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Effect of Bulb Circumference on Bulb Yield and Bulblet Formation Capacity of *Sternbergia lutea* (L.) Ker-Gawl. Ex Sprengel (Winter Daffodil)

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Abstract: In this study, bulb yield (bulb number and weight) of *Sternbergia lutea* (L.) in annual growing period and bulblet formation capacities were investigated. Different - sized planting materials gave different growth rates, weight increases and bulblet formation capacity. Bulbs with circumference of 4-6 and 6-8 cm were shown to be more effective for bulb yield and bulblet formation capacity, respectively.

Key words: Geophyte, cultivation, growth rate

INTRODUCTION

Sternbergia is mainly a Mediterranean genus and extends to the Caucasus, North Persia and the mountains of Central Asia in the East and to Hungary and Rumania in the North (Davis *et al*., 1984; Ünal *et al*., 1997; Zencirkiran, 2002; Mirici *et al*., 2005).

The genus *Sternbergia* is known by seven species. Two of them are vernal (*S. fischeriana* (Herbert) Rupr. and *S. candida* Mathew and T. Baytop) and five are autumnal (*S. lutea* (L.) Ker-Gawl. Ex Sprengel, *S. sicula* Tineo ex Guss., *S. greuteriana* Kamari and Artelari, *S. clusiana* (Ker-Gawl.) Ker-Gawl. and *S. colchiciflora* Waldst. And Kit.) (Ünal *et al*., 1997).

All species in this family contain Amaryllidacea-type alkaloids (tazettin, lycorin, belladin, galanthamin, etc.) which are known to have antimicrobial, antiviral, antitumor, antileukaemial, anticholinesterase and immune-stimulant activities (Gabrielsen *et al*., 1992; Weniger *et al*., 1995; Hudson *et al*., 2000; Barthelmes *et al*., 2001; Baxandale *et al*., 2002).

This genus also has great potential as an ornamental plant (Arslan *et al*., 2002; Mirici *et al*., 2005; Zencirkıran, 2002) because of its attractive golden-yellow and white (only in *S. candida*) flowers which open in early spring and autumn.

Sternbergia lutea (L.) Ker-Gawl. Ex Sprengel is the most important species for bulb trade as ornamental and medicinal plant in Turkey (Ekim *et al*., 1991; Zencirkıran, 2002). The amount of material exported from Turkey has increased every year. However, this species is threatened by extinction (Ekim *et al*., 2000). In recent years international agreements have been employed throughout the world for the protection of endangered geophytes and therefore collection of *S. lutea* (L.) from the natural habitats is now forbidden in Turkey. This species are allowed to be exported only if cultivated by Man (Ekim *et al*., 1997). On the other side, cultivated bulbs have many advantages over those collected in the wild. The cultivated plant is likely to be healthier and free from disease and pests. These plants can be raised in conditions that are environmentally safe and provide renewable, steady supply of bulbs for trade.

Sternbergia lutea (L.) can be propagated from seed and bulblets. However, propagation of seed takes five or more years from seed to develop plant capable of flower production. On the other side, the bulblet formation capacity of bulbs is low (Ekim *et al*., 1991; Arslan *et al*., 2002; Zencirkıran, 2002).

However, annual development capacity of different circumference bulbs used for wide range production and bulblet numbers propagated by these bulbs in this period have great importance, but there is not enough research about this subject.

In the present study, bulb yield (total number and weight of bulbs), the rate of growth occurred in different circumference bulbs of *S. lutea* (L.) and bulblet formation capacities of these bulbs were investigated.

MATERIALS AND METHODS

This study was carried out in the experimental fields of Görükle Campus, Uludag University. Soil characteristics related to the experimental area are

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presented in Table 1. Textural analysis was performed using a hydrometer method (Bouyoucos, 1962). Soil pH was determined in a 1:2.5 soil water suspension (Jackson, 1958). Electrical Conductivity (EC) was determined by the method of Richard (1954). Total N was measured by the Kjeldahl method and organic matter was analysed calorimetrically using the modified Walkley-Black method (Houba *et al*., 1989).

Bulbs of *Sternbergia lutea* (L.) Ker-Gawl. Ex Sprengel was provided from a private company dealing with exportation of flower bulbs. *Sternbergia lutea* (L.) bulbs with three different circumference (4-6, 6-8 and 8-10 cm) were used as planting material. Bulbs were treated for 30 min. with the fungicide Rovral™ (1%) containing iprodione as the active ingredient before planting (Hanks and Phillips, 1982) and planted in rows 30 cm apart.

Planting were made in September 2003. No irrigation, fertilization, weeding etc. were applied during the trial periods. Bulbs were picked at the end of the trial in May 2004 an devaluated for the total number and weight of bulbs, the growth of bulbs, bulblet formation capacity and bulblet weight.

