

RESEARCH REGARDING THE INFLUENCE OF CULTIVAR AND STORAGE SUBSTRATE AT *DAHLIA VARIABILIS* DESF. CACTUS TYPE

Ciobanu Ioana, Erzsebet Buta, Anca Husti, Maria Cantor*

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Calea Manastur, 3-5, 400372 Cluj-Napoca, Romania; marcantor@yahoo.com

*Corresponding author: marcantor@yahoo.com

Abstract. Dahlia is one of the flowers always present in gardens near the houses, cultivated especially for the beauty of flowers and ornamental long period, until late autumn. The scientific researches presented in this paper were focused on finding the best substrates for storage during the rest period of the plant. The study was conducted during the years 2014 – 2015. In this paper were carried out researches on the influence of cultivar and of the substrate storage at *Dahlia variabilis* Desf. Cactus type. Were taken into study five varieties of Dahlia, 'Kennemerland', 'Tsuki Yori No Sisha', 'Hayley Jane', 'Purple Gem' and 'Veritable'. Tuberos roots of these cultivars of dahlias were stratified during the rest period in the three substrates: sand, sand + sawdust (70% + 30%), peat + sawdust (70% + 30%). The best results were recorded in the substrate composed of peat + sawdust (70% + 30%), cultivars 'Kennemerland', 'Tsuki Yori No Sisha' and 'Veritable' had the best behavior in this substrate storage, showing significant differences from the other cultivars studied.

Keywords: tuberos roots, storage, sand, sawdust, peat

INTRODUCTION

Dahlia variabilis Desf. is a very popular ornamental species and economically relevant species (Sabine *et al.*, 2013). Dahlia genus includes about 30 perennial species, with tuberos roots, belonging to the family Asteraceae (Lord, 2003).

In the last hundred years, more than 50.000 varieties of *Dahlia* with different colors, shapes and sizes of inflorescences are grown in gardens (Sho Ohno *et al.*, 2011). Indigenous varieties of *Dahlia*: 'Helios', 'Rubin', 'Star', are found in this vast assortment (Cantor, 2009), which are grouped by type inflorescences in several types: dahlias with simple flowers (daisy), dahlias with anemones flowers, dahlias colerette (collar), dahlias lily, decorative dahlia, dahlia with globular flowers, pompon dahlias, dahlia with flowers of cactus, dahlias with flowers of chrysanthemums, dahlias veins, dahlias with flowers of peony dahlias with flowers of carnations, Miscellaneous dahlias (TOMA, 2009).

Due to the high genetic variability of the genus *Dahlia*, producers introduce new varieties every year on the market. Given the great popularity enjoyed by this plant, became a flower used mainly for exhibitions, first in England, then in the USA, Australia and New Zealand (Cantor *et al.*, 2012). Tuberos dahlia roots provide plant durability and also their vegetative propagation, is formed by thickening a portion with internodes of the geophyte stem (Tarhon *et al.*, 1993). The same as species: *Begonia tuberhybrida*, *Canna*, *Gladiolus*, *Polyanthes* also *Dahlia* needs dormant and sequence of temperatures (hot-cold-hot or cold-hot), reason for which are known as geophytes semi rustic perennials (Dumitraș, 2010).

In the tuberos roots of *Dahlia* are a large number of: fat-soluble vitamins (A, E), water-soluble vitamins (B1, B2, B3, B6, B7, C), minerals (Fe, Zn, Na, K, Cu, Mg, Ca, Co, Cr, P), fats, proteins, fibers, ashes (Nsabimana *et al.*, 2011) and carbohydrates (Dobrotă,

2013). The large temperature differences between day and night favors the thickening of tuberous roots. This may explain why the hilly and mountainous areas correspond better to the needs of dahlia (plant is sensitive to diurnal thermoperiodic) (Toma, 2009). At temperatures of (-1 -20C), buds from the neck are affected (Șelaru, 2007), which requires the removing of tuberous roots and winter storage. Removing tuberous roots from the soil before to form suber thick tissue lowers their resistance to fungi that cause rot in winter (Smith, 2007). The relative humidity of air in spaces designed to preserve the tuberous roots is 50-60% (Toma, 2009). Șelaru (2007) mentions that the storage temperature should be 4-60 C. To maintain turgescence, tuberous roots of Dahlia needs to stratified in sand, peat or to be paraffin (Pane et al., 2011).

