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RESEARCH CONCENING THE INFLUENCE OF CULTURE SUBSTRATE ON THE MAIN CHARACTERISTICS OF TUBEROSE

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Abstract
Tuberoses is known for its fragrance and are among the most important ornamental flowers grown mainly due the long flowering period, which is an important aspect whether grown as cut flowers or landscaping. The purpose of this study was to improve the cultivation methodology of the species Polyanthes tuberosa, by using easily accessible, cheap substrates with influence on morphological, ornamental and production characteristics. The research was carried out in 2017 at the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca. The experience was bifactorial and watched the influence of some culture substrates (garden soil, 50% peat + 50% garden soil, 50% sand + 50% garden soil and 50% manure + 50% garden soil), on the main decorative morphological characteristics of the 'Perla' tuberose variety. Following the interpretation of the results by the LSD test (variance analysis) it is recommended to use the culture substrate formed by peat or manure + garden soil (1:1) and bulbs with a larger diameter.

Keywords: bulbs, culture substrate, cut flowers, tuberose, variety.

1. INTRODUCTION

Tuberose (*Polyanthes tuberosa*) is part of genus *Polyanthes*, comprising 11 species, three of them with red orange flowers and the rest with white flowers (Toma, 2003).
The most known species and frequently the only one cultivated is *Polyanthes tuberosa* L., which is native from Mexico and was introduced to Europe in the year 1629 (Bryan, 1989). It has been demonstrated that this fragrance has a role in improving the emotional capacity, but also the fact that stimulates the right side of the brain, bringing serenity to the brain and heart (Safeena et al., 2015).
Simple flowered varieties have a double fragrance, containing up to 0.14% of the substance used in the perfume production industry (Singh and Uma, 1995). Therefore, only simple flowered varieties are used for extraction of essential oils, while the doubles are used as cut flowers or in different indoor or outdoor design (Safeena et al., 2015).
In some countries, the flowers and the bulbs are used as a remedy in treating diseases (Toma, 2012). The powder obtained from dehydrated bulbs is an excellent remedy for gonorrhea (Safeena et al., 2015). In Cambodia, Laos and Vietnam, tuberose bulbs are used to calm spasms and treat malaria.

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In the Philippines, the bulbs are boiled in water to make a liquid used in the treatment of gonorrhea and furuncles. In China, bulbs are used in the treatment of burns, infections and edema (Wiart, 2012). Flowers and bulbs are used as a remedy for treating diseases in India. In Cuba, tuberose is considered a magical plant and is used in medicine (Hanelt et al., 2001). The essential oil purely obtained by solvent extraction from tuberose flowers is used in the food industry to give food a strawberry flavor. They can also be used to flavor chocolate products, giving them a wonderful flavor (Safeena et al., 2015). Fruits and boiled flowers are consumed in the Philippines, alongside fruit juice.

Originally from a country much closer to the tropics, tuberose can also be grown in Romania in warm and sunny places because it has no high water and moisture requirements than during the flowering period, so it can be planted without problems in the garden (https://gradinavisata.wordpress.com/2010/09/06/tuberoza/).

Known for a long time in Romania, she has been forced into the flower market in the last 20-25 years. In our country, culture is well-known in the villages and areas around the capital and Dumbrăveni (Alba County).

The growth and flowering of tuberose plants are influenced by the thermal regime of the environment, which has a vital role, influencing the development of physiological processes and the passage of various phenophases (germination, vegetative growth, flowering and fructification) (Chis, 2010). Under our country, tuberoses are grown as semi-rustic plants because they do not withstand frost, the bulbs are harvested in autumn, kept in storage and replanted in spring, after the danger of late frosts (Drăghia and Chelariu, 2011). Tuberose has high demands on the soil in which it is cultivated (Băla, 2012). Tuberose generally has a non-uniform flowering, which mainly depends on the size of the bulbs and the temperature during the rest of the bulbs. Flowering bulbs should be large (over 3-4 cm in diameter) and heavy (at least 70-80 g, and during vegetative rest have high temperatures (20°C) and relatively high humidity (Toma, 2003). The central bulbs are used to obtain a suitable production, their size influencing the quantity of the reserve substance and the quantity and quality of production respectively (Chiș, 2010).

