Scientific Papers. Series B, Horticulture. Vol. LXIV, No. 1, 2020
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

STUDY REGARDING THE INFLUENCE OF SUBSTRATE TYPE ON SOME PARAMETERS OF GROWTH OF GERBERA SEEDLINGS

Dragoș Emanuel DRĂGHICI, Sorina PETRA, Ovidiu Ionuț JERCA, Florin TOMA

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania

Corresponding author email: draghiciem@yahoo.com

Abstract

The study was conducted at the University of Agronomic Sciences and Veterinary Medicine of Bucharest, the greenhouses Hortinvest. In the experiment I followed the influence of some factors on the germination of gerbera seeds. We used 12 types of substrate, V1-100% peat with pH 5.5; V2 - 100% peat with pH 4; V3 - 100% Perlite; V4 - 50% Perlite + 50% peat with 5.5 pH; V5 - 50% Perlite + 50% peat with 4 pH; V6 - 100 vermiculite; V7 - 50% vermiculite + 50% peat with pH 5.5; V8 - 50% vermiculite +50% peat with 4 pH. V9 jiffy seven peat pot; V10- pot with perlite; V11- pot with vermiculite and V12 pot of grodan, I tested the capacity of emergence at seeds stored in different condition. The varieties of gerbera were analized, regarding the percent of emergences and growth rate of the seedlings. The best variants with the highest percentage of seeds emerged were those where we used peat and mixed of perlite and peat with a pH of 5.5.

Key words: *Gerbera jamesonii, substrate, fertilizers, condition of growing.*

INTRODUCTION

Gerbera, is a species belonging to the *Asteraceae* family that comprises about 40 species and is also known as the "African daisy". *Gerbera jamesonii* is appreciated both as a potted flower but especially as a cut flower. This species is originary from South Africa, it has elegant flowers with single, double or multiple petals and come in various sizes and colors including white, yellow, orange, red and pink. The flower diameter is between 9-13 cm and there are four different classes of Gerbers with a single flower, semi-double flower, double flowers, and spider flowers. We can remark that each class delineates the number, position, and type of petals. The leaves of the gerbera are lobed, or pinnate, and often toothed.

Gerbera requires a lot of sun and grows in optimal conditions at temperatures of 20-21ºC. Different varieties of gerbera have different nutrient requirements depending on the stage, Savvas and Manos (1999), EunJoo et al. (2001), Savvas et al. (2003).

Gerbera can be propagated by seeds, vegetatively or *in vitro*. Vegetative propagation of gerbera plants gave better results compared to seed propagation (Nazma et al., 2012).

Propagation of gerbera by seed or in vitro (Pierik et al., 1973; 1975; Kanwar and Kumar, 2008), from a commercial point of view, is much longer, lasting, and growers prefer the method of dividing the bushes (Schiva, 1975; Reynoird et al., 1993).

In some varieties the propagation coefficient is very low and seed multiplication ensures an earlier production (Krause, 1988; Lisiecka, 1988; Mayer, 1992).

Usually, the plant of gerbera can be generally propagated both vegetatively by rhizome divisions and cuttings and generatively by seeds. This method by seeds produces a higher number of regenerants, the technique results in varied-regenerants and their performances (Kanwar and Kumar, 2008; Rukmana, 1995; Draghici et al., 2016).

One of the commonly used methods is clonal propagation via tissue culture works are importantly addressed in producing a large number of plants, uniform, vigorous and pathogen free in a short time (Mohammed and Azzambak, 2014).

The improvement of the species and the creation of new varieties of gerbera has been and is in the attention of many researchers (Cantor and Chis, 2006).

