RESEARCH REGARDING FLOWERING OF SOME *CANNA INDICA* L. CULTIVARS OBTAINED FROM SEEDS, UNDER THE INFLUENCE OF SUBSTRATE IN CONTAINER CULTURE

CERCETĂRI PRIVIND ÎNFLORIREA UNOR CULTIVARE DE *CANNA INDICA* L. OBȚINUTE DIN SEMINȚE, SUB INFLUENȚA SUBSTRATULUI LA CULTURA ÎN VASE

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Abstract. *This paper aims to analyze the influence of the culture substrate on flowering of three Canna indica L. cultivars. Plants were obtained from seeds, they were grown in pots and placed in the field, using three types of substrate: rotten manure, sludge from wastewater treatment plant in Bistrița+ sand (1:1) and for the third type of substrate was fitted an aquatic culture: the flower pots were placed in containers with water, where they remained throughout the entire growing season. Observations were made on the number and size of inflorescences, statistically significant differences being observed at the number of flower stems and the number of inflorescences per plant, on aquatic culture at the 'Tropical Yellow' cultivar.*
Key words: *Canna indica L., flowering,rotten manure, sludge, aquatic culture*

Rezumat. *Lucrarea urmăreşte analiza influenței pe care o are substratul de cultură asupra înfloririi a trei cultivare de Canna indica L. Plantele au fost obținute din semințe şi au fost cultivate în vase aşezate în câmp, utilizându-se trei tipuri de substrat: mraniță, nămol provenit de la stația de epurare a apelor uzate din municipiul Bistrița + nisip (1:1), iar pentru al treilea tip de substrat a fost montată o cultură acvatică, în care ghivecele cu plante au fost introduse în vase cu apă, unde au rămas pe tot parcursul perioadei de vegetație. Au fost făcute observații asupra numărului şi dimensiunilor inflorescențelor, diferențe semnificative statistic observându-se în privința numărului tijelor florale şi al inflorescențelor pe plantă, în cazul culturii acvatice, la cultivarul 'Tropical Yellow'.*
Cuvinte cheie: *Canna indica L., înflorire,mraniță, nămol, cultura acvatică*

INTRODUCTION

As landscaping components, *Canna* plants are an impressive presence, often considered harsh by size, shape and color. In public green spaces they are successfully used along thoroughfares, in squares and parks.

Canna flowers highlight extroverted nature of these plants,by different colors, both vivid and pastel tones. They are grouped in spike inflorescences, the color being given mostly by staminodes (sterile metamorphosed stamens), style

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and stamens rather than petals. In inflorescence, flowers open one at a time, starting at its baseand the flowering period varies depending on the habitat. Thus, in areas of originthey may flourish 11 months per year, while in temperate climates Cannasflourish 5-6 months per year (Kamer and Maas, 2008).

The purpose of this paperaims to establish the influence of the culture substrateon flowering of three *Canna indica* L. cultivars.

MATERIAL AND METHOD

The experiments were conducted in the Public Services Department's production base of Bistrița City Hall, in 2011. The biological material used in experiments, was represented by planting material belonging to three *Canna indica* L. cultivars, grown from seeds: 'Tropical Rose, 'Tropical Bronze Scarlet' and 'Tropical Yellow'.

Seedlings were produced in the greenhouse, where they were kept until May 18, when they were transplanted in to pots with a volume of 7,7L and then they were placed in the field.

Three types of substrate were used: rotten manure, sludge from waste water treatment local plant (Shugeng et al., 2009) mixed with sand (1:1) and for the third type of substrate an aquatic culture was fitted: the pots with plants were introduced in rubber containers with water, having a volume of 39,5L.

Plants remained in these containers throughout the whole growing season, and the water level in the recipients was maintained at the substrate level in the pots, respectively 20 cm height. Plant maintenance was ensured by weed removing and daily watering the variants cultivated onrotten manure and sludge + sand (1:1) substrates, not using pesticidesor fertilizer products.

Observations and measurements of this study focused primarily the number of inflorescence per plant, number of flowers per inflorescence, length of floral stems and the length of spikes.

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.Organizing the experiment, 12 plants were used for each variant, and for results comparing, it was calculated the average of nine experimental variants, considering it the control.

RESULTS AND DISCUSSIONS

There were made observations on the number and size of the inflorescences, in table 1 being presented the average absolute results regarding plant flowering under the influence of culture substrate and cultivar.

Regarding the number of inflorescences per plant (table 2), the differences statistically as very significant negative from control are registered in variant V1, and the differences very significant positive compared to control, in variant V9. The data in table 3 show that the type of culture substrate influenced the number of inflorescences per plant, distinctly significant negative at the culture on rotten manure and distinctly significant positive from control ataquatic culture.

Depending on the cultivar (table 4), the results show a distinctly significant positive difference at 'Tropical Yellow' and a very significant negative difference at 'Tropical Rose'.

