

# RESEARCH REGARDING RHIZOMES DEVELOPMENT OF THREE *CANNA INDICA* L. CULTIVARS OBTAINED FROM SEEDS, UNDER THE INFLUENCE OF SUBSTRATE IN CONTAINER CULTURE

## CERCETĂRI PRIVIND DEZVOLTAREA RIZOMILOR DE *CANNA INDICA* L., LA TREI CULTIVARE OBȚINUTE DIN SEMINȚE, SUB INFLUENȚA SUBSTRATULUI LA CULTURA ÎN VASE

**POPESCU Liana<sup>1</sup>, ZAHARIA D.<sup>2</sup>**

e-mail: popescu.liana@primariabistrita.ro

**Abstract.** *In relation to the soil, Canna plants are relatively flexible and can be grown on sandy soils, clay or intermediate. Given that most parental species grow in wetlands, a number of Canna cultivars can be used as water plants. This study aims rhizomes development of three Canna indica L. cultivars obtained from seeds, under the influence of three types of substrate: rotten manure, sludge from wastewater treatment plant in Bistrița mixed with sand (1:1) and for the third type of substrate an aquatic culture was fitted. Following rhizomes measurements, the most relevant results were obtained for aquatic culture at all three cultivars, regarding both mass rhizomes and number of highlighted buds on rhizomes, at harvest.*

**Key words:** *Canna indica L., rhizomes, rotten manure, sludge, aquatic culture*

**Rezumat.** *În relația cu solul, plantele de Canna sunt relativ flexibile, putând fi cultivate pe soluri nisipoase, argiloase sau intermediare. Având în vedere faptul că majoritatea speciilor parentale de Canna cresc în zone mlăștinoase, o serie de cultivare pot fi utilizate ca plante de apă. Acest studiu urmărește dezvoltarea rizomilor la trei cultivare de Canna indica L. obținute din semințe, sub influența celor trei tipuri de substrat utilizate: mraniță, nămol provenit de la stația de epurare a apelor uzate din municipiul Bistrița în amestec cu nisip (1:1), iar pentru al treilea tip de substrat a fost montată o cultură acvatică. În urma biometrizării rizomilor, cele mai relevante rezultate s-au obținut în cazul culturii acvatice, la toate cele trei cultivare, atât în ceea ce privește masa rizomilor formați, cât și numărul mugurilor evidențiați pe rizomi la recoltare.*

**Cuvinte cheie:** *Canna indica L., rizomi, mraniță, nămol, cultura acvatică*

### INTRODUCTION

Extremely versatile, *Canna indica* L. plants have a wide range of use. Thus, they can be successfully grown directly in the ground or in pots, in private gardens and public green areas, in rounds, flats or spots, offering an exotic note for these plantations. Regarding soil, Cannas grow well on sandy

---

<sup>1</sup>Bistrița City Hall – Public Services Department, Romania

<sup>2</sup>University of Agricultural Science and Veterinary Medicine of Cluj-Napoca, Romania

soils, clay or intermediate. Given that most parental species grow in wetlands, a growing number of *Canna* cultivars can be used as water plants (Cooke, 2001).

The purpose of this paper aims to establish the influence of culture substrate on rhizome development at *Canna indica* L. plants grown from seed.

## 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 into 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 wastewater treatment local plant (Shugeng et al., 2009) mixed with sand (1:1) and for the third type of substrate an aquatic culture (fig. 1) was fitted: the pots with plants were introduced in rubber containers with water, having a volume of 39,5 L.

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 on rotten manure and sludge + sand (1:1) substrates, not using pesticides or fertilizer products.

At the end of the growing season plants were extracted from pots and biometric measurements were performed on rhizomes, observations mainly aiming mass, length and diameter, as well as clearly defined number of buds, which will provide new shoots in the following year.

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).



**Fig.1 - Aquatic culture**

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

Observations were made on rhizomes parameters, in table 1 being presented the average absolute results regarding their development under the influence of culture substrate and cultivar.