Seed wetting reduces the germination and emergence time of gerbera seeds (Harris et al., 2001). There is a serious problem in seed germination and uniform growth of gerbera seedlings (Tjia, 1984; Cockshull, 1985; Moe et

al., 1996) due to temperature fluctuations during nursery preparation (Farooq et al., 2004), which negatively affect flowering synchronization to all plants. So far, the increasing of germination of gerbera seeds induced by seed priming has been observed it has been observed.
William J. Carpenter and Eric R. Ostmark (1995) state that temperature and humidity affect the germination of gerbera seeds (*Gerbera jamesonii*). Also, keeping the seeds at temperatures from 5ºC to -5ºC or -10ºC did not significantly influence germination. Other authors recommend for seed germination temperatures of 21-24ºC (Ball, 1991)

MATERIALS AND METHODS

The experiment was carried in greenhouse conditions (in Hortinvest greenhouse). We used seeds of mix cultivars.
We used 12 experimental substrate variants: V1- 5.5 peat; V2- peat 4; 2 mm perlite V3; V4 mixture 50% peat 5.5, + 50% 2 mm perlite; V5 mixture 50% peat 4.0 + 50% perlite 2 mm; V6 vermiculite; V7 mixture 50% peat 5.5, + 50% vermiculite; V8 mixture 50% peat 4.0 + 50% vermiculite; V9 pots peat jiffy seven; V10- pots filled with perlite; V11- pots filled with vermiculite; V12 mineral wool pots
For each experimental variant we used 20 gerbera seeds. The seeds were 25 days old after harvest. I sowed seeds exposed for 5 days at a temperature of 20ºC and 4ºC.
The seeds exposed at 20ºC and 4ºC, respectively were sown in two variants, on the surface of the substrate without coating and with seed coating. The seeds were sown with the tip up, and for the variants where we covered the seeds we used a layer of about 0.5 cm substrate. The temperature in the greenhouse was maintained at 25ºC during the day and night until sunrise, then in the vegetation it was reduced to 20ºC during the day and 18ºC at night.
The seeds were sown according to the experimental substrate variants. Wetting was performed with nutrient solution with EC 0.5 and pH 5.5. We followed the percentage of emergence, the growth of seedlings in dynamics, the number of leaves in gerbera seedlings. Only the variants that responded very well and had well-formed leaves were retained. After planting in pots I watched the number of leaves, the appearance of flower buds and the number of flowers on the plant.
Data were analyzed statistically according to analysis of variance technique using analytical software and treatment means were compared using Tukey's test (Steel et al., 1997).

RESULTS AND DISCUSSIONS

The experiment in which we used seeds 25 days after harvest.
If we follow the total percentage of seeds sprouted after 8 days from sowing, we found that the variant in which the seeds had 25 days from harvest, sown on peat substrate with pH 5.5 showed the highest emergence of 92.0%.
A high percentage of emergence was also observed in the variant in which the seeds were kept in conditions of 20ºC, this being 87% when the seeds were covered at sowing. The lowest germination percentage was recorded for variant 5 (mixture 50% peat 4.0 + 50% perlite 2 mm) of 72% for seeds kept at 20ºC and uncovered. In the case of seeds stored at a temperature of 20ºC and sown in peat pots jiffy seven (V9) we recorded the lowest germination rate of 51% at 25 days old stored at 20ºC.
If we follow by comparison the germination percentage of the seeds kept in conditions of 20ºC in the variants with uncovered seeds and covered with a layer of substrate we found that the seeds in the case of the uncovered variant emerged faster, after 4 days after sowing.

Figure 1. Aspect of some experimental variants

Depending on the substrate, the percentage was 24% for V2 and V12 and 52% for V4 and V7. (Table 1). In the case of variants were seeds do not covered with substrate, after 4 days no seed emergence was recorded on any substrate variant, but after 6 days from sowing we noticed that in the uncovered variant the germination percentage was higher compared to the variant in which the seeds were covered.

After 6 days, the percentage of sprouted seeds was between 88% (V6) and 52% (V2) for the variant without covering the seeds with substrate. In the case of variants in which the seeds were covered with a mixing layer, the seeds emerged after 6 days in a percentage of 32% (V2) and 68% (V7) (Tables 1 and 2).

Analyzing the data from a statistical point of view, we find, in Table 1, that, compared to the control variant (peat substrate with pH 5.5), the meanings are negative distinctly very significant at V2, V5 and V9, and, insignificant at V3, V8, V10, V11 and V12.

