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## PERFORMANCE OF EXOTIC TULIP CULTIVARS UNDER AGRO-CLIMATIC CONDITIONS OF PESHAWAR

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### ABSTRACT

The performance of ten exotic tulip cultivars under agro-climatic conditions of Peshawar was studied at Ornamental Nursery, Department of Horticulture, The University of Agriculture Peshawar, Pakistan during the year 2013-14. The experiment was laid out in Randomized Complete Block (RCB) Design with three replications. Ten cultivars of tulips viz., Bastogne, Don Quichotte, China Town, White Dream, Red Riding Hood, Mascotte, Orange Angelique, Strong Gold, Rajka and Romantic Sunset were tested for their performance. Significant differences ( $P \leq 0.05$ ) were observed among the cultivars regarding various parameters. The cultivar "Don Quichotte" produced the maximum number of leaves per plant (8.1), bulbs per plant (6.3), as well as early flowering (144.3 days) that was statistically at par with cultivar "Strong Gold" for flowering (144.8 days), leaves per plant (7.3) and number of bulbs plant<sup>-1</sup> (5.3). The maximum flower diameter (8.3 cm), bulb diameter (3.6 cm) and bulb weight (16.3 g) was noted in cultivar "Orange Angelique". In the case of plant height, the tallest (32.5 cm) plants were observed in cultivar "White Dream". The instant results suggest that Cultivar "Don Quichotte" is recommended for quality flowers and bulbs production under the agro-climatic conditions of Peshawar.

**Keywords:** Bulb attributes, Don Quichotte, soil analysis, Flowering, Pakistan.

### INTRODUCTION

The tulip (*Tulipa spp.*) plays an important role in decorating homes, offices and even shops in this modern era and its importance cannot be denied. The tulip is a bulbous flower having more than 3000 varieties. It originated from Turkey and central Asia, but now Holland is regarded as home of the tulip (Debrowski, 1964). Throughout the world it is generally planted in late winter, early spring, mid spring and late spring. There are many colors of flowers and its life and fragrance ranges from 10 to 20 days (Hartsema, 1961). This delicate flower can be grown on beds alone, with other

bulbs and even indoor in pots. Its extract is used in cosmetics and medicines while its bulbs are also edible, having an onion like taste (Larson, 1980).

Tulips are grown as a foreign exchange source in almost all the countries of the world; however, in our country, negligible work has been done on various aspects of this important flower. Keeping in view the importance of the tulip flower, various cultivars were introduced and their performance was evaluated so as to boost the floriculture industry using the potential of the area. The cultivars were evaluated for vegetative and

reproductive growth parameters. The cultivar evaluation is briefly described and reviewed as:

Cultivars	Colors
Bastogne	Blood red
Don Quichotte	Pink
China Town	Pink/ white
White Dream	White
Red Riding Hood	Red
Mascotte	Orchid
Orange Angelique	Orange, Pink
Strong Gold	Golden yellow
Rajka	Red, white
Romantic Sunset	Pink and Purple

For flower formation of different cultivars, the optimum temperature is 17-20 °C and bulb size is directly proportional to the flower; the larger the bulb, the bigger the flower (Rasmussen, 1980). Hertogh *et al.*, 1978 evaluated different cultivars regarding selection of early and late forcing and found “Topsiore” and “Pink supreme” as the most suitable cultivars. Dosser and Larson, 1981, reported that either warm days or night temperatures decreased the number of days to flowering in the cultivar Red Queen, Utopia, Roland, Madami, Spoor and Charles. Safiullah and Ahmad, 2001 investigated various varieties, and recorded that Blue Isle, Blad Jack and City of Light were more promising cultivars. Ahmad and Khan also observed that different cultivars showed variable responses for bulbs per plant, flowers per plant, number and size of tuber. In the present research, various tulip cultivars were evaluated to find out the most suitable cultivar that can be grown under the agro-climatic conditions of Peshawar.