The aim of this research was to improve the cultivation methodology of *Polyanthes tuberosa* using cheap, affordable materials, aiming the achieving of a higher flowering rate and producing potential flowering bulbs.

From the point of view of the current trend, to maximize the production capacity per unit area and to reduce the cost per unit of product, it is necessary to develop and improve efficient crop technologies in order to achieve these goals.

2. MATERIALS AND METHODS

The research was carried out in 2017 at the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca as a series of bifactorial experiences, having the following factors, with the respective graduations. The '*Perla*' tuberose variety was used to perform the experiments.

Factor A - culture substrate:

- a_1 - garden soil;
- a_2 - 50% peat + 50% garden soil;
- a_3 - 50% sand + 50% garden soil;
- a_4 - 50% manure + 50% garden soil.

Factor B - Bulb diameter planted in the '*Perla*' variety:

- b_1 - bulb diameter of 10 mm;
- b_2 - bulb diameter of 15 mm;

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• b_3 - bulb diameter of 20 mm.

The combination of the two factors resulted in 12 experimental variants, which were placed in three repetitions, each variant with 20 plants. The tuberose culture was set up in plastic pots with a size of 13/10/10 and a capacity of 0.5 liters. The culture pots were placed on a ground covered with agrotextile to eliminate the risk of weeds invasion.

The planting was carried out on 23 April 2017 in previously prepared pots by disinfection and filling with previously prepared mixtures. The substrates used were prepared by mixing the components in the proportions previously established. After planting, the necessary watering was done. The plants occurred after about 30 days after planting.

Maintenance work on tuberose culture was the usual one, recommended in the literature (Buta and Cantor, 2009). The irrigation of the plants was carried out in such a way as to ensure optimal humidity in the root system, and the fertilization was done with the fertilizer NPK (15:30:15), applying a 0.5% solution, 200 ml per pot. At the same time soil mobilization and weeding were carried out. It is important to thin the pots, so that as plants grow distances between plants be about 20 cm.

Measurements and observations were made in accordance with the objectives pursued in the research on the main morpho-decorative characters of the cultivars: bulb weight; bulb diameter; number of planted plots/plant; number of leaves; the length of the floral stem; inflorescence length; number of flowers/inflorescence; number of bulbs/plant and flowering rate.

The data obtained were interpreted statistically using the variant analysis method (LSD test) (Ardelean et al., 2007).

3. RESULTS AND DISCUSSIONS

The results of the influence of culture substrate and bulb diameter on bulb medium weight (g) are showed in the Table 1. Analyzing this table we can conclude that the average bulb weight was between 2.05 and 4.45 g, the average of the experience being 2.97 g.

Table 1. Influence of culture substrate and bulb diameter on bulb weight (g)

Variants		Medium weight/bulb		± Difference (g)	The significance of difference
Substrate of the culture	Bulb diameter (mm)	g	%		
Garden soil	10	2.05	86.0	-0.33	-
	15	2.30	96.5	-0.08	-
	20	2.80	117.5	0.42	*
Average		2.38	100	-	Control
50% peat + 50% garden soil	10	2.35	70.5	-0.98	ooo
	15	3.20	96.0	-0.13	-
	20	4.45	133.5	1.12	***
Average		3.33	100	-	Control
50% sand + 50% garden soil	10	2.00	70.2	-0.85	ooo
	15	2.70	94.7	-0.15	-
	20	3.85	135.1	1.00	***
Average		2.85	100	-	Control
50% manure + 50% garden soil	10	2.30	69.7	-1.00	ooo
	15	3.40	103.0	0.10	-
	20	4.20	127.3	0.90	***
Average		3.30	100	-	Control
LSD 5%				0.39	
LSD 1%				0.54	
LSD 0.1%				0.74	