At the same time, in the variant with coating of seeds, we counted from a statistical point of view very significant negative meanings at V2, V4, V5, V7, VV8, V9 and V12, compared to the control variant (Table 2)

Table 1. The evolution of seed germination at the variant without coating of seeds (seeds stored at 20°C)

Variants	After 4 days	After 6 days	After 8 days	Diferences		Significance
	%	%	%	%	% to Ct.	
V1	48	78	92	0.00	100.00	Control
V2	24	52	76	-16.00	82.61	OOO
V3	44	86	88	-4.00	95.65	N
V4	52	83	86	-6.00	93.48	OO
V5	32	68	72	-20.00	78.26	OOO
V6	44	88	87	-5.00	94.57	O
V7	52	84	87	-5.00	94.57	O
V8	44	84	88	-4.00	95.65	N
V9	32	68	78	-14.00	84.78	OOO
V10	48	87	89	-3.00	96.74	N
V11	48	86	88	-4.00	95.65	N
V12	24	72	89	-3.00	96.74	N
Average	41	78	85	-7.00	92.39	OO
			DL5= 4.110 DL5% in % = 4.4674 DL1% = 5.600 DL1% in % = 6.0870 DL01% = 7.540 DL01% in %= 8.1957			

Table 2. The evolution of seed germination at the variant with coating of seeds (seeds stored at 20°C)

Variants	After 4 days	After 6 days	After 8 days	Differences		Significance
	%	%	%	%	% to Ct.	
V1	0	61	87	0.00	100.00	Control
V2	0	32	66	-21.00	75.86	OOO
V3	0	37	75	-12.00	86.21	OO
V4	0	42	73	-14.00	83.91	OOO
V5	0	47	68	-19.00	78.16	OOO
V6	0	66	75	-12.00	86.21	OO
V7	0	68	73	-14.00	83.91	OOO
V8	0	33	47	-40.00	54.02	OOO
V9	0	46	51	-36.00	58.62	OOO
V10	0	66	77	-10.00	88.51	OO
V11	0	67	76	-11.00	87.36	OO
V12	0	37	66	21.00	75.86	OOO
Average	0	50.17	69.5	-17.50	79.89	OOO
			DL5%= 6.960 DL5% in % = 8.0000 DL1%=9.470 DL1% in% = 10.8851 DL01%=12.750 DL01%in%=14.6552			

If we follow by comparison, the percentage of seed germination, kept at 20ºC, with that of seeds kept at 4ºC, we estimate that, in case of seed storage at 4ºC and then sown on different types of substrate, the percentage of seed germination was zero after 4 days, in both variants without coverage and with seed coverage. After 6 days from sowing, for the variant without seed cover, the percentage of seedlings emergented was 32% at V12 and 48% at V3 and V4. In the case of the variant with seed cover at sowing, at V2, no seed emerged, and at V11 only 67%.

In the variant with seed cover, with substrate, the percentage of seeds sprouted was lower compared to the variant not covered with substrate, the percentage of sprouted seeds being 66% in V7 and V10 and only 47% in V4 and V9 (Tables 3 and 4).

At the variant without coating of seeds, we found an insignificant significance at V2, from a statistical point of view but in the most variants, we also found negative distinctly very significant, from a statistical point of view (Table 3). In the case of seed cover (seeds stored at 4°C) we noticed from a statistical point of view, very significant positive meanings, at V7 and V10 (Table 4).

Correlations made between the type substrate and the percentage of seeds sprouted after 6 days from sowing indicated minimum values of 52% for the variant stored at 20ºC and uncovered and 47% for the variant stored at 4ºC and covered with substrate. The highest percentage of emergence of 88% was recorded in the seed stored at 20ºC and uncovered with a standard deviation of 10.9461 and the lowest in the stored at 20ºC and covered, with a standard deviation of 4.9909 (Table 5).

Correlations made in order to see the influence of seed treatment conditions (stored at 20°C and 4°C, respectively), and substrate types, indicated a significant relationship to the variant with seeds stored at 4oC and then sown on substrates without cover the seed (Table 6).

After 8 days, the variant without seed cover, the lowest percentage of emergence was 47% recorded at V12, and the highest at 73% at V1.