## MATERIALS AND METHODS

The experiment was conducted at Ornamental Nursery, Department of Horticulture, The University of

Agriculture Peshawar, Pakistan during the year 2013-14. The experimental site is situated at 34.0167° N, 71.5833° E. The experiment was laid out in the Randomized Complete Block (RCB) Design with three replications. Ten cultivars of Tulip were tested for their performance. Four plants per treatment were grown in the experiment. Recommended dose of chemical fertilizer, N:P:K @ 200:100:100 kg ha<sup>-1</sup> were supplied. The doses were adjusted as per the chemical characteristics of the soil (Table 1). Four bulbs from each cultivar were planted, having been obtained from Canada (Florissa Company, [www.florissa.com](http://www.florissa.com)). The plant-to-plant and row-to-row distance was 15 and 30 cm respectively. All the cultural practices were carried out uniformly and irrigation was given at 7-10 day intervals, keeping in view the soil moisture condition. The bulbs were planted on 6 November, 2013 and were harvested on 27 May, 2014, when all the leaves dried and withered after flowering. The harvested bulbs were cleaned and stored in a cool place.

## Data collection and analysis

Procedure was recorded on days to flowering, number of leaves on the plant<sup>-1</sup>, plant height (cm), flower diameter (cm), number of bulbs which produced a plant<sup>-1</sup>, bulb diameter (cm) and bulb weight (g). The collected data was analyzed using the ANOVA technique, with the least significant difference (LSD) test was applied for separation and comparison of means as suggested by Steel *et al.*, (1997).

## RESULTS AND DISCUSSION

### Days to Flowering

Highly significant ( $P \leq 0.01$ ) differences were found among the

**Table 1: Chemical Analysis of Experimental Soil**

Determination	Nitrogen (%)	Lime (%)	EC dms <sup>-1</sup>	pH	Textural class
Quantity	0.166	11.4	0.27	7.55	Silty loam

exotic tulip cultivars for days to flowering (Table 2). Maximum days to flowering (175.5) were taken by the cultivar Bastogne followed by Orange Angelique (166.3 days). Cultivars China Town, White Dream, Red Riding Hood and Mascotte behaved the same, taking 161.2, 160, 160 and 155.7 days to flowering respectively (Table 3). Cultivar Mascotte was also at par with cultivars Rajka and Romantic Sunset, which took 154 and 153.5 days to flowering respectively. Don Quichotte and Strong Gold proved to be the earliest flowering cultivars taking a minimum 144.3 and 144.8

days to flowering respectively (Table 3). Don Quichotte and Strong Gold depict that the cultivar can be better selected on account of producing flowers earlier than the others. The early flowering in Don Quichotte and Strong Gold might be attributed to the better interaction with the environmental temperature and early flower buds formation. These results are partially in agreement with the findings of Moore *et al.* (1979) who reported that the formation of early flowering might be due to the resistance to physiological disorders.

**Table 2: Mean squares of various morphological attributes of tulip cultivars sown under agro-climatic conditions of Peshawar-Pakistan.**

Source of variation	D F	Days to flowering	Leaves plant <sup>-1</sup>	Plant height	Flower diameter	Bulbs plant <sup>-1</sup>	Bulb diameter	Bulb weight
Rep	2	6.10	0.38	2.30	0.07	0.16	0.01	0.70
Varieties	9	64.82	4.74	122.60	11.08	2.59	0.22	17.42
Error	18	19.38	1.09	5.29	0.21	0.28	0.02	1.14
CV%	--	2.79	17.19	8.56	10.51	12.30	4.99	8.58

This may also be due to endogenous growth promoters, which alter the formation of flowering pattern and initiate early flowering (Pharis and King, 1985).

#### Number of leaves plant<sup>-1</sup>

Highly significant ( $P \leq 0.01$ ) differences among tulip cultivars were observed regarding the number of leaves on the plant<sup>-1</sup> (Table 2). Cultivar Don Quichotte produced maximum leaves (8.1) closely followed by cultivars Strong Gold, White Dream

and Romantic Sunset, which were at par with each other producing 7.3, 7.1 and 7.0 leaves respectively. Rajka, China Town, Mascotte and Orange Angelique produced similar numbers of leaves per plant<sup>-1</sup> i.e. 6.1, 5.2, 5.3 and 5.5 respectively (Table 3). Minimum leaves per plant<sup>-1</sup> were found in cultivars Red Riding Hood (4.5 leaves) and Bastogne (4.6 leaves). Maximum number of leaves in Don Quichotte and Strong Gold cultivars may be due to

