RESEARCH ON *CANNA INDICA* L. RHIZOMES SPROUTING, UNDER THE INFLUENCE OF STORAGE CONDITIONS AND CULTIVAR

CERCETĂRI PRIVIND PORNIREA ÎN VEGETAȚIE A RIZOMILOR DE *CANNA INDICA* L., SUB INFLUENȚA CONDIȚIILOR DE PĂSTRARE ȘI A CULTIVARULUI

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Abstract. *It was studied the influence of storage conditions of Canna indica L. rhizomes, on the start of their vegetation. Were selected two locations, characterized by different temperature and humidity conditions: a warehouse and a greenhouse. Four cultivars were used in the experiment: 'Sémaphore', 'Tropical White', 'Austria' and 'Firebird'. The best results regarding the number of highlighted shoots per rhizomes were obtained at 'Austria' and 'Firebird' cultivars, stored in the greenhouse.*
Key words: *Canna indica* L rhizomes, dormancy, storage conditions.

Rezumat. *A fost studiată influența condițiilor de depozitare pe perioada repausului, a rizomilor de Canna indica L., asupra pornirii în vegetație a acestora. Au fost alese două locații caracterizate prin condiții diferite de temperatură şi umiditate: o magazie neîncălzită şi o seră. În organizarea experienței s-au utilizat rizomi proveniți de la 4 cultivare: 'Sémaphore', 'Tropical White', 'Austria' şi 'Firebird'. Cele mai bune rezultate privind numărul de lăstari formați pe rizom, au fost obținute la cultivarele 'Austria' și 'Firebird', depozitate în seră.*
Cuvinte cheie: *Canna indica* L., rizomi, repaus, condiții de depozitare.

INTRODUCTION

Genus *Canna* is native to tropical regions, the West Indies and South America, where it grows spontaneously in the mountain areas and in the plains. As ornamental plants, *Canna* species have been used in temperate regions of Europe since XVI century, where they were introduced thru Spain (Sonea și colab., 1979). In the last three decades there have been many debates regarding infragenerică classification of Cannas, currently two opinions being outlined: one according to which *Canna* genus includes 19 species (Tanaka, 2001) and the other, that supports the existence of 10 species (Kamer and Maas, 2008), of which *Canna indica* L. has the highest degree of complexity. Cannas are often used in landscape design as focal points of a group if planted solitary, but the tropical look is revealed when they are planted in floral massive, in association with other herbaceous plants. Semi hardy geophytes, Canna plants are vegetative propagated by rhizomes dividing. They have elongated shape, relatively short internodes,

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adventitious roots at nodes and buds in the axils of rudimentary leaves (squama). The rhizomes grow horizontally; they are sympodially branched and have terminal buds for annual shoot growth (Toma, 2005). Division is made after a storage period, in spaces providing the necessary conditions for rhizomes vegetative dormancy.

This paper aims to establish the influence of storage conditions of *Canna indica* L. rhizomes during dormancy period, on the start of their vegetation.

MATERIAL AND METHODS

The present research was performed in the Public Services Department's production yard, of the Bistrița City Hall, in 2011. The biological material used in experiments, was represented by the rhizomes belonging to four cultivars of *Canna indica* L. (fig.1) and harvested from field (public green spaces of Bistrița city), in November 2010: 'Sémaphore' 'Tropical White', 'Austria' and 'Firebird'.

a b c d

Fig.1. *Canna indica* L. cultivars used in the experiments:
a) 'Sémaphore', b) 'Tropical White', c) 'Austria', d) 'Firebird'

Plants were entirely removed from the field at the beginning of November, after aerial parts having been cut to approx. 15 cm. The rhizomes were stratified in a mixture of compost and sawdust and they were stored in two locations (a warehouse and a greenhouse), with different temperature and humidity conditions. During the dormancy period (November 11 – January 25), environmental condition were monitored in both locations (table 1).

Table 1

Values of environmental factors, registered in rhizomes storage locations (November-January)

Location	Air temperature (ºC)	Soil temperature (ºC)	Rel. air humidity (Rh%)	Soil humidity (%)
Warehouse	7,5	6,7	42,6	7,8
Greenhouse	16,9	14,7	60,8	12,2

After the storage period (75 days), warehouse rhizomes were brought into the greenhouse and those stored in the greenhouse were uncovered. The material was weight in order to determine how much turgidity the rhizomes have lost during storage and then it was planted in 22 cm diameter pots, into an exclusively compost substrate. The start of rhizomes vegetation was daily observed, watching the shoots emergence at the soil surface and their number, considering the two factors (fig.3).

Statistical analysis of data was based on the variance calculation on a bifactorial experiment that allowed the significance of differences interpretation

between experimental variants (Ardeleanu, 2008). Each variant was found in the experiments in three repetitions.