Table 3. The evolution of seed germination at the variant without coating of seeds (seeds stored at 4ºC)

Variants	After 4 days	After 6 days	After 8 days	Diferences		Significance
	%	%	%	%	% to Ct.	
V1	0	47	73	0.00	100.00	Control
V2	0	37	58	-15.00	79.45	OOO
V3	0	48	68	-5.00	93.15	N
V4	0	48	57	-16.00	78.08	OOO
V5	0	41	61	-12.00	83.56	OOO
V6	0	37	63	-10.00	86.30	OO
V7	0	36	54	-19.00	73.97	OOO
V8	0	41	64	-9.00	87.67	OO
V9	0	41	47	-26.00	64.38	OOO
V10	0	42	52	-21.00	71.23	OOO
V11	0	42	51	-22.00	69.86	OOO
V12	0	32	47	-26.00	64.38	OOO
Average	0	41	57,92	15.08	79.34	OOO
			DL5% = 6.250 DL5% in % = 8.5616 DL1%= 8.500 DL1% in % = 11.6438 DL01%=11.450DL01% in %=15.6849			

Table 4. The evolution of seed germination at the variant coating of seeds (seeds stored at 4ºC)

Variants	After 4 days	After 6 days	After 8 days	Diferences		Significance
	%	%	%	%	% to Ct.	
V1	0	11	58	0.00	100.00	control
V2	0	0	51	-7.00	87.93	OO
V3	0	21	56	-2.00	96.55	N
V4	0	42	47	-11.00	81.03	OOO
V5	0	47	54	-4.00	93.10	N
V6	0	66	63	5.00	108.62	N
V7	0	66	66	8.00	113.79	**
V8	0	33	52	-6.00	89.66	O
V9	0	46	47	-11.00	81.03	OOO
V10	0	66	66	8.00	113.79	**
V11	0	67	64	6.00	110.34	*
V12	0	37	48	-10.00	82.76	OOO
Average	0	42	56	-2.00	96.55	N
			DL5% = 5.050 DL5% in % = 8.7069 DL1% = 6.880 DL1% in % =11.8621 DL01% = 9.260 DL01% in %= 15.9655			

Table 5. Standard deviation at the variants recorded at 6 days after sowing

Variable	Variants	Min.	Max.	Mean	Std. deviation
a.	12	52.00	88.00	78.00	10.9461
b.	12	32.00	48.00	41.00	4.9909
c.	12	32.00	68.00	50.17	14.4148
d.	12	47.00	66.00	56.00	7.3113

a. stored at 20 degrees C and uncovered; b. stored at 20 degrees C and covered; c. stored at 4 degrees C and uncovered; d. stored at 4 degrees C and covered

Table 6. Correlation matrix at the variants

Variables	stored at 20ºC and uncovered	stored at 20ºC and covered	stored at 4ºC and uncovered	stored at 4ºC and covered
a.	**1**			
b.	0.326	**1**		
c.	0.529	-0.016	**1**	
d.	0.571	-0.047	**0.851**	**1**

a.stored at 20 degrees C and uncovered; **b**. stored at 20 degrees C and covered; **c.** stored at 4 degrees C and uncovered; **d.** stored at 4 degrees C and covered

Values in bold are different from 0 with a significance level alpha=0,01

Analyzing the influence of seed storage treatment at 4oC and substrate type and emergence percentage, we found a significant positive correlation, the correlation coefficient being $R^2 = 0.7234$ between the variant stored at 4 degrees C and covered and the variant stored at 4 degrees C and uncovered (Figure 2).

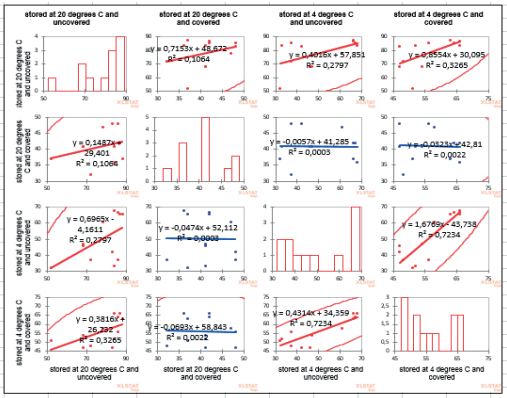

Figure 2. The influence of seed storage treatment, substrate type and percentage of emergence

The experiment in which we used seeds 25 days after harvest.