The purpose of these researches is to determine which the best substrates to storage dahlias are during the rest period with influence on the starting in vegetation.

MATERIAL AND METHOD

Biological material researched belongs to the species of *Dahlia variabilis* Desf., genus *Dahlia*, Asteraceae family, type Cactus. They are characterized by spectacular inflorescences consisting of ligulate flowers, twisted in length, in the form of tubes with a sharp point, integer or bifurcated. Were studied five cultivars, representing factor A: a₁- 'Kennemerland' a₂ -'Tsuki Yori No Sisha', a₃ 'Hayley Jane', a₄ 'Veritable', a₅ 'Purple Gem'. Biological material used is purchased from The Botanical Garden Al. Borza in Cluj - Napoca. Regarding the storage of tuberous roots of the five varieties of dahlias were stratified in three substrates (factor B):

b₁ = sand

b₂ = sand + sawdust (70% + 30%)

b₃ = peat + sawdust (70% + 30%)

Peat- purchased in compressed form, packaged (home country Lithuania), with a grain size of 0-20 mm, disinfected, pH 5.5-6.5 and a content of fertilizers (N-P2O5-K2O) of 1.7 kg/m³.

The sand used was with sizes of 2 - 20 mm from the bottom of waters. Sawdust – originate from the deciduous wood processing. From the combination of these two factors, with five and respective three graduations revealed the following 15 experimental variants:

V₁ = a₁b₁ = 'Veritable' / sand

V₂ = a₁b₂ = 'Veritable' / sand + sawdust

V₃ = a₁b₃ = 'Veritable' / peat + sawdust

V₄ = a₂b₁ = 'Hayley Jane' / sand

V₅ = A₂B₂ = 'Hayley Jane' / sand + sawdust

V₆ = a₂b₃ = 'Hayley Jane' / peat + sawdust

V₇ = a₃b₁ = 'Kennemerland' / sand

V₈ = a₃b₂ = 'Kennemerland' / sand + sawdust

V₉ = a₃b₃ = 'Kennemerland' / peat + sawdust

V₁₀ = a₄b₁ = 'Tsuki Yori No Sisha' / sand

V₁₁ = a₄b₂ = 'Tsuki Yori No Sisha' / sand + sawdust

V₁₂ = a₄b₃ = 'Tsuki Yori No Sisha' / peat + sawdust

V₁₃ = a₅b₁ = 'Purple Gem' / sand

V₁₄ = a₅b₂ = 'Purple Gem' / sand + sawdust

V₁₅ = a₅b₃ = 'Purple Gem' / peat + sawdust

In each substrate were put four tuberous roots of every cultivar, in three repetitions, a total number of 60 tuberous roots. Stratification was performed between the interval 08.11.2014 - 03.18.2015 in deposit (warehouse) at a temperature of 5-8°C and humidity of 30-40%. Before storing, each tuberous root was weighed to determine the weight and tubers were counted (Figure 1).



Figure 1. The air humidity in the warehouse and the number of tubers on root; Source: original

These morphological characterizations were retaken in the spring at the removing of roots from the substrates. Statistical interpretation of data was performed using Duncan test (Ardelean *et al.*, 2007).

RESULTS AND DISCUSSION

After the storage period (131 days), tuberous roots from the warehouse were brought into the greenhouse and weighed to determine to what extent tuberous roots lost their turgescence during storage. Differences in weight recorded to the tuberous roots are shown graphically in Figure 2.