Table1

**Rhizomes parameters in harvesting the *Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture**

Variant		Mass (g)	Length (cm)	Diameter (cm)	No. of buds
No.	Factor combination				
V1	Rotten manure x <i>Tropical Rose</i>	162,1	14,7	1,7	11,5
V2	Rotten manure x <i>Tropical Bronze Scarlet</i>	116,3	11,6	1,7	11,1
V3	Rotten manure x <i>Tropical Yellow</i>	188,3	19,9	2,0	15,36
V4	Sludge +sand (1:1) x <i>Tropical Rose</i>	153,8	14,2	1,9	11,5
V5	Sludge +sand (1:1) x <i>Tropical Bronze Scarlet</i>	138,3	11,9	1,9	13,0
V6	Sludge +sand (1:1) x <i>Tropical Yellow</i>	294,2	21,0	2,3	19,0
V7	Aquatic cult. x <i>Tropical Rose</i>	554,2	21,4	2,3	24,1
V8	Aquatic cult. x <i>Tropical Bronze Scarlet</i>	546,3	19,5	2,1	21,8
V9	Aquatic cult. x <i>Tropical Yellow</i>	758,8	22,3	2,3	33,9
	Average V1-V9, Control	323,6	17,4	2,0	17,9

Table2

**Rhizome mass in harvesting the *Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture**

Variant		Rhizome mass		±d	Signif. of difference
No.	Factor combination	Absolute (g)	Relative (%)		
V1	Rotten manure x <i>Tropical Rose</i>	162,1	50,1	-161,5	0
V2	Rotten manure x <i>Tropical Bronze Scarlet</i>	116,3	35,9	-207,3	00
V3	Rotten manure x <i>Tropical Yellow</i>	188,3	58,2	-135,3	–
V4	Sludge +sand (1:1) x <i>Tropical Rose</i>	153,8	47,5	-169,8	0
V5	Sludge +sand (1:1) x <i>Tropical Bronze Scarlet</i>	138,3	42,7	-185,3	0
V6	Sludge +sand (1:1) x <i>Tropical Yellow</i>	294,2	90,9	-29,4	–
V7	Aquatic cult. x <i>Tropical Rose</i>	554,2	171,3	230,6	**
V8	Aquatic cult. x <i>Tropical Bronze Scarlet</i>	546,3	168,8	222,7	**
V9	Aquatic cult. x <i>Tropical Yellow</i>	758,8	234,5	435,2	***
	Average V1-V9, Control	323,6	100,0	-	-

LSD 5% = 138,21g

LSD 1% = 194,01g

LSD 0,1% = 273,89 g

Table 2 data shows that after rhizome weighing, the differences statistically as distinctly significant negative from control are recorded in variant V2, and those very significant positive compared to control, in variant V9. Mass rhizomes was influenced by culture substrate (table 3), in a distinctly negative significant way in rotten manure case and very positive significant way from control in aquatic culture case. The cultivar was not a relevant factor in rhizomes growth. As can be noted from table 4

data, only at 'Tropical Yellow' cultivar a positive significant difference from control was registered.

Table 3

**The influence of substrate on rhizome mass inharvesting the *Canna indica* L. plants obtained from seeds, in container culture**

Factor A graduations (substrate)	Rhizome mass		± d	Signif.of difference
	Absolute (g)	Relative (%)		
Rotten manure	155,6	48,1	-168,0	00
Sludge +sand (1:1)	195,4	60,4	-128,2	0
Aquatic culture	619,8	191,5	296,2	***
Average V1-V9, Control	323,6	100,0	-	-

LSD 5% = 85,38g

LSD 1% = 141,27g

LSD 0,1% = 264,42g

Table4

**The influence of cultivar on rhizome mass inharvesting the *Canna indica* L. plants obtained from seeds, in container culture**