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The bulb's greatest weight, 3.33 g, was recorded in the case of a substrate consisting of 50% peat + 50% garden soil, followed by the substrate consisting of 50% manure + 50% garden soil, in which case the average weight bulbs was 3.3 g. Both variants recorded very positive differences compared to the average of the experience of 2.97 g. The lowest average bulb weight, was recorded by using as garden substrate the difference from the control variant being very significant negative (table 1). Using bulbs with a diameter greater than 20 mm, the bulbs obtained had a weight of more than 3.80 g, with 0.83 g higher than the average of the experience, which is statistically very positive.
In the case of cultivation of tuberoses in garden soil a significantly positive difference from the weight of bulb weight (2.38 g) was observed only when using bulbs with a diameter of 20 mm, the difference being 0.42 g. By cultivating this variety in a substrate formed from 50% peat + 50% garden soil, average bulb weight varied between 2.35 g (in the case of the smallest bulbs) and 4.45 g (in the case of the largest bulbs), with the average difference being -0.98 g and 1.12 g respectively, both of which being very significant. Significant differences were also observed for the substrate consisting of 50% sand + 50% garden soil, the average difference being -0.85 g, for the planting of bulbs with a diameter of 10 mm and 1 g, in case planting bulbs with a diameter of 20 mm.
The research of Bahadoran et al. (2012) to investigate the effect of natural zeolite in various concentrations on vegetative growths of tuberoses indicates that zeolite decreases the weight of bulbs.

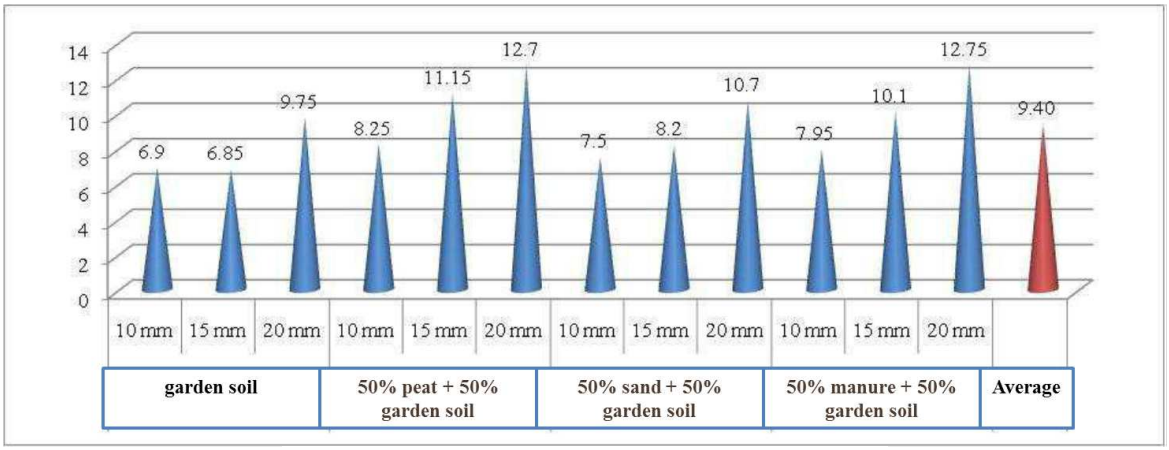

Figure 1. Average diameter of the bulbs obtained (mm)

The largest diameter of the bulbs was recorded when the bulbs were planted in the substrate consisting of 50% peat + 50% garden soil, having a diameter of 10.70 mm, 13.8% higher than the calculated average, the difference being very significant positive (fig. 1). On the opposite side the crop is differentiated into garden soil, in which case the diameter of the bulb was smaller by 1.57 mm, the difference being very significantly negative (table 2).
The diameter of the planted bulb had a very significant influence on the average diameter of the bulbs obtained (table 2). Thus, using 20 mm diameter bulbs led to the production of bulbs with a diameter of 11.47 mm, about 22% higher than the average of the experience. The bulbs with the smallest diameter (7.65 mm) were recorded using the smallest diameter bulbs, the difference from the average being very negative.