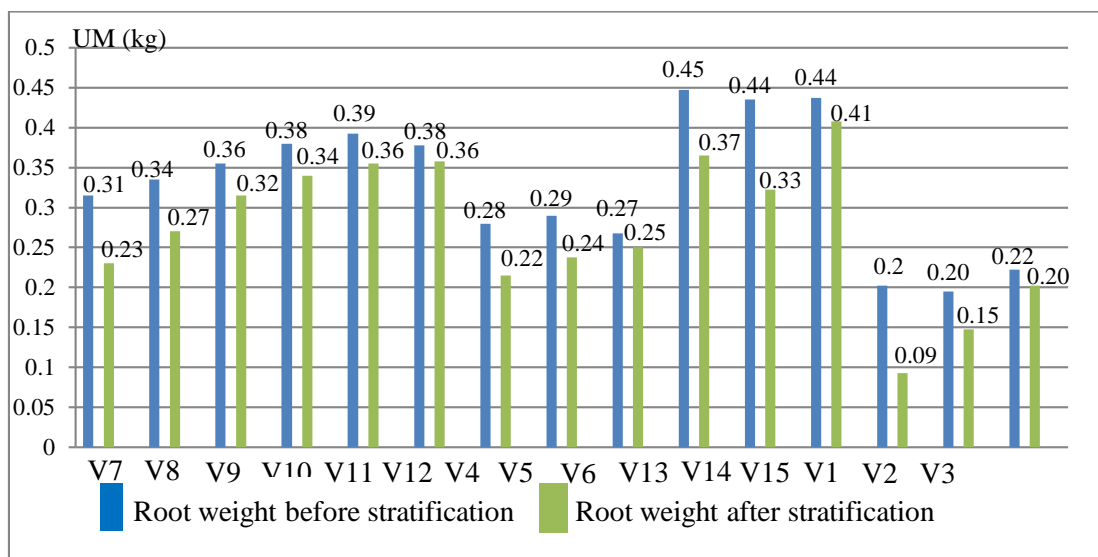


Figure 2. Weight (kg) of tuberous roots before and after storage in different substrates

Cultivars 'Purple Gem' / sand + sawdust' and 'Veritable' / sand recorded the largest loss (0.11 kg), followed by 'Kennemerland' / sand (0.085 kg), while the lowest mass loss was found in cultivars 'Kennemerland' / peat + sawdust, 'Tsuki Yori No Sisha' / peat + sawdust' and 'Veritable' / peat + sawdust (0.02 kg).

Results regarding the weight of *Dahlia variabilis* Desf. tuberous roots.

The results obtained by assessing the weight of tuberous roots at the five cultivars of *Dahlia variabilis* before and after their storage in the three substrates are presented in Table 1.

Table 1

Tuberous root weight of *Dahlia variabilis* in three storage substrates

No. var.	Cultivar /Substrate storage	Root weight before storage kg	Root weight after storage kg
V ₁	'Veritable'/sand	0.20 c	0.09 d
V ₂	'Veritable'/ sand + sawdust	0.20 c	0.15 cd
V ₃	'Veritable'/peat + sawdust	0.22 c	0.20 cd
V ₄	'Hayley Jane'/sand	0.28 abc	0.22 cd
V ₅	'Hayley Jane'/sand + sawdust	0.29 abc	0.24 bcd
V ₆	'Hayley Jane'/ peat + sawdust	0.27 bc	0.25 bcd
V ₇	'Kennemerland'/sand	0.31 abc	0.23 cd
V ₈	'Kennemerland'/ sand + sawdust	0.34 abc	0.27 bcd
V ₉	'Kennemerland'/ peat + sawdust	0.36 abc	0.31 abcd
V ₁₀	'Tsuki Yori No Sisha'/sand	0.38 abc	0.34 abcd
V ₁₁	'Tsuki Yori No Sisha'/ sand +sawdust	0.39 abc	0.36 abc
V ₁₂	'Tsuki Yori No Sisha'/ peat + sawdust	0.38 abc	0.36 abc
V ₁₃	'Purple Gem'/sand	0.45 a	0.37 ab
V ₁₄	'Purple Gem'/ sand + sawdust	0.44 ab	0.32 abcd
V ₁₅	'Purple Gem'/ peat + sawdust	0.44 a	0.41 A