**Table 3: Various morphological attributes of tulip cultivars sown under agro-climatic conditions of Peshawar-Pakistan.**

Cultivars	Days to flowering	Leaves plant <sup>-1</sup>	Plant height (cm)	Flower diameter (cm)	Bulbs plant <sup>-1</sup>	Bulb diameter (cm)	Bulb weight (gm)
Bastogne	175.5 A	4.6 D	28.3 CD	3.1 DE	3.4 E	2.7 E	08.2 F
Don Quichotte	144.3 E	8.1 A	31.6 AB	4.0 BC	6.3 A	3.2 BC	12.7 CDE
China Town	161.2 BC	5.1 CD	19.5 E	2.8 E	4.4 C	3.0 D	11.9 E
White Dream	160.0 C	7.1 AB	32.5 A	7.7 A	4.3 CD	3.1 CD	12.3 DE
Red Riding Hood	160.0 C	4.5 D	12.0 F	3.5 CD	3.4 E	2.8 E	09.1 F
Mascotte	155.7 CD	5.3 CD	30.7 ABC	3.9 BC	3.6 DE	3.4 B	14.5 B
Orange Angelique	166.3 B	5.5 CD	26.2 D	8.3 A	4.2 CD	3.6 A	16.3 A
Strong Gold	144.8 E	7.3 AB	30.6 ABC	3.8 BC	5.3 B	3.1 CD	13.4 BCD
Rajka	154.0 D	6.1 BC	29.3 BC	4.1 B	4.4 C	3.0 D	12.0 E
Romantic Sunset	153.5 D	7.0 AB	27.8 CD	3.1 DE	3.5 E	3.4 B	13.9 BC
LSD <sub>0.01</sub>	<b>5.67</b>	<b>1.35</b>	<b>2.96</b>	<b>0.60</b>	<b>0.68</b>	<b>0.20</b>	<b>1.38</b>

Means not sharing common letters are significantly different at 1% level of significance

the favorable agro environmental conditions and their better interaction with the present environment. It might also be attributed to the favorable genotype x environment interaction which made them capable of producing leaves in higher quantity. Therefore the mutual coordination of nutrients absorption and photo assimilates in the presence of optimum temperature and relative humidity during the vegetative growth resulted in more leaves appearing in some cultivars. These results coincide with the observation of Wilson (1972), who reported that the production of more leaves may be attributed to the influence of environmental factors which accelerate photosynthesis processes and enable the plant to form a large number of leaves.

#### **Plant height (cm)**

The data regarding mean values of plant height revealed that there were significant differences in plant heights of exotic tulip cultivars (Table 2). Maximum plant height was attained by the cultivar White Dream (32.5 cm), which was closely followed by cultivars Don Quichotte, Mascotte and Strong Gold, producing heights of 31.6 cm, 30.7 cm and 30.6 cm respectively. Cultivars Rajka, Bastogne and Romantic Sunset exhibited comparatively shorter plants. They behaved alike with each other gaining plants heights of 29.3 cm, 28.3 cm and 27.8 cm respectively (Table 3). Red Riding Hood proved to be the shortest cultivar producing 12.0 cm tall plants. The differences in the heights of the plants may be due to the environmental factors, which may have accelerated or retarded the activity of natural plant hormones in the stem. It may also be attributed to the different genetic formation of different genotypes.

These findings are in agreement with those of Khan *et al.* (2001), who observed that the growth parameters of these cultivars to particular environmental conditions.

#### **Flower diameter (cm)**

The mean values of flower diameter revealed that tulip cultivars produced significantly different flowers in terms of diameter. Cultivars Orange Angelique exhibited the maximum flower diameter (8.3cm), closely followed by cultivar White Dream (7.7 cm). Cultivars Rajka, Don Quichotte, Mascotte and Strong Gold behaved alike, producing lesser flower diameters of 4.1, 4.0, 3.9 and 3.8 cm respectively (Table 3). The minimum flower diameter (2.8 cm) was attained by cultivar China Town which was also at par with Romantic Sunset (3.1 cm) and Bastogne (3.1 cm). The difference in the diameter of the flowers might depend on the genotype environment interaction. The size of the flowers also depends on the size and health of the bulbs, which produced flowers accordingly. Sestras *et al.* (2007) also conducted research on the varietal evaluation of different tulip cultivars and noted that the increase in the diameter of the flower was due to climatic factors and the genetic potential of the cultivars. There work is in close agreement with the findings of this study.

