

**STUDIES ON TECHNOLOGICAL ASPECTS OF THE SPECIES TULIPA GESNERIANA
(FAM. LILIACEAE)**

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E-mail: cristi2morarita@yahoo.com**Abstract**

Flowers represent one of those perfect joys of life, they are almost always with us and surround us with their splendor, tenderness and fragrance, from the first days of our lives, at some of the most important moments in life (anniversaries, special events, baptisms, weddings, etc.); and still with the flowers we leave this world. Precisely for these reasons, flowers deserve special attention. They are described both in verse and in prose by the most famous writers, who manage to convey their beauty and tenderness to us, and the plastic artists are the ones who, through their brushes, have managed to transpose nature and especially flowers on canvas, so that to create a universe of infinite beauty, awakening strong emotions and feelings in our soul. Consequently, it is all man who has the duty to carry forward, by his own means, the art of growing flowers and to create a more beautiful and better world for everyone else. Over the years, several types of floral arrangements, garden arrangements that include flowers have been highlighted. Tulips are easy to plant and care for. These spring flowers are among the favorites of gardening enthusiasts, due to the multitude of colors, shapes and sizes in which they are found. Used in the most diverse combinations, tulips delight the eyes and soul of viewers, bringing an inner peace that we all need.

Keywords: tulip, colors, sizes, flowers

1. INTRODUCTION

Tulips are annual or perennial flowering plants, which are easily propagated by bulbs, and the production of planting material is usually carried out in greenhouses or nurseries, with the production of seedlings, in early spring. Choosing the location of the tulip culture and ensuring the vegetation factors are based, first of all, on the known requirements of these species in terms of temperature and light.

As it appears from the specialized literature and from the experience of growers, the advantage offered by tulips resides in their duration of use, in the fact that they can be obtained easily and that they are generally cheap and available to anyone.

In this paper, we have proposed to present a series of aspects regarding the influence that the provenance of the bulbs can have on the germination percentage, the duration of germination of the bulbs and the decorative value of the plants obtained.

The effect of treatments applied to the bulbs with stimulating substances was also tested.

2. MATERIALS AND METHODS

Uliești commune is located in the extreme south of Dambovită county, with Teleorman county, at the border, the main road traffic axis that crosses the center of the commune is the national road 61 Giurgiu - Ghimpati - Gaesti, and in the northern part, the commune is crossed by the Autostrada (A1) Bucharest - Pitesti. The commune has an area of 61.47 square kilometers.

The relief in general presents itself as a uniform plain without an important level difference.

The town of Uliești is located on the right bank of the Argeș river on the highest terrace, extending also on the right bank of the Neajlov river, occupying the smooth plateau called Tailors' Hill.

The main characteristics of the climate

The thermal regime of the soil has an important role, both directly and indirectly, determining the thermal regime of the air, which heats practically from the ground, which transmits the caloric radiation received from the Sun through conductivity, radiation and convection.

Temperatures over 6°C begin to appear from March and last until November, and those that exceed 10°C begin in April and meet until October, this being the optimal period for plant cultivation.

Compared to the average values of the soil temperature, the absolute extremes are much higher. Thus, the absolute maximum soil temperature was recorded on July 25, 2016.

During the year, the maximum monthly averages are exclusively positive.

If in July it reaches 24.6°C. From May to August, there is a possibility that the maximum temperatures will exceed the value of 30°C, which can trigger drought at ground level.

Atmospheric precipitation

According to the Climatological Atlas of Romania, the 500 mm isohyet crosses the basin in its middle zone; to the south the precipitation tends to 450 mm/year, while to the north it exceeds 600 mm/year.

The highest amounts of precipitation fall at the end of spring and the first half of summer (in the months of June, May, July, 38% of the total fall) and the lowest values are recorded in the months of February and March (18% of the total).

The average maximum value is recorded in June (68.6 mm) and in February the minimum occurs (23.3 mm).

Precipitation in the October-March season represents 35% (one third) of the total, while the warm season participates

with 64% (two thirds) of the total amount of annual precipitation.

Agrometeorological conditions from the winter-spring of 2022

The winter of 2022 was characterized by the lack of precipitation, accumulated over the two months, January and February of -11.5 mm and by particularly high temperatures compared to the multi-year average, +6.8° C compared to the average in January.

This drought phenomenon that started in the fall of 2020 continued in the winter and spring of 2021.

So, except for March when there was an increase of 12.9 mm compared to the multi-year average, the months of April and May were particularly dry, registering a cumulative deficit of 49.6 mm.

These against the background of the increase in the average monthly temperature, especially in the months of March and May.

In May, although the average temperature was only 26.0°C higher than the multi-year average, there were many days when the maximum exceeded 31°C, which caused dehydration of crops, especially those sown in autumn.