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Table 2. Influence of culture substrate and bulb diameter on diameter of the bulbs obtained (mm)

Variants		Diameter		± mm Difference	Signification of difference
Culture substrate	Bulb diameter (mm)	mm	%		
Garden soil	10	6.90	88.1	-0.93	o
	15	9.85	87.4	-0.98	o
	20	9.75	124.5	1.92	***
Average		7.83	100	-	Control
50% peat + 50% garden soil	10	8.25	77.1	-2.45	ooo
	15	11.15	104.2	0.45	-
	20	12.70	118.7	2.00	***
Average		10.70	100	-	Mt.
50% sand + 50% garden soil	10	7.50	85.2	-1.30	oo
	15	8.20	93.2	-0.60	-
	20	10.70	121.6	-0.60	***
Average		8.80	100	-	Control
50% manure + 50%garden soil	10	7.95	77.4	-2.32	ooo
	15	10.10	98.4	-0.17	-
	20	12.75	124.2	2.48	***
Average		10.27	100	-	Control
		LSD 5% = 0.88	LSD 1% = 1.21	LSD 0.1% = 1.67	

Regarding the influence of the culture substrate and the diameter of the bulb on the average diameter of the obtained bulbs, it is noted that the best results were obtained with the use of bulbs with a diameter of 20 mm at all variants of the substrate used.

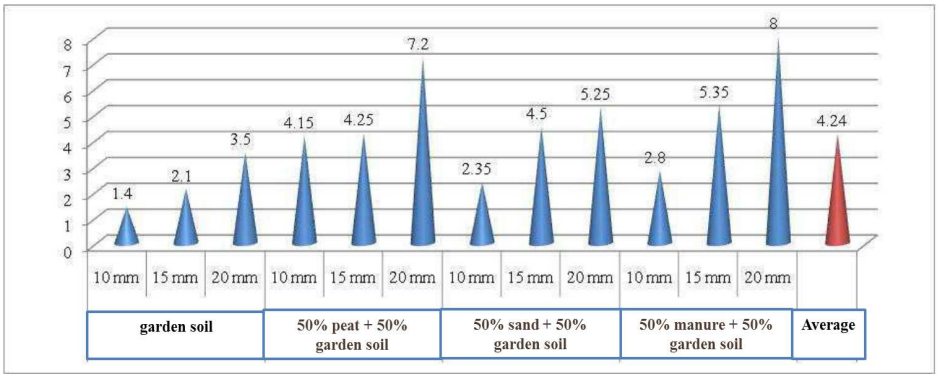

Figure 2. The average number of plants made up of a bulb

The most suitable substrates for obtaining a large number of plants are those consisting of 50% manure + 50% garden soil (with 5.38 plantlets/bulb), respectively 50% peat + 50% garden soil (5.20 plantlets/bulb), the differences from the average of the experience (4.24 plantlets/bulb) being 1.15 and 0.96, being statistically very significant, respectively distinctly positive (fig. 2).
The worst result from this point of view was recorded in the case of planting bulbs in garden soil, in which case only 2.33 plants were formed from a bulb, about 45% less than the average of the experience, the difference of -1.90 being very significant negative (table 3).

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Table 3. Influence of the culture substrate and bulb diameter on the plantles from a bulb

Variants		Number of plantlets from bulb		± Difference	Signification of difference
Substrate of the culture	Bulb diameter (mm)	Number of plantlets	%		
Garden soil	10	1.40	60.0	-0.93	o
	15	2.10	90.0	-0.23	-
	20	3.50	150.0	1.17	**
Average		2.33	100	-	Control
50% peat + 50% garden soil	10	4.15	79.8	-1.05	o
	15	4.25	81.7	-0.95	o
	20	7.20	138.5	2.00	***
Average		5.20	100	-	Control
50% sand + 50% garden soil	10	2.35	58.3	-1.68	ooo
	15	4.50	111.6	0.47	-
	20	5.25	130.2	1.22	***
Average		4.03	100	-	Control
50% manure + 50%garden soil	10	2.80	52.0	-1.68	ooo
	15	5.35	99.4	-0.03	-
	20	8.00	148.6	2.62	***
Average		5.38	100	-	Control
		LSD 5% =0.83	LSD 1%= 1.15	LSD 0.1% =1.58	

The use of larger bulbs lead to a larger number of plantlets, averaging 5.99 of each planted bulb, the difference compared to the average of 4.24, of 1.75 plants being very significantly positive. In contrast, for small bulb variants, the number of platelets obtained is smaller, with -1.56 less than the calculated average, the difference being very negative (table 3).