Gerbera seeds, 80 days old, stored at 20ºC and 4ºC had a very low germination in the case of sowing without cover. If we covered the seeds at sowing the percentage of emergence was zero.

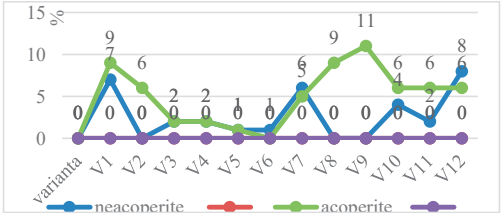

Figure 3. The percentage of the seeds emerged in the variants with seeds of 80 days after harvest

The number of leaves after 45 days from emergence in the variants stored at 20ºC covered and uncovered and stored at 4ºC covered and uncovered was different from one variant to another. Thus, we noticed the highest number of leaves per plant in V1 - peat substrate 5.5, in the variant without coating, this being 10.25 leaves / plant and 9.75 in V1 with coating. In the variant where we kept the seeds at a temperature of 4ºC the number of leaves per

plant was 8.25 leaves/plant in the uncovered variant and 6.55 leaves in the covered variant (Figure 4).

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
stored at 20 degrees C and uncovered no. leafes	10,25	5,50	6,25	7,25	5,50	6,75	6,00	5,75	5,25	6,25	5,25	5,75
stored at 20 degrees C and covered no. leafes	9,75	3,75	5,25	6,75	5,00	5,75	5,50	5,75	5,00	6,00	5,50	5,50
stored at 4 degrees C and uncovered no. leafes	8,25	4,25	5,25	6,65	4,75	5,00	5,75	5,50	5,25	5,75	5,50	4,25
stored at 4 degrees C and covered no. leafes	6,55	3,25	4,00	4,75	4,00	4,25	5,25	5,00	4,75	5,50	5,00	3,00

Figure 4. Number of leaves on plant

Analyzing the number of leaves per plant we noticed that there was a positive relationship (R^2=0.3191) depending on the type of substrate (Figure 5).

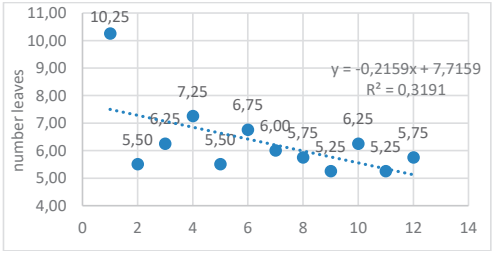

Figure 5. Influence of substrate type on the number of leaves formed on the plant in the variant with seeds stored at 20ºC and uncovered

At the time of the observations, 50 days after emergence, for the variant in which the gerbera seeds were covered with a thin layer of substrate, we noticed that the plants had a smaller number of leaves/plant and the substrate it had very little influence on the formation of leaves on the plant (R^2 = 0,0817) (Figure 6).

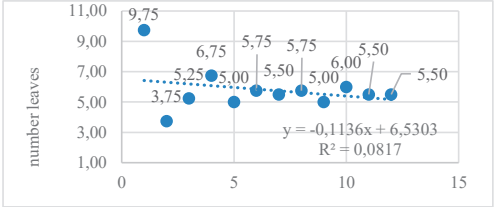

Figure 6. Influence of substrate type on the number of leaves formed on the plant in the variant with seeds stored at 20ºC and covered

In the variant where the seeds were kept at 4oC, and at sowing they were not covered, the plants after 50 days formed the smallest number of leaves, being between 4.25 leaves at V2 and V12 and 8.25 leaves at V1. Among the experimental variants we noticed relatively small influences (R^2=0.1479). We noticed between the experimental variants relatively small influence (R^2 = 0.1479) (Figure 7).