The average temperature of the 2021-2022 agricultural year is 12.5°C, and the average precipitation of the 2021-2022 agricultural year amounts to 449.5 mm.

The 2021-2022 agricultural year was a completely atypical year.

The characterization from the climatic point of view is edifying in explaining the production results from the experimental lots as well as in terms of water losses from the soil.

Thus, the agricultural year began with a deep drought, registering in the first three months (October, November, and December) only 25.64 mm compared to 95.9 mm (multiannual average), a deficit of 68.5 mm.

In the winter period, the precipitation fell was only 75% of the multi-year average. Spring began with an excess of the multi-year average in March, after which the rainfall until August was far below the multi-year average, respectively at 40% of the multi-year average.

The last two months of the agricultural year (August and September) recorded precipitation above the multiannual average, respectively by 42 mm in August and 83.9 mm in September. During these months, significant water leaks occurred in all crops.

The varieties studied are:

• *Verandi Tulip*

A favorite variety of florists, spectacular Dutch variety. The bud has a graceful calyx shape 10 cm high, the flower itself grows up to 55 cm.

Attracts attention from afar with silky-textured scarlet petals and yellow border.

The flowers emit a delicate aroma.



Figure 1. Verandi Tulip

The variety is part of the Triumph group, like the other representatives, it gradually opens the buds and only half, remaining in this state for up to 7 days. The petals do not lose their shine over time.

The Verandi variety is suitable for making a bouquet with yellow, white and blue flowers and fits well in a bouquet.

• *Lalibela Tulip*

Darwin hybrid of Dutch selection, relatively recently bred by crossing wild and cultivated specimens. It is distinguished by a large calyx bud of 11 cm high. The height of the plant itself can reach 80 cm.

At the beginning of April, it blooms and until May pleases the eye. The color of the petals is bright red, uniform. It needs protection against scorching sun rays, it needs moisture.



Figure 2. Lalibela Tulip

• *Strong Gold Tulip*

The Dutch variety belongs to the Triumph group. Its flower resembles a bright sun in its shadow.

It goes well with other flowers both in a flower bed and in a bouquet. The tulip multiplies easily and is unpretentious in care.



Figure 3. Strong Gold Tulip

The height is up to 60 cm of the whole plant and the bottle is 8-9 cm. In the flower bed, flowering occurs at the end of April or the beginning of May and lasts a long time. Prefers a partial shade or a sunny place for growth.

Care is standard for this group of tulips.

For lush flowering, bulbs should be planted in light, organically rich soil with a neutral acidity. Bulbs should be dug up annually in late June and replanted in the fall. For each studied species, 2 experimental variants were carried out, which followed the application of some treatments before sowing.

Bulbs are planted in wide boxes 15 cm deep, being disinfected by soaking in a dark pink solution of potassium permanganate or pouring boiling water over them.



Figure 4. Planting bulbs in boxes

For the M1 variant in all species, bulbs were treated with potassium permanganate solution, a product also used as a foliar fertilizer and containing macro and micro elements. The M2 variants, made with untreated bulbs, represented the control variant.

The two main variants were divided, in turn, into 2 sub-variants, differentiated by the origin of the seeds (fruits) from the inflorescences:

- variants M1a- made with seeds (fruits) coming from the central part of the inflorescence
- variants M1b- made with seeds (fruits) coming from the periphery of the inflorescence.

The experiment scheme is present in table 1.

The soil must be light and permeable to water. For its manufacture, sand and sawdust are mixed in equal proportions. Drainage should be used: chipped brick, expanded clay, fine gravel, shell rock. To disinfect the soil, it is calcined in the oven at maximum temperature for ¼ hour. When the soil has cooled, it is watered with a dark pink solution of potassium permanganate or „Fitosporin”. Drainage is treated in the same way. Bulbs are planted in wide boxes 15 cm deep, being disinfected by soaking in a dark pink solution of potassium permanganate or pouring boiling water over them.

The greenhouse is fumigated with sulfur, and the walls are wiped with a solution of copper sulfate - 1 tbsp. for 10 liters of water. The maintenance works were carried out respecting the known technologies and were identical to all the tested variants.

Bulbs imported from Holland were used for planting. Healthy tulip bulbs have brownish-brown tunics, well-ripened, hard, heavy bulbs with an undamaged disk are used for planting. Planting distances are very small, 2–3 cm, ensuring a density of 300–350 plants per square meter. The planting depth will be established so that the bulb remains outside the substrate on the upper third [6]. It is very important to direct the environmental factors (temperature, humidity, lighting) thus, throughout the actual forcing stage, the substrate is kept permanently moist and the atmospheric humidity is regulated at the level of 70-80%.