Analyzing the combined influence of the culture substrate and the bulb diameter on the average number of plantlets (table 3), it can be observed that large bulbs have the capacity to produce a larger number of plants. The differences from the control variant (average) for bulbs with a diameter of 20 mm were 1.17 plantlets (garden soil), 2.00 (substrate consisting of 50% peat + 50% garden soil), 1.22 (substrate of 50 % sand + 50% garden soil), 2.62 (substrate consisting of 50% manure + 50% garden soil), the differences being distinctly significant, respectively very significant positive.

Significant differences from the control variant (mean of experience, with a value of 8.04) were recorded by cultivating tuberoses in a substrate consisting of 50% peat + 50% garden soil, respectively 50% manure + 50 % garden soil. Less favorable results were recorded after planting in garden soil (plants with less than 3.04 leaves less than the control variant) or a mixture of 50% sand + 50% garden soil (plants with 1.01 leaves less than at the control variant) (table 4).

El-Naggar (2010) recommends the application of organic compost combined with mineral fertilizers and biofertilizers in a proportion of 15.0 g, 3.0 g and 10 g/pot, which had the greatest effect on the leaves, flowering parameters and bulb characteristics of daffodils.

Very favorable results were obtained by using bulbs with a diameter of 20 mm, the average number of leaves per plant being higher by almost 50%, as compared to the average of the experience. In these variants the average number of leaves is higher by over 4 leaves, the difference being very significant positive.

On the other hand, significant negative differences were observed in the case of smaller diameters (table 4). In the case of the three substrates, positive results were recorded for the variants where the bulbs with a diameter of 20 mm were used, the differences from the medium being between 4.22

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and 5.72 leaves/plant, all being very significant positive (table 4). Negative differences were recorded both for bulbs with a diameter of 10 mm and for those of 15 mm.

Table 4. The influence of the culture substrate on the number of leaves/plant

Variants	Diameter	Number of leaves / plant		± Difference	Signification of difference
Substrate of the culture	Bulb diameter (mm)	Leaf number	%		
Garden soil	10	4.75	95.0	-0.25	-
	15	4.50	90.0	-0.50	-
	20	5.75	115.0	0.75	-
Average		5.00	100	-	Control
50% peat + 50% garden soil	10	5.80	59.2	-4.00	ooo
	15	8.20	83.7	-1.60	o
	20	15.40	157.1	5.60	***
Average		9.80	100	-	Control
50% sand + 50% garden soil	10	4.95	70.4	-2.08	oo
	15	4.90	69.7	-2.13	oo
	20	11.25	160.0	4.22	***
Average		7.03	100	-	Control
50% manure + 50% garden soil	10	6.25	60.5	-4.08	ooo
	15	8.70	84.2	-1.63	o
	20	16.05	155.3	5.72	***
Average		10.33	100	-	Control
		LSD 5% = 1.40	LSD 1% =1.92	LSD 0.1%= 2.65	

Table 5 shows that the average length of stems in the present study was 87 cm. The culture substrate used for the tuberoses cultivation had no significant influence on the length of the flowering rods, but the variants with the longest roots were those in which the substrate consisted of 50% peat + 50% garden soil (table 5).

The culture substrate used for the tuberoses cultivation had no significant influence on the length of the flower stem, but the variants with the longest roots were those in which the substrate consisted of 50% peat + 50% garden soil (table 5). Analyzing the data in table 5 it is observed that only statistically ensured differences were observed for substrate with 50% peat + 50% garden soil and 50% soil + 50% garden soil.