RESULTS AND DISCUSSIONS

In order to organize the experiment were used 12 rhizomes from each cultivar, meaning 4 rhizomes on each of the three repetitions. Following storage, it was found that all rhizomes have lost some of their mass (fig. 2, fig. 3), depending of storage conditions and the cultivar.

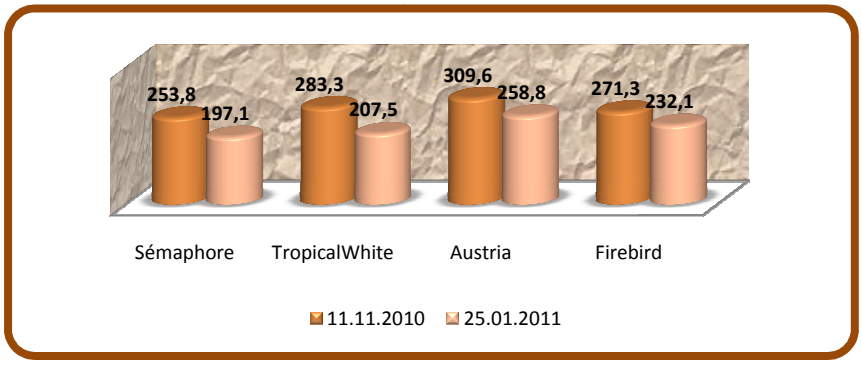

Fig. 2 - Rhizomes average mass (g), before and after storage in the warehouse

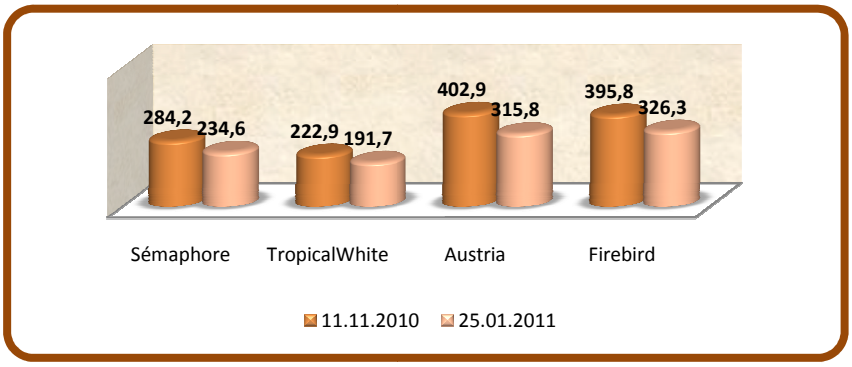

Fig. 3 - Rhizomes average mass (g), before and after storage in the greenhouse

The highest loss (26,8%), occurred at 'Tropical White' cultivar stored in the warehouse, and the lowest, at the same cultivar (14,0%), with rhizomes stored in the greenhouse (tab. 2). In table 3 are presented the average results (absolute and percentage) regarding shoots emergence at the soil surface until May 17, when the plants were transferred to field. In order to comparing the

results, it was calculated the average of variants 1-4, where the rhizomes were maintained for dormancy in an unheated warehouse.

Table 2

Percentage mass loss during rhizomes storage

Specification \ Cultivar		*Sémaphore*	*Tropical White*	*Austria*	*Firebird*
Mass loss (%)	warehouse	22,3	26,8	16,4	14,4
	greenhouse	17,5	14,0	21,6	17,6

Table 3

Experimental results regarding *Canna indica* L. rhizomes sprouting, under the influence of storage conditions and cultivar

Variant		Shoots emergence at soil surface		Period (no. of days)	Initial number of buds on the rhizome	Shoots / rhizome formed until May 17	
No.	Factor combination	first shoot	last shoot			(no.)	(%)
V1	Warehouse x Sémaphore	Feb.18	May 10	81	7,7	3,2	41,7
V2	Warehouse x Tropical White	Feb.27	May 17	79	8,3	1,3	15,8
V3	Warehouse x Austria	Feb.03	May 17	103	5,8	5,3	90,9
V4	Warehouse x Firebird	Feb.10	May 17	96	6,3	4,2	66,3
V5	Greenhouse x Sémaphore	Feb.03	May 09	95	8,5	5,2	61,2
V6	Greenhouse x Tropical White	Feb.10	May 16	95	7,8	5,4	69,7
V7	Greenhouse x Austria	Jan.28	May 17	109	6,6	6,0	91,1
V8	Greenhouse x Firebird	Jan.28	May 17	109	7,9	5,7	72,0
	Average V1-V4, Control			89,8	7,0	3,5	53,7