From the establishment of the experiments, respectively from the sowing, during the entire vegetation period, observations, determinations and measurements were carried out that tracked a series of plant properties (morphological and ornamental properties), depending on the variable factors of the experience.

The main determinations and observations concerned the dynamics of emergence, the dynamics of plant growth and the production of flowers and their quality.

Table 1. Scheme of experimentation

Nr. crt.	Species	Treatment	The position of the seeds in the inflorescence
1	Verandi	M1 – Treated seeds	M1a – central part
			M1b – outer part
		M2 – Untreated seeds	M2a – central part
			M2b – outer part
2	Lalibela	M1 – Treated seeds	M1a – terminal part
			M1b – base part
		M2 – Untreated seeds	M1a – terminal part
			M2b – base part
3	Strong Gold	M1 – Treated seeds	M1a – central part
			M1b – outer part
		M2 – Untreated seeds	M2a – central part
			M2b – outer part

Temperature

The first 2 months after planting in the greenhouse maintain a temperature of + 7 ... + 9 ° C.

Then the temperature is increased to + 18 ... + 17 ° C during the day and + 14 ... + 15 ° C at night. When tulips bloom, the temperature is lowered to + 15 ° C.



Figure 5. Growing bulbs (personal photos)

The first two weeks of watering are alternated with feeding 20 g of calcium nitrate diluted in 10 liters of water.

During the entire growing period, tulips are fed twice with special fertilizers for bulbous plants.

The determination of the plant height was carried out by the measurement method at the beginning of the harvesting period of the flower stalks.

The number of leaves formed was determined by counting.

The diameter of the flower bud was measured at the time of the beginning of the coloring of the bud by measuring in the area with the largest diameter, and the height by measuring from the base to the tip of the bud.



Figure 6. Tulips in the greenhouse (personal photos)

3. RESULTS AND DISCUSSIONS

Table 2 shows the percentage of emergence in the studied species, by variant, with treated and untreated seeds, treated bulbs from the Verandi and Lalibela species, or with untreated bulbs from the Strong Gold species.

The observations were made every other day for each species starting from the sixth day after sowing and up to the sixteenth day.

In the Verandi species:

- for variant M1a (bulbs treated with Fitosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 85%;

- for variant M1b (bulbs treated with permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 90%;

- for variant M2a (untreated peeled bulbs), the first plants sprouted 10 days after sowing. The total emergence percentage for this variant is 75%;

- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 80%.

The best emergence percentage is represented by treated bulbs from the M1b variant, and the lowest emergence percentage is represented by the M2a variant, untreated peeled bulbs where the emergence percentage was 75% and the emergence duration was 10 days.

In the Verandi species:

- for variant M1a (bulbs treated with phytosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 85%;

- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 90%;

- for variant M2a (untreated peeled bulbs), the first plants sprouted 10 days after sowing. The total emergence percentage for this variant is 65%;

- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 12 days after sowing. The total emergence percentage for this variant is 55%.

Table 2. Dynamics of emergence

Species	Variant	Number of bulbs	Emergence percentage after					
			4 days	5 days	6 days	8 days	10 days	12 days
Verandi	M1a	100	-	3	40	69	75	85
	M1b	100	-	7	29	64	69	90
	M2a	100	-	-	15	45	55	65
	M2b	100	-	2	30	44	50	55
Lalibela	M1a	100	-	-	3	11	26	95
	M1b	100	-	10	45	57	74	80
	M2a	100	-	-	10	59	79	75
	M2b	100	-	-	20	40	62	70
Strong Gold	M1a	100	1	9	24	37	56	88
	M1b	100	3	20	40	65	70	77
	M2a	100	-	1	10	43	69	65
	M2b	100	-	4	16	31	39	45

The best percentage of emergence is represented by bulbs treated with potassium permanganate solution from variant M1b, with 90%.

The lowest percentage of emergence is represented by variant M2a, untreated unpeeled bulbs where the percentage of emergence was 55% and emergence duration of 12 days from sowing.

In the Lalibelia species, from a total of 100 bulbs sown, the percentage of emergence for both variants is as follows:

- for variant M1a (with bulbs treated with phytosporin), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 95%;

- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 80%;

- for variant M2a (untreated peeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 75%;

- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 70%.

The best percentage of emergence is represented by the treated seeds from variant M1b (bulbs treated with potassium permanganate solution) with 77%, and the lowest percentage of emergence is represented by variant M2a, untreated peeled bulbs where the percentage of emergence was 55% and the emergence duration of 8 days from sowing.

In the Strong Gold species, from a total of 100 bulbs sown, the percentage of emergence for both variants is as follows:

- for variant M1a (bulbs treated with phytosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 88%;

- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 77%;

- for variant M2a (untreated peeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 65%;

- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 45%.