In the case of the first substrate, the use of bulbs with a diameter of 20 mm lead to the increase of the flowering stem by 9.38 cm against the control (92.27 cm), the difference being significantly positive, while for the second substrate the flowering rods were higher with 12.78 cm, compared to the average of 90.67 cm, the difference being significantly positive. The research of Bahadoran et al. (2012) to investigate the effect of natural zeolite with different concentrations on vegetative growth and floral characteristics of tuberoses indicates that zeolite increased flower stem length, flower diameter, leaf area and chlorophyll content.

Cultivation of the plants in the substrate formed in equal proportions of peat and garden soil, respectively grass and garden soil, led to significant differences compared to the average of the experience of 17.42 cm. The diameter of the planted bulb had a very significant influence on the average length of inflorescences, as can be seen in table 5. The use of natural zeolite in different concentrations has decreased the inflorescence length in tuberoses (Bahadoran et al., 2012).

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Table 5. Influence of the culture substrate and bulb diameter on length of the flower stem (cm)

Variant		Average length of flower stem		± cm Difference	Signification of difference
Substrate of the culture	Bulb diameter (mm)	cm	%		
Garden soil	10	74.75	98.70	-0.98	-
	15	70.90	93.60	-4.83	-
	20	81.55	107.70	5.82	-
Average		75.73	100.00	-	Control
50% peat + 50% garden soil	10	86.55	93.80	-5.72	-
	15	88.60	96.00	-3.67	-
	20	101.65	110.20	9.38	*
Average		92.27	100.00	-	Control
50% sand + 50% garden soil	10	90.60	101.40	1.27	-
	15	88.95	99.60	-0.38	-
	20	88.45	99.00	-0.88	-
Average		89.33	100.00	-	Control
50% manure + 50% garden soil	10	78.55	86.60	-12.12	oo
	15	90.00	99.30	-0.67	-
	20	103.45	114.10	12.78	**
Average		90.67	100.00	-	Control
		LSD 5% = 7.90	LSD 1% = 10.88	LSD 0.1%=14.97	

Concerning the combined influence of the culture substrate and the diameter of the bulb on the average inflorescence length (fig. 3), it is observed that the use of bulbs with a diameter of 20 mm led to longer inflorescences. On the other hand, when using bulbs with a diameter of 10 mm, the number of flowers in inflorescences was 19.41, 11% lower than the control variant.

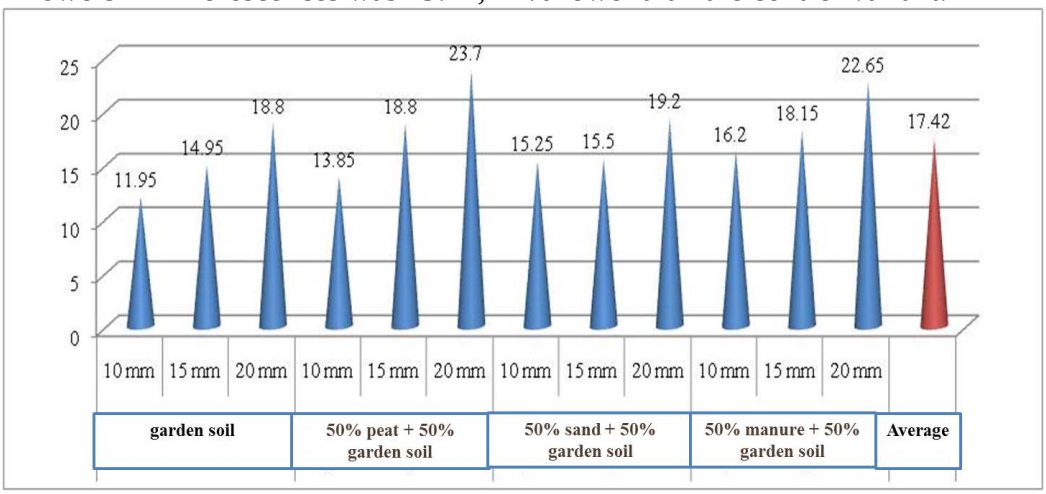

Figure 3. Average inflorescence length (cm)