#### **Number of bulbs plant**

The data regarding the number of bulbs produced per plant (Table 2) revealed that all the cultivars were significantly different ( $P \leq 0.001$ ) from each other regarding number of bulbs produced per plant. Maximum number of bulbs per plant (6.3) was produced by the cultivar Don Quichotte followed

by Strong Gold producing 5.3 bulbs per plant. China Town, White Dream, Orange Angelique and Rajka behaved alike, producing 4.4, 4.3, 4.2 and 4.4 bulbs per plant. Minimum bulbs per plant was noted in Bastogne (3.4), Red Riding Hood (3.4), Romantic Sunset (3.5) and Mascotte (3.6), which were found statistically at par with each other. The production of more bulbs may be due to some cultivars acclimatizing well to the environment and thus producing more bulblets per plant. These findings are related to the research of Jhon *et al.* (2007), who presented that the bulblets production increased in some cultivars by the interaction of soil nutrients and environment.

#### **Bulb diameter (cm)**

The data presented in table 3 shows that there were significant differences ( $P \leq 0.01$ ) among the exotic tulip cultivars for bulb diameter (Table 2). Mean value of bulb diameter for different tulip cultivars indicated that the maximum bulb diameter (3.6 cm) was attained by cultivar Orange Angelique followed by cultivars Mascotte, Romantic Sunset and Don Quichotte, which were at par with each other, producing bulb diameters of 3.4 cm, 3.4 cm and 3.2 cm respectively. Lesser bulb diameters were produced by cultivars China Town (3.0 cm), Rajka (3.0 cm), White Dream (3.1 cm) and Strong Gold (3.1 cm), which were at par with each other. Cultivars Bastogne and Red Riding Hood gave minimum bulb diameters of 2.7 cm and 2.8 cm respectively (Table 3). The differences in bulb sizes may be due to the presence of more leaves, which increased the process of photosynthesis that might have produced bigger size bulbs. Environmental factors like light, humidity, temperature and exposure to

soil diseases might have played a role in the expansion and contraction of bulb sizes. These results are in harmony with the findings of Moore *et al.* (1979), who evaluated different cultivars of tulip and found some cultivars possess susceptibility to bulb diseases, which eventually result in variation in the size of bulbs. Also, the combination of environmental and genetic factors might have resulted in an increase in the size of bulb (Ahmad and Gul 2002). According to the study of Nard *et al.* (1997), the presence of more leaves increased the availability of food, which might have increased the size of bulb.

### **Bulb weight (g)**

The data regarding mean values of bulb weight as presented in table 3, showed that the different tulip cultivars produced significantly different bulb weights. It is evident from the means table that the maximum bulb weight (16.3 g) was attained by cultivar Orange Angelique. This was followed by Mascotte (14.5 g), Romantic Sunset (13.9 g) and Strong Gold (13.4 g), which behaved alike. Don Quichotte, White Dream, Rajka and China Town gave similar results producing 12.7 g, 12.3 g, 12.0 g and 11.9 g bulbs respectively. Bastogne and Red Riding Hood attained minimum bulb weights of 8.2 g and 9.1 g, respectively. Variations in bulb weight among the different tulip cultivars under trial might be due to the genetic differences and local environmental conditions. The differences in the weights of the bulbs may be attributed to the number of leaves and leaf area, which might have supplied a larger amount of food to the bulb, increasing the weight. The other factor which might have increased the weight of bulb is the soil structure and texture. These results are

similar to findings of Ahmad and Khurshid (2004), who reported that the differences in the weight of bulbs might be due to the marked varietal differences and genetic variation among the particular cultivars.

### **CONCLUSIONS**

The instant results concluded that the cultivars Don Quichotte and Strong Gold were found superior in most growth parameters because of the comparatively better interaction with the agro-ecological conditions of Peshawar, and are hence recommended for general cultivation for ornamental purposes.

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