The best percentage of emergence is represented by the treated seeds from variant M1b (bulbs treated with potassium permanganate solution) with 77%, and the lowest percentage of emergence is represented by variant M2a, untreated peeled bulbs where the percentage of emergence was 55% and the emergence duration of 8 days from sowing.

The varieties were grouped according to the variety they belong to, thus, the difference in the initiation of the phenological phases was observed depending on the variety and from one variety to another.

Lalibelia varieties were selected from the Darwin Hybrid variety, the varieties from this group compared to the other Triumph Verandi and Strong Gold varieties recorded the longest period until the harvesting of the flower stalks, being 105-110 days.

Another objective taken into account was the dynamics of plant growth. Special cells of 80 pieces (0.6 x 0.4) m² are used. Thus, up to 300 plants can be obtained from one square meter.

Table 3. Recording the phenological phases according to the biological characteristics of the tulip varieties

Varieties	Breed	Planting of bulbs	Start in vegetation		Flower bud emergence		Colouring of the button (15%)	
			Date	Days from the sowing	Date	Days from the sowing	Date	Days from the sowing
Darwin Hybrid	Lalibelia	16 nov. 2022	23 jan. 2022	63	07 feb. 2022	82	05 mar. 2022	108
Triumph	Verandi		27 dec. 2021	35	11 jan. 2022	54	06 feb. 2022	80
Triumph	Strong Gold		04 jan. 2022	45	20 jan. 2022	64	15 feb. 2022	90

These varieties are well rated on the market for the simple reason that they have well-developed stems and the flowers are quite long-lived, and they are also appreciated for the classic shape of the flower bud.

The variety of tulips Lalibelia, Verandi and Strong Gold have an average period of 90-108 days, with small differences from one variety to another.

The growth and development of plants is influenced by a wide range of factors, among which are very important: the quality of the planting material, the ecological conditions as well as the quality of the culture substrate, all of which condition to a greater or lesser extent the uniformity and quality of the production.

Table 4. The height of the plants according to the variety and the applied technological process

Variety	M1a (bulbs treated with phytosporin)	M1b (bulbs treated with potassium permanganate solution)	M2a (peeled untreated bulbs)	M2b (unpeeled untreated bulbs)
Lalibelia	54	51	49	47
Verandi	38	35	33	30
Strong Gold	48	45	40	42

From the data presented in the table above, it is highlighted that depending on the cultivation method, the height of the plants varies, with the highest indices being recorded for M1a and the lowest for the M2b variant.

The highest flower stalks depending on the variety are recorded in those from the Darwin hybrid Lalibelia group, correlating with the peculiarity of the variety in this group (tall, vigorous stems).

Table 5. The quality of the flower stalks depending on the variety and the technological process applied

Variety	Plants, pcs/m ²	M1a (bulbs treated with phytosporin)	
Lalibelia	320	225	99
Verandi	340	249	95
Strong Gold	310	190	115

The expenses incurred within a month are shown in the table below:

Table 6. Monthly expenses

Salaries	800 euro
Fuel	300 euro
Publicity	100 euro
Products for flower care	200 euro
Flowers	500 euro
Total	1800 euro

The flowers are sold cut for floral arrangements or bouquets or in pots.

Table 7

No. crt.	Name	Price per piece	Pieces	Est. Value
1	Lalibelia	2	1500	3000
3	Verandi	2,5	1500	3750
3	Strong Gold	2,4	1500	3600

4. CONCLUSIONS

- Growing tulips in a greenhouse requires special equipment and constant attention from the plantation owner. In case of violation of the temperature regime, insufficient humidity or improper watering, the plants will get sick and will not bloom.
- Before planting tulips, we must prepare the soil. Otherwise, the plants will get sick
- The best time to buy tulip bulbs is from the beginning of July to the end of September. At this time, it will be possible to purchase high-quality planting material.
- In order for all tulips to sprout, give beautiful buds and not get sick during the growing process, it is important to choose the right planting material.
- Growing flowers for sale requires knowledge of the technology of forcing tulips by March 8 in a greenhouse.
- Any business idea up to the stage of implementation requires a good analysis of the market, estimation of investments and possible risks associated with it.
- Growing tulips in sheltered areas can become a successful business.

- For growing tulips in the greenhouse, different varieties and hybrids are available on the market, I use bulbs from Holland, among which I remember Verandi, Lalibela Strong Gold.

- Growing tulips in forced culture is a rather difficult process that requires great care and constant supervision. Forced culture can be achieved through a set of agrotechnical measures that cause the plants to come out of dormancy and flower at a completely different time than the normal one, and its main purpose is to obtain flowers in the period from the end of the late crops to the beginning of the early ones (December-March).

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