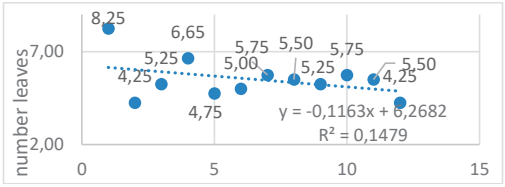

Figure 7. Influence of substrate type on the number of leaves formed on the plant in the variant with seeds stored at 4ºC and seed uncovered

In the variant where the seeds were kept at 4ºC, and when sown they were covered, the plants after 50 days formed a number of leaves of 3 at V12 and 6.55 leaves at V1, between the experimental variants was a relatively small influence (R^2 = 0,0127) (Figure 8).

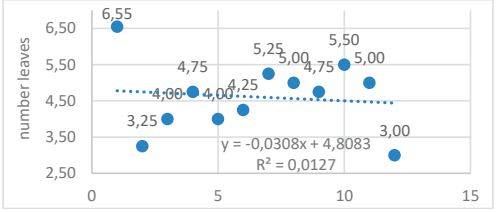

Figure 8. Influence of substrate type on the number of leaves formed on the plant in the variant with seeds stored at 4ºC and seed covered

Figure. 9. Aspect of gerbera plant in V1 - variant with seeds kept at 20ºC, uncovered - on peat substrate with pH 5.5 and V2 - peat with pH 4.5

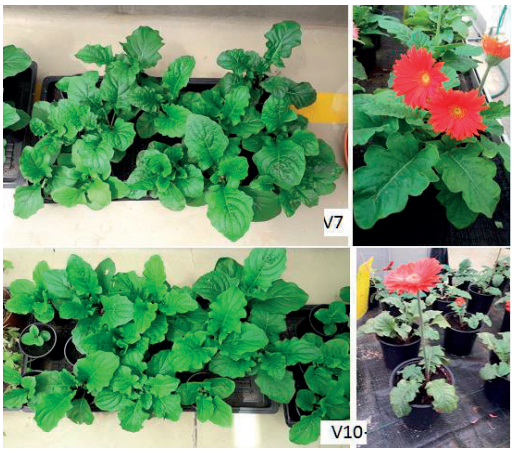

Figure. 10. Aspect of gerbera plant - variant with seeds kept at 20ºC, uncovered V7 and V10

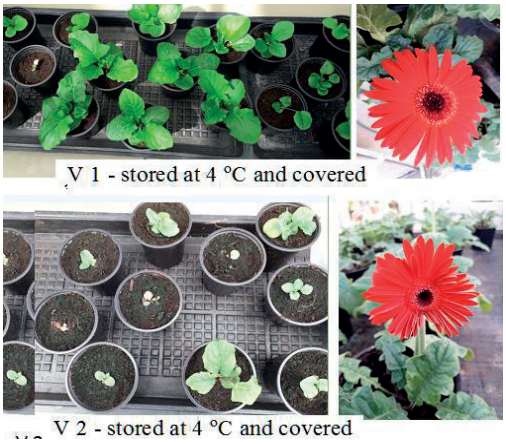

Figure 11. Aspect of gerbera plant in V1-variant with seeds kept at 4oC, covered seeds with substrate, on peat substrate with pH 5.5 and V2 -peat with pH 4.5

CONCLUSIONS

Gerbera seeds with aged of 25 days after harvested showed a higher viability compared to seeds aged 80 days after harvest. The highest percentage of sprouted seeds was recorded in the variant with seeds kept at 20ºC and not covering the seeds with a layer of substrate. Also, the seeds emerged in a percentage of 87% in the case of the variant with covering the seeds after sowing with a layer of substrate. The culture substrate influenced the germination of seeds but also the growth of gerbera plants. The number of leaves on the plants was different depending on the treatment made to seeds also by the type of substrate.

REFERENCES

Ahmad, I., A.M. Saleem, G. Mustafa, K. Ziaf, I. Afzal and M. Qasim (2017), Seed halopriming enhances germination performance and seedling vigor of gerbera jamesonii and zinnia elegans. *Sarhad Journal of Agriculture*, 33(2): 199-205.