DS (0.15-0.18) DS (0.15-0.18)

Analyzing Table 1 it can be observed that the variants V₁ ('Veritable'/sand) and V₂ ('Veritable'/sand + sawdust), with a weight of 0.20 kg do not present statistical and value differences. Among variants V₁, V₂ and V₃ (cultivar 'Veritable' in the three substrates) no significant differences are recorded, these roots having the lowest weight, but are significantly different from the variants V₁₃, V₁₄ and V₁₅ (cultivar 'Purple Gem' in the three substrates) whose roots have the highest weight.

Among variants V₁, V₂, V₃, V₄, V₅, V₆, V₇, V₈, V₉, V₁₀, V₁₁ and V₁₂ are recorded value differences but the differences are not statistically assured.

Were recorded values of 0.45 kg (V₁₃ - 'Purple Gem' / sand) and 0.44 kg (V₁₅ - 'Purple Gem' / peat + sawdust) between which there is no statistical differences, but are significantly different from V₆ represented by the cultivar 'Hayley Jane' in substrate composed of peat + sawdust weighing 0.27 kg.

Before stratifying the root with the highest weight of 0.45 kg belongs to variant V₁₃ ('Purple Gem'/sand), and the lowest weight of 0.20 kg belongs to variant V₁ ('Veritable'/sand) and V₂ ('Veritable'/sand + sawdust).

The weight of tuberous roots of *Dahlia variabilis* after storing them in substrates

The variants V₁, V₂, V₃, V₄, V₅, V₆, V₇, V₈, V₉, V₁₀ and V₁₄ do not present statistical differences, but are different in value, weight ranging between numerical values 0.09 kg at variant V₁ ('Veritable' / sand) and 0.34 kg at V₁₀ ('Tsuki Yori No Sisha' / sand), both stratified in sand.

No significant differences are recorded between variants V₁, V₂, V₃, V₄, V₅, V₆, V₇ and V₈, but compared with variant V₁₅ are differences statistically assured.

Variant V₁ weighing of 0.09 kg present inferior significant differences than the variants V₁₁, V₁₂, V₁₃ and V₁₅, with values are between 0.36 kg to 0.41 kg.

Variants V₂, V₃, V₄ and V₇ form a homogeneous group symbolized by the letters "cd", the recorded differences between them being insignificant but significantly different of variants V₁₃ and V₁₅. Variants V₉, V₁₀, V₁₁, V₁₂, V₁₃, V₁₄ and V₁₅ are different in values, not being statistically assured.

Variants V₁ and V₂ differ in value, although initial weight was identical (0.20 kg for both versions). The weight 0.09 kg of variant V₁ shows that the sand is inferior to the substrate composed of sand + sawdust where the root weight is 0.15 kg.

Similar results were obtained by Mehwish *et al.* (2007) in the study regarding the effect of growing substrates (sand, mud, dry leaves, sand + sludge, dry leaves + sand + sludge, dry leaves, dry leaves + sludge, dry leaves + sludge + sand) on growth and development of *Dahlia pinnata* species. The parameters followed were: plant height, stem thickness, number of branches per plant, number of leaves per plant and period of flowers decor. Of the seven substrates, sand used alone gave the unsatisfied results in all parameters.

After storing the roots in those three substrates, variants V₁₀ (0.34 kilograms) are different in values from V₁₁ and V₁₂ (0.36 kg), as well as variants V₁₃ (0.37 kg), V₁₄ (0.32 kg), compared to V₁₅ (0.41 kg). Following these interpretations it is shown that between the three substrates exist differences in terms of weight of tuberous roots of *Dahlia variabilis*, substrate composed of peat + sawdust (70% + 30%) has the best ability to storage them, and the sand used alone has the smallest capacity of storage tuberous roots.