Table1

Experimental results on flowering of *Cannaindica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture

Variant		No. of inflor. /plant	No. of flowers /inflor.	Floral stem length (cm)	Spike length (cm)
No.	Factor combination				
V1	Rotten manure x*TropicalRose*	7,0	15,1	49,9	19,1
V2	Rotten manure x *Tropical Bronze Scarlet*	8,9	15,1	58,0	14,2
V3	Rotten manure x *TropicalYellow*	9,5	13,3	43,1	15,1
V4	Sludge+sand(1:1) x *Tropical Rose*	9,7	17,1	49,4	17,0
V5	Sludge+sand (1:1) x *Tropical Bronze Scarlet*	14,1	16,3	57,0	13,2
V6	Sludge+sand (1:1) x *Tropical Yellow*	13,4	15,6	49,1	14,2
V7	Aquatic cult. x *Tropical Rose*	12,2	16,9	49,8	17,3
V8	Aquatic cult. x *Tropical Bronze Scarlet*	14,6	15,9	52,0	14,2
V9	Aquatic cult. x *Tropical Yellow*	16,7	14,3	42,7	14,1
	Average V1-V9, Control	11,8	15,5	50,1	15,4

Table2

Number of inflorescences at*Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar, in container culture

Variant		No. of inflorescences /plant		±d	Signif. of difference
No.	Factor combination	Absolute (pieces)	Relative (%)		
V1	Rotten manure x *Tropical Rose*	7,0	59,3	-4,8	000
V2	Rotten manure x *Tr.Bronze Scarlet*	8,9	75,4	-2,9	00
V3	Rotten manure x *Tropical Yellow*	9,5	80,5	-2,3	0
V4	Sludge +sand (1:1) x *Tropical Rose*	9,7	82,2	-2,1	0
V5	Sludge +sand (1:1) x *Tr. Bronze Scarlet*	14,1	119,5	2,3	*
V6	Sludge +sand (1:1) x *Tr. Yellow*	13,4	113,6	1,6	–
V7	Aquatic cult. x *Tropical Rose*	12,2	103,4	0,4	–
V8	Aquatic cult. x *Tropical Bronze Scarlet*	14,6	123,7	2,8	**
V9	Aquatic cult. x *Tropical Yellow*	16,7	141,5	4,9	***
	Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 1,66 pieces LSD 1% = 2,33pieces LSD 0,1% = 3,29pieces

Table 3

The influence of substrate on the number of inflorescences at *Canna indica* L. plants obtained from seeds, in container culture

Factor A graduations (substrate)	No. of inflorescences /plant		± d	Signif.of difference
	Absolute (pcs.)	Relative (%)		
Rotten manure	8,5	72,0	-3,3	00
Sludge +sand (1:1)	12,4	105,1	0,6	–
Aquatic culture	14,5	122,9	2,7	**
Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 1,56pieces LSD 1% = 2,56pieces LSD 0,1% = 4,79pieces

Table 4

The influence of cultivar on the number of inflorescences at *Canna indica* L. plants obtained from seeds, in container culture

Factor B graduations (cultivar)	No. of inflorescences /plant		± d	Signif. of difference
	Absolute (pcs.)	Relative (%)		
Tropical Rose	9,6	81,4	-2,2	000
Tropical Bronze Scarlet	12,5	105,9	0,7	–
Tropical Yellow	13,2	111,9	1,4	**
Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 0,96pieces LSD 1% = 1,34pieces LSD 0,1% = 1,90pieces

Regarding the number of flowers per inflorescence, in fig. 1 can be observed that its lightly differs from control (15,5 pieces). Thus, the lowest number of flowers per inflorescence is registered in'Tropical Yellow'grown on rotten manure substrate (13,3 pieces), and the highest number of flowers per inflorescence (17,1 pieces), is registered in 'Tropical Rose'grown on sludge + sand(1:1). In each of the three cultivars, the maximum number of flowers per inflorescence was found in plants grown on sludge + sand (1:1), and the minimumin plants grown on rotten manure.

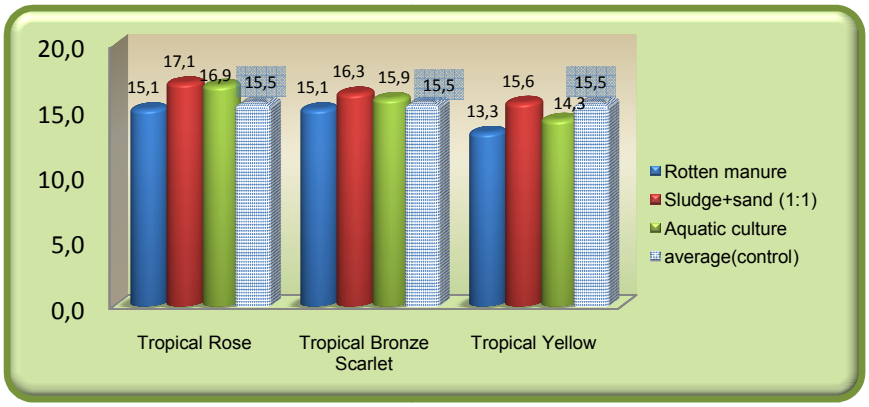

Fig.1 - Numberof flowers per inflorescence, depending on culture substrateandcultivar

The length of floral stems, which in fact represents the plant high, is analyzed in table 5. Statistically differences provided as verysignificant negative from control are registered in variants V3 and V9, and those verysignificantpositivefrom control, in variant V2.