The trial was established using randomized block design with four replicates and each replicate consisting of 50 bulbs. The data were analysed statistically by analysis of variance (Minitab version 10.1 for Windows). Seperation of means was done by Duncan multiple range test at p = 0.05.

RESULTS AND DISCUSSION

Total number and weight of bulbs: The total numbers and weights of bulbs in the end of one year growing period are presented in Table 2.

The growth of bulbs: The results obtained from one year growing period are shown in Table 3. The highest increase of bulb circumference was observed in the planted at 4-6 cm circumference bulb, while the lowest increase was noted in those planted at 8-10 cm circumference bulb (Table 3).

Bulblet formation capacity and weight: According to the results from the lifting's made in May 2004, the bulblet formation capacity and bulblet weight exhibited differences depending on the circumference of bulbs planted (Table 4).

This study provides important data for the bulb yield (total number and weight of bulbs), the growth rate of bulbs, bulblet formation capacity and bulblet weight.

The results obtained indicated that a notable increase occurred in bulb yield within the annual growth period in term of number and weight as well, while the bulb losses were at quite low levels (except 4-6 cm bulb circumference). The results obtained concerning the bulb yield are similar to Zencirkiran (2002).

The growth rate of bulbs depended on circumference of planted bulb (Luria *et al*., 2002). Considering the bulb circumference, it was noted that more than 50% of planted bulbs exceeded the initial circumference within the annual growth period and the highest increase was obtained from the bulbs with 4-6 and 6-8 cm circumferences. Use of greater bulbs as planting material caused the increase in bulb circumferences at quite low levels. Regarding the bulblet forming capacity, 6-8 cm bulb circumference was found more effective while the bulbs above this size had no bulblet forming capability.

For cultivation, the usage of 6-8 cm circumference bulbs of *S. lutea* (L.) having importance as an ornamental plant and used for alkaloid production can be provided. If smaller bulbs than 6-8 cm circumference use for cultivation, growth period must be minimum two years (for increase bulblet number and bulb yield). These results agree with earlier findings for various bulbous plant species (Zencirkiran and Mengüç, 1996; Zencirkiran, 1998; Arslan *et al*., 2002; Entwistle *et al*., 2002). Arslan *et al*. (1997) also reported that lifting *Galanthus* bulbs at the end of one growing season is undesirable.

Table 1: Soil characteristics in the experimental area

	Mechanical analysis							
Depth (cm)	Clay (%)	Silt (%)	Sand (%)	Soil texture	Electrical conductivity (mS cm^{-1})	Organic matter (%)	pH (1:2.5)	Total N
0-20	49.1	20.2	30.8	Clay	<3	1.55	7.3	0.075

Table 2: Total numbers and weights of bulbs*

Initial bulb circumference (cm)	Initial bulb number	Lifted undamaged bulb number	Lossing rate (%)	Total weight of initial bulbs (g)	Total weight of lifted bulbs (g)	Increasing of weight (%)
4-6	200	86	57.00a	359.57	583.26	62.21a
6-8	200	200	0.00c	814.82	1301.95	59.78a
8-10	200	192	4.00b	1781.82	1926.16	8.10b

* Mean Seperation in columns by Duncan's Multiple Range Test, p = 0.05

Table 3: Bulb circumferences in the end of one year growing period

Initial bulb circumference (cm)	Lifted undamaged bulb number (total)	Lifted bulbs		Percentage of lifted bulbs (%)
		Circumference (cm)	Number	
4-6	86	4-6	7	8.14
		6-8	75	87.21
		8-10	4	4.65
6-8	200	6-8	61	30.50
		8-10	130	65.00
		10-12	9	4.50
8-10	192	8-10	161	83.85
		10-12	31	16.15

Table 4: Bulblet formation capacity and bulblet weight in the end of one year growing period*

Initial bulb circumference (cm)	Number of bulblet (bulblet/bulb)	Bulblet weight (g)
4-6	0.09b	1.80b
6-8	0.70a	2.09a
8-10	0.00c	0.00c

* Mean Seperation in columns by Duncan's Multiple Range Test, p = 0.05

REFERENCES

Arslan, N., M. Koyuncu and T. Ekim, 1997. Commercial propagation of snowdrops (*G. elwesii* Hook.) in different environments. Acta Hortic., 430: 743-746.

Arslan, N., B. Gürbüz, A. Gümüşçü, S. Özcan, S. Mirici and K.M. Khawar, 2002. Cultivation of *Stenbergia fischeriana* (Herbert) Rupr. and a study on its morphological characteristic. Pak. J. Bot., 4: 411-418.

