed. Mc Graw Hill Book Co. Inc., New York.