The average number of inflorescences in the experiment was 21.81, the highest value being recorded for peat and garden soil in the case of larger bulb planting (table 6). Regarding the influence of the culture substrate on the average number of flowers in the inflorescence, in table 6 it can be seen that the variants, in which the planting was carried out in the mixture of peat and garden soil in equal proportions the average was 24.18 flowers, being distinctly positive. The diameter of the planted bulb had an important influence on the studied character, as it was observed that by

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using larger bulbs, the number of flowers in the inflorescence was higher, respectively, on average, 24.94 flowers in inflorescences, the variants to which are 20 mm diameter bulbs, 14.3% more than the average of the experience. In both cases, the differences of 3.13 and -2.40 were very statistically significant (table 6).

Table 6. Influence of the culture substrate and bulb diameter on the number of flowers/inflorescence

Variant		Average number of flowers / inflorescence		±Difference	Signification of difference
Substrate of the culture	Bulb diameter (mm)	Number of flowers	%		
Garden soil	10	18.75	92.7	-1,48	-
	15	18.55	91.7	-1,68	-
	20	23.40	115.7	3.17	**
Average		20.23	100	-	Control
50% peat + 50% garden soil	10	21.00	86.8	-3.18	oo
	15	23.90	98.8	-0.28	-
	20	27.65	114.3	3.47	***
Average		24.18	100	-	Control
50% sand + 50% garden soil	10	18.55	86.8	-2.82	oo
	15	20.90	97.8	-0.47	-
	20	24.65	115.4	3.28	***
Average		21.37	100	-	Control
50% manure + 50%garden soil	10	19.35	90.2	-2.10	o
	15	20.95	97,7	-0.50	-
	20	24.05	112,1	2.60	***
Average		21.45	100	-	Control
		LSD 5% 1.71	LSD 1% 2.35	LSD 0.1% 3.24	

Table 7. Influence of the culture substrate and bulb diameter on the number of bulbs plant

Variant		Bulb number/plant		Difference	Signification of the difference
Substrate of the culture	Bulb diameter (mm)	Bulb number	%		
Garden soil	10	5.95	73.8	-2.12	oo
	15	6.60	81.8	-1.47	o
	20	11.65	144.4	3.58	***
Average		8.07	100	-	Control
50% peat + 50% garden soil	10	8.50	79.6	-2.18	ooo
	15	9.15	85.6	-1.53	o
	20	14.40	134.8	3.72	***
Average		10.68	100	-	Control
50% sand + 50% garden soil	10	8.85	84.3	-1.65	oo
	15	8.85	84.3	-1.65	oo
	20	13.80	131.4	3.30	***
Average		10.50	100	-	Control
50% manure + 50% garden soil	10	8.75	87.9	-1.20	o
	15	9.80	98.5	-0.15	-
	20	11.30	113.6	1.35	*
Average		9.95	100	-	Control
		LSD 5% =1.15	LSD 1% =1.58	LSD 0.1% =2.18	

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Analyzing the combined influence of the two experimental factors, it is observed that in the case of the cultivation in the garden soil, a difference statistically ensured (distinctly positive) from the average, taken as the control variant, was recorded only for bulbs with a diameter of 20 mm, variants at which inflorescences showed 15.7% more flowers (Table 6).
Grassotti et al. (2003) in the study of the effects of the five growth media with coconut perlite and coconut fiber, both alone and mixed with clay and peat granules, noted that coconut fiber, used alone, as well as a mixture, determined a higher inflorescence size, an increase in bulb number and stem length.
When using substrates made of garden soil, 50% peat + 50% garden soil and 50% sand + 50% garden soil and bulbs with a diameter of 20 mm, the largest number of bulbs/plants was obtained. The differences from the control variants varied between 3.30 and 3.58 and were very significantly positive. As with the other characters, the use of bulbs with a smaller diameter was directly proportional to the number of bulbs obtained, the differences from the mean being negative (Table 7).