Ball, V. (1991), Ball red book: Greenhouse growing. 15th *ed. Geo. J. Ball Publishing, West Chicago, Ill.*

Cantor Maria, Lenuta Chis (2006), Breeding of gerbera hybrida at the Fruit research station *Cluj Buletin USAMV-CN, 63/2006, ISSN 1454-2382*

Draghici E.M, Scarlat V., Pele M., Postamentel M., Somacescu C. (2016). Usage of Perlite in Polluted Sandy Soils for Potato Crop. *Revista de chimie*, *vol. 67*(11), 2281-2286.

EunJoo H., MinWha J., KeeYoeup P. (2001). Culture method and growing medium affect growth and flower quality of several Gerbera cultivars, *Acta Hortic.,* 548, 385-391.

Kanwar J. K., S. Kumar (2008). *In vitro* propagation of Gerbera - A Review, *Hort. Sci., 35*(1), 35-44.

Krause, J. (1988). PROPAGATION OF GLORIOSA FROM SEEDS. *Acta Hortic*., 226, 555-558.

Lisiecka, A. (1988). The influence of the vegetative propagation methods on the flower yield of gerbera. *Acta Hortic.*, 226, 717-720.

Mayer, A.M. (1992). What makes seeds and their germination special for propagation. *Acta Hortic*., 314, 165-172.

Nazma Akter, M.I. Hoque, R.H. Sarker (2012). *In vitro* Propagation in Three Varieties of Gerbera (*Gerbera jamesonii* Bolus.) from Flower Bud and Flower Stalk Explants, *Plant Tissue Cult. & Biotech. 22*(2), 143-152.

Panter Elena, Pele Maria, Dăghici Elena Maria **(**2016). Influence of ilumination with Led s on some chemical compounds, *Revista de chimie, vol.67,* nr.6.

Pierik R.L.M., Jansen J.L.M., Maaddam A. (1974), Vegetative propagation of gerberas in test tubes. *Vakblad voor de Bloemisterij*, 29, 18–19.

Pierik R.L.M., Jansen J.L.M., Maasdam A., Binnendijk C.M. (1975). Optimization of gerbera plantlet production from excised capitulum explants. *Scientia Horticulturae*, 3, 351–357.

Savvas D., Karagianni V., Kotsiras A., Demopoulos V., Karkamisi I, Pakou P (2003). Interactions between ammonium and pH of the nutrient solution supplied to gerbera (*Gerbera jamesonii*) grown in pumice. *Plant and Soil,* 254, 393-402.

Savvas D., Manos G. (1999) Automated composition control of nutrient solution in closed soilless culture systems. *J. Agric. Eng. Res.*, 73, 29-33.

Schiva T. (1975), Miglioramento genetico della Gerbera. Analisi genetica dei caratteri metrici di importanza commerciale e conseguenze dell'ininciociol. I. *Genet. Agr.*, 29, 233-240.

Singh S., Raja Ram, Somu Kaundal, Akhil Sharma, Ashok Kumar, D. Dhyani (2016), *American Journal of Experimental Agriculture,* 10(1): 1-11, *Article no. AJEA.20653,* ISSN: 2231-060.

Tanveer Ahmad, Arfan Gulfam, Muhammad Saleem, Ahmad Iftikhar (2012). Growth and flowering of

gerbera as influenced by various horticultural substrates, J. *Bot.*, 44, 291-299*, Special Issue March*.

Toma Fl**.**, Păun Oana, Petra Sorina, Zamfir-Vășcă Diana (2011). Research on the influence of the cold period and type of substrate on growth and flowering plants *Hyacinthus orientalis* L., the variety '*Ostara*'. *Lucrări ştiinţifice USAMV Bucureşti*, *seria B*, *vol. LV*, pg. 257-260.

Toma Florin, Mihaela Ioana Georgescu, Sorina Petra, Cristina Manescu, Ecaterina Ailincai, Daniel Constantin Potor (2018). Research on the technological and morpho-anatomic particularities on forcing bulbs of iris reticulata. *Sciendo/De Gruyter Journal, Volume 1.*

William J. Carpenter and Eric R. Ostmark (1995). Temperature and Seed Moisture Govern Germination and Storage of Gerbera Seed, *Hortscience*, 30(1), 98-101.