Analyzing the results, it is observed that the shoots were revealed in different number and percentage, depending on the storage conditions during dormancy and the cultivar. Thus, minimum values are registered at 'Tropical White' stored in the warehouse (15,8%), and the maximum at 'Austria' stored in the greenhouse (91,1%) – reporting at initial number of buds clearly defined on each rhizome, at the storage moment. Comparison to control value shows that two variants (V1 and V2) are placed under it. The period between the first and the last shoot appearance (until May 17), varies between 79 days (V2) and 109 days (V7 and V8). The results from table 4 show that a single variant (V2), records values under the control, difference being statistically assured at distinctly negative significant. Variant V7 shows a very positive significant

difference, followed by variants V5, V6 and V8, with distinctly significant positive difference from control.

Table 4

**Summary of results on *Canna indica* L.
rhizomes sprouting, under the influence of storage conditions and cultivar**

Variant		Visible shoots at soil surface		± d	Significance of difference
No.	Factor combination	Absolute (nr.)	Relative (%)		
V1	Warehouse x Sémaphore	3,2	91,4	-0,3	–
V2	Warehouse x Tr. White	1,3	37,1	-2,2	00(0)
V3	Warehouse x Austria	5,3	151,4	1,8	**
V4	Warehouse x Firebird	4,2	120,0	0,7	–
V5	Greenhouse x Sémaphore	5,2	148,6	1,7	**
V6	Greenhouse x Tr. White	5,4	154,3	1,9	**
V7	Greenhouse x Austria	6,0	171,4	2,5	***
V8	Greenhouse x Firebird	5,7	162,9	2,2	**(*)
	Average V1-V4, Control	3,5	100,0	-	-

DL 5% = 0,86 pieces DL 1% = 1,62 pieces DL 0,1% = 2,26 pieces

Table 5 data shows that the rhizomes sprouting, meaning the number of shoots formed from the existing number of buds on the rhizomes at the storage moment, was distinctly significant influenced by the storage conditions during dormancy.

Table 5

**Summary of results on *Canna indica* L.
rhizomes sprouting, under the influence of storage conditions**

Factor A graduations (storage location)	Visible shoots at soil surface		± d	Significance of difference
	Average no. of shoots /var.	(%) from control		
a1 = warehouse, Control	3,5	100,0	-	-
a2 = greenhouse	5,6	160,0	2,1	**(*)

DL 5% = 0,78 pieces DL 1% = 1,47 pieces DL 0,1% = 2,12 pieces

Table 6

**Summary of results on *Canna indica* L.
rhizomes sprouting, under the influence of cultivar**

Factor B graduations (cultivar)	Visible shoots at soil surface		± d	Significance of difference
	Average no. of shoots /var.	(%) from control		
b1 = Sémaphore	4,2	120,0	0,7	–
b2 = Tropical White	3,4	97,1	-0,1	–
b1 = Austria	5,7	162,9	2,2	***
b1 = Firebird	5,9	168,6	2,4	***
Average V1-4, Control	3,5	100,0	0	-

DL 5% = 0,82 pieces DL 1% = 1,63 pieces DL 0,1% = 2,08 pieces

Depending on cultivar (tab. 6), differences from control are statistically assured at very significant positive at 'Austria' and 'Firebird' cultivars. The values of 'Sémaphore' and 'Tropical White' cultivars are close to control, differences being insignificant. From the date of rhizomes planting in pots and start watering them (meaning actual removal from dormancy) to the date of first shoot appearance at the soil surface, there was a different period, influenced by the storage conditions and the cultivar (table 7).

The greenhouse stored rhizomes started their vegetation earlier (7,8 days) than those stored in the warehouse (20,5 days). The shortest time was registered at rhizomes stored in the greenhouse – 'Austria' and 'Firebird' cultivars (3 days), and the longest time was registered at 'Tropical White' cultivar (33 days), with rhizomes stored in the warehouse.

Table 7

Period (days) between rhizomes planting time and shoots emergence, depending on storage conditions and cultivar

Specification \ Cultivar		*Sémaphore*	*Tropical White*	*Austria*	*Firebird*	Average
No. of days from rhizomes planting to shoots emergence	warehouse	24	33	9	16	20,5
	greenhouse	9	16	3	3	7,8

CONCLUSIONS

1. During storage time in the dormancy period, the largest mass losses were registered at 'Tropical White' cultivar (26,8%), stored in the warehouse.

2. The best results regarding the number of shoots formed on the rhizome were obtained at 'Austria' and 'Firebird' cultivars, stored in the greenhouse, showing very significant positive difference from control.

3. The rhizomes stored in the greenhouse started their vegetation 12 days earlier than the rhizomes stored in the warehouse.

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