Barthelmes, H.U., E. Niederberger, T. Roth, K. Schulte, W.C. Tang, F. Boege, H.H. Fiebig, G. Eisenbrand and D. Marko, 2001. Lycobetaine acts as a selective topoisomerase II β poison and inhibits the growth of human tumour cells. Br. J. Cancer, 85: 1585-1591.

Baxandale, I.R., S.V. Ley, M. Nessi and C. Piutti, 2002. Total synthesis of Amaryllidaceae alkoloid (4)-Plicamine using solid-supported reagents. Tetrahedron, 58: 6285-6304.

Bouyoucos, G.J., 1962. Hydrometer method improved for making particle size analyses of soils. Agron. J., 54: 464-465.

Davis, P.H., R. Mill and K. Tan, 1984. Flora of Turkey and the East Aegean Islands. University Press, Edinburg. Vol. 8.

Ekim, T., M. Koyuncu, A. Güner, S. Erik, B. Yıldız and M. Vural, 1991. Taxonomical and Ecological Researches on the Geophytes of Turkey with Economical Value. Ministry of Agriculture, Forestry and Rural Affairs. General Forestry Directorate of Management and Marketing, Turkey. Number: 669, pp: 65.

Ekim, T., N. Arslan and M. Koyuncu, 1997. Developments in consercation and propagation of flowerbulbs native to Turkey. Acta Hortic., 430: 773-778.

Ekim, T., M. Koyuncu, M. Vural, H. Duman, Z. Aytaç and N. Adıgüzel, 2000. Red Data Book of Turkish Plants: Pteridophyta and Spermatophyta. Barışcan Ofset. Ankara, Turkey, pp: 246.

Entwistle, A., S. Atay, A. Byfield and S. Oldfield, 2002. Alternatives for the bulb trade from Turkey: A case study of indigenous bulb propagation. Oryx, 36: 333-341.

Gabrielsen, B., T.P. Monath, J.W. Huggins, D.F. Kefauver and G.R. Petit *et al*., 1992. Antiviral (RNA) activity of selected Amaryllidaceae isoquinoline constituents and synthesis of related substances. J. Natl. Prod., 55: 1569-1581.

Hanks, G.R. and J. Phillips, 1982. Twin-Scaling. Growers Bulletin Number 6. G.C.R.I. pp: 15.

Houba, V.J.G., J.J. Van der Lee, I. Navozomsky and I. Walinga, 1989. Soil and Plant Analysis, Part 5. The Netherland: Wageningen Agricultural University, pp: 4-10.

Hudson, J.B., M.K. Lee, B. Şener and N. Erdemoglu, 2000. Antiviral activities in extracts of Turkish Medicinal Plants. Pharm. Biol., 38: 171-175.

Jackson, M., 1958. Soil Chemical Analysis. Englewood Cliffs, New Jersey: Prentice Hall, Inc.

Luria, G., A.A. Warad, Y. Cohen-Zhadek and A. Borochova, 2002. Growth and flowering of *Ornithogalum dubium*. Eight International Symposium on Flowerbulbs. Acta Hortic., pp: 570.

Mirici, S., İ. Parmaksız, S. Özcan, C. Sancak, S. Uranbey, E.O. Sarıhan, A. Gümüşçü, B. Gürbüz and N. Arslan, 2005. Efficient *in vitro* bulblet regeneration from immature embryos of endangered *Sternbergia fischeriana*. Plant Cell Tiss. Org. Cult., 80: 239-246.

Richard, L.A., 1954. Diagnosis and Improvement of Saline and Alkaline Soils. Handbook: 60, US Department of Agriculture.

Ünal, F., D. Yüzbaşıoglu and H. Duman, 1997. Karyotyping in *Sternbergia clusiana* and *S. colchiciflora* (Amaryllidaceae) from Turkey. Hereditas, 126: 277-280.

Weniger, B., L. Italiano, J.P. Beck, J. Bastida, S. Bergonon, C. Codina, A. Lobstein and R. Anton, 1995. Cytotoxic activity of Amaryllidaceae alkaloids. Planta Med., 61: 77-79.

Zencirkiran, M. and A. Mengüç, 1996. The effect of different bulb sizes and incubation temperatures on bulblet production in *Leucojum aestivum* L. By chipping method. Propagation of Decorative Plants. IPPS in Bulgaria, Second Scientific Conference. Sofia, pp: 128-134.

Zencirkiran, M., 1998. Research on the propagation methods of some important bulbs ornamental plants in Turkey Flora. Ph.D Thesis Uludag University, Institute of Natural Sciences, pp: 97.

Zencirkiran, M., 2002. Geophytes. Publication of Uludag Rotary Association. Number: 1, pp: 105.