Both before and after storage tuberous roots of *Dahlia variabilis* with the most weight belong to the variety 'Purple Gem'/peat + sawdust, and the lowest weight roots belong to the variety 'Veritable' / sand.

The results regarding the number of tubers per each tuberous root of cultivars of *Dahlia variabilis* studied are presented in Table 2.

The number of tubers on the roots of five varieties analyzed were between 22.00 tubers at variety 'Hayley Jane' and 5.50 tubers at variety 'Tsuki Yori No Sisha'. It can be seen in Table 2 that the varieties 'Hayley Jane', 'Purple Gem' and 'Kennemerland' had recorded the highest values for this character: 22.00 tubers, 19.25 tubers respectively 12.00 tubers, these being situated at a significant difference than the varieties 'Veritable' and 'Tsuki Yori No Sisha'.

Differences in the number of tubers on the roots of *Dahlia variabilis* after keeping in the three substrates: sand, sand + sawdust (70%) + 30%) and peat + sawdust (70% + 30%) occurred only in the case of variant V₇ ('Kennemerland' / sand), at the stratification root had a number of 10.5 tubers per root, and after stratification 10.00 tubers per root.

Table 2

The number of tubers on the roots of *Dahlia variabilis*

No. var.	Cultivar / Substrate storage	Number of tubers on the root before storage	Number of tubers on the root after storage
V ₁	'Veritable'/sand	7.25 cde	7.25 cdef
V ₂	'Veritable'/ sand + sawdust	6.25 de	6.25 ef
V ₃	'Veritable'/peat + sawdust	7.00 cde	7.00 def
V ₄	'Hayley Jane'/sand	18.50 ab	18.50 ab
V ₅	'Hayley Jane'/sand + sawdust	22.00 a	22.00 a
V ₆	'Hayley Jane'/ peat + sawdust	15.25 ab	15.25 ab
V ₇	'Kennemerland'/sand	10.50 abc	10.00 abcde
V ₈	'Kennemerland'/ sand + sawdust	10.50 abcd	10.50 abcd
V ₉	'Kennemerland'/ peat + sawdust	12.00 abc	12.00 abc
V ₁₀	'Tsuki Yori No Sisha'/sand	6.50 de	6.50 ef
V ₁₁	'Tsuki Yori No Sisha'/ sand +sawdust	7.50 bcde	7.50 bcdef
V ₁₂	'Tsuki Yori No Sisha'/ peat + sawdust	5.50 e	5.50 f
V ₁₃	'Purple Gem'/sand	19.25 a	19.25 a
V ₁₄	'Purple Gem'/ sand + sawdust	19.00 a	19.00 a
V ₁₅	'Purple Gem'/ peat + sawdust	16.00 ab	16.00 ab
		DS (7.35-8.75)	DS (7.30-8.69)

CONCLUSIONS AND RECOMMENDATIONS

Based on the researches of the five cultivars of *Dahlia variabilis* Desf. stored in different substrates can be concluded that:

The cultivars included in the study: 'Veritable', 'Hayley Jane', 'Kennemerland', 'Tsuki Yori No Sisha', 'Purple Gem', were stored well in all substrates, but the best results being in the substrate composed of peat + sawdust (70% + 30%).

The smallest weight differences were observed in tuberous roots layered in the substrate composed of peat + sawdust (70% + 30%) at the cultivars 'Kennemerland', 'Tsuki Yori No Sisha' and 'Veritable', while the largest differences were recorded in layered sand roots.

The highest number of tubers belongs to the variety 'Hayley Jane'. Most tuberous dahlia roots have kept the number of tubers after stratification, which has led to changes in their weight.

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