Table 5

The length of floral stems at*Canna indica* L. plants under the influence of substrate and cultivar, in container culture

Variant		Floral stems length		± d	Signif. of difference
No.	Factor combination	Absolute (cm)	Relative (%)		
V1	Rotten manure x *Tropical Rose*	49,9	99,6	-0,2	–
V2	Rotten manure x *Tr.Bronze Scarlet*	58,0	115,8	7,9	***
V3	Rotten manure x *Tropical Yellow*	43,1	86,0	-7,0	000
V4	Sludge +sand (1:1) x *Tropical Rose*	49,4	98,6	-0,7	–
V5	Sludge +sand (1:1) x *Tr. Bronze Scarlet*	57,0	113,8	6,9	**
V6	Sludge +sand (1:1) x *Tr. Yellow*	49,1	98,0	-1,0	–
V7	Aquatic cult. x *Tropica lRose*	49,8	99,4	-0,3	–
V8	Aquatic cult. x *Tr. Bronze Scarlet*	52,0	103,8	1,9	–
V9	Aquatic cult. x *Tropical Yellow*	42,7	85,2	-7,4	000
	Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 3,56cm LSD 1% = 4,99cm LSD 0,1% = 7,05cm

Tabl e6

The influence of substrateon floral stems length at*Canna indica* L. plants obtained from seeds, in container culture

Factor A graduations (substrate)	Floral stems length		± d	Signif. of difference
	Absolute (cm)	Relative (%)		
Rotten manure	50,3	100,4	0,2	–
Sludge +sand (1:1)	51,8	103,4	1,7	–
Aquatic culture	48,2	96,2	-1,9	–
Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 2,88cm LSD 1% = 4,76 cm LSD 0,1% = 8,91 cm

Table 7

The influence of cultivar on floral stems length at*Cannaindica* L. plants obtained from seeds, in container culture

Factor B graduations (cultivar)	Floral stems length		± d	Signif. of difference
	Absolute (cm)	Relative (%)		
Tropical Rose	49,7	99,2	-0,4	–
Tropical Bronze Scarlet	55,7	111,2	5,6	***
Tropical Yellow	45,0	89,8	-5,1	000
Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 2,05 cm LSD 1% = 2,88 cm LSD 0,1% = 4,07 cm

Table 6 shows that the length of flower stems and the default plant height is not significantly influenced by substrate type, instead it varies depending on the cultivar (table 7). Differences statistically significant at very negative compared to control are registered in 'Tropical Yellow' and the very significant positive differences in 'Tropical Bronze Scarlet' cultivar.

Spike length is shown in fig. 2. The smallest inflorescences were registered at 'Tropical Bronze Scarlet' (13.2 cm) grown onsludge + sand (1:1) substrate, and the longest in 'Tropical Rose' grown on rotten manure substrate (19.1 cm).

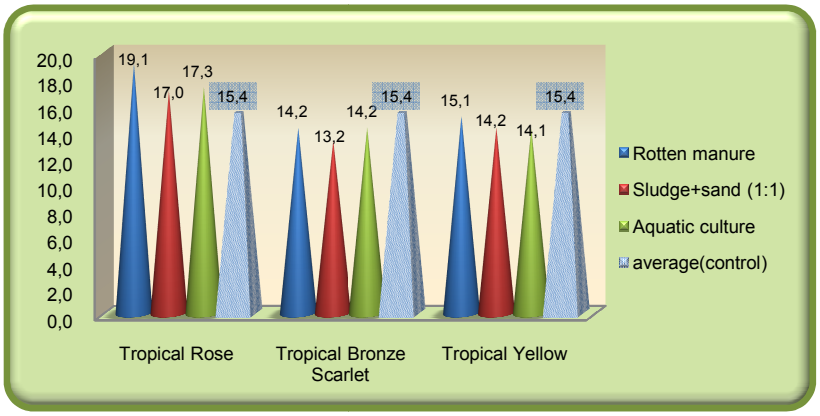

Fig.2 -Spike length (cm) depending on culture substrate and cultivar

CONCLUSIONS

1. *Canna indica* L. plants can be successfully grown as water plants, in this study the largest number of inflorescences per plant being registeredat 'Tropical Yellow' cultivar in aquatic culture.

2. At all three studied cultivars the maximum number of flowers per inflorescence was registeredat plants grown onsludge + sand (1:1) substrate, and the minimum number at plants cultivated on rotten manure.

3. Both, length of flower stems (plant height) and spikes length were not significantly influenced by any of the three used substrates, the differences being observed between cultivars.

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