4. CONCLUSIONS

In order to obtain high quality crops on *Poliantes tuberosa*, it is recommended to use peat substrates consisting of peat and garden soil or manure and garden soil in a ratio of 1:1. Since the level of production is mainly influenced by the diameter of the planted bulb, it is advisable to plant bulbs of the largest diameter for high production, the plants of such bulbs tend to flourish in high proportion with vigorous inflorescences with a number large flowers in inflorescence. Thus, it is recommended to cultivate this species due to simple crop technology, in a mixture of peat or broom, and garden soil, but also the use of bulbs with a diameter as high as possible. For the cultivation of tuberoses to produce bulbils, it is recommended to plant bulbs of smaller diameter. Plants made up of these bulbs usually do not bloom, instead they form a large number of replacement bulbs of appreciable, potentially florals.

5. REFERENCES

Ardelean, M., Sestraş, R., Cordea, M. (2007). Horticultural experimental design. *Ed. AcademicPres*, (pp. 24-26), Cluj-Napoca.

Bryan, J. E. (1989). Bulbs. *Timber Press*. (pp. 451). Portland, Oregon, USA.

Buta, E., Cantor, M. (2009). Floriculture - practice guide. *Ed. Todesco*, (pp. 84-85), Cluj-Napoca.

Hanelt, P., Büttner, R., Mansfeld, R. (2001). Mansfeld' s encyclopedia of agricultural and horticultural crops (except ornamentals). *Ed. Springer*, Berlin.

Bahadoran, M., Salehi, H., Eshghi, S. (2011). Growth and flowering of tuberose (*Polianthes tuberosa* L.) as affected by adding poultry litter to the culture medium. *Spanish Journal of Agricultural Research 9(2)*, 531-536 .

Bahadoran, M., Salehi, H., Eshghi, S. (2012). Growth and flowering of tuberose as affected by adding natural zeolite to the culture medium. *Journal of Plant Nutrition, 35:10*, 1491-1496.

Băla, M. (2012). General and special floriculture. *Ed. Partos.* (pp. 271-273). Timişoara.

Drăghia, L., Chelariu, E. L. (2004). Floriculture. *Ed. Ion Ionescu de la Brad*, (pp. 252-254). Iaşi.

El-Naggar, A. H. (2010). Effect of biofertilizer, organic compost and mineral fertilizers on the growth, flowering and bulbs production of Narcissus Tazetta, L.. *J.Agric.&Env.Sci.Alex.Univ.*. Egypt.

Grassotti, A., Nesi, B., Maletta, M., Magnani, G. (2003). Effects of growing media and planting time on lily hybrids in soilless culture. *ActaHorticulturae*.

Chiş, L. M. (2010). Research on the influence of culture technology on floral growth, development and induction of tuberculosis (*Polyanthes tuberosa* L.). PhD thesis. Cluj – Napoca: University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca.

Safeena, S.A, Thangam, M., Priya Devi, S., Desai, A.R., Singh, N.P. (2015). Ready Reckoner on Cultivation of Tuberose, *Technical Bulletin: 50*, ICAR-Central Coastal Agricultural Research Institute (Indian Council of Agricultural Research), Ela, Old Goa-403 402, Goa, India.

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Singh, K. P. and Uma, A. (1995). Response of graded levels of nitrogen on growth and flowering in shringar tuberose (*Polianthes tuberosa* L.). *Indian J. Agric* sci 66(11):655-657

Toma, F. (2003). Floriculture and grass. *Ed. Cris Book Universal*, (Vol. 1). Bucharest.

Toma, F. (2003). Floriculture and grass. *Ed. Universitas Company*, (Vol. 2 pp. 262-263). Bucharest.

Toma, F. (2012). General floriculture. *Ed. Ex-Terra Aurum*, (pp. 67). UASVM Bucharest.

Wiart, C. (2012), Medicinal Plants of China, Korea, and Japan, Bioresources for Tomorrow's Drugs and Cosmetics, *CRC Press*.

***, https://gradinavisata.wordpress.com/2010/09/06/tuberoza/

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