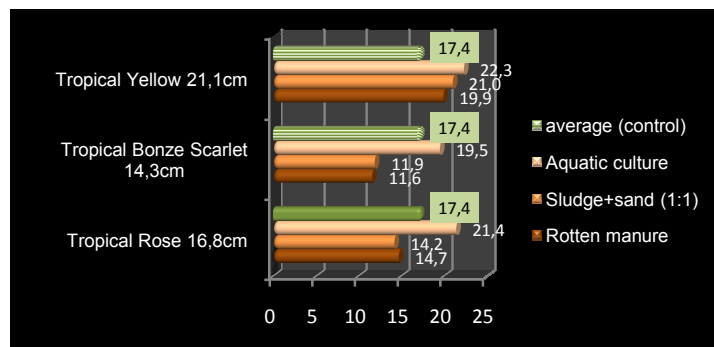
Factor B graduations (cultivar)	Rhizome mass		± d	Signif.of difference
	Absolute (g)	Relative (%)		
<i>Tropical Rose</i>	290,0	89,6	-33,6	—
<i>Tropical Bronze Scarlet</i>	267,0	82,5	-56,6	—
<i>Tropical Yellow</i>	413,8	127,9	90,2	*
Average V1-V9, Control	323,6	100,0	-	-

LSD 5% = 79,80g

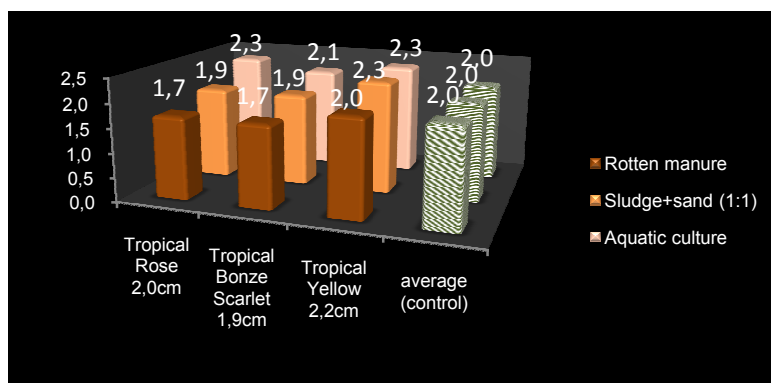
LSD 1% = 112,01g

LSD 0,1% = 158,13g

The length of formed rhizomes is graphic represented in fig.2, the highest value being registered at 'Tropical Yellow' cultivar with an average of 21,1cm, higher than the control (17,4cm), and the lowest at 'Tropical Bronze Scarlet' (14,3cm). Regarding the diameter of rhizomes (fig.3.), the same cultivar, 'Tropical Yellow', shows an average value of 2,2 cm, higher than the control (2,0cm), while 'Tropical Bronze Scarlet' has 1,9 cm diameter rhizomes. In each of three studied cultivars, rhizomes with the largest dimensions were formed in aquatic culture.



**Fig. 2** - Rhizomes length (cm) in harvesting the *Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture



**Fig. 3** - Rhizomes diameter (cm) in harvesting the *Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture

Analyzing table 5 data can be observed that the number of buds clearly defined at plants harvesting from field at the end of growing season, differs depending both on culture substrate and on cultivar. The differences from control provided as very significant negative, stand at variants V2 and V4, while those very significant positive, at variants V7 and V9. According to table 6, distinctly negative significant differences are observed at rotten manure and sludge + sand (1:1) substrates and those very significant positive at aquatic culture. Depending on cultivar (table 7), the highest number of buds was registered at 'Tropical Yellow' with a very significant positive difference from control.

Table 5

**Number of buds on rhizomes in harvesting the *Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture**

No.	Variant Factor combination	No. of buds / rhizome		± d	Signif. of difference
		Absolute (pieces)	Relative (%)		
V1	Rotten manure x <i>Tropical Rose</i>	11,5	64,2	-6,4	—
V2	Rotten manure x <i>Tropical Bronze Scarlet</i>	11,1	62,0	-6,8	000
V3	Rotten manure x <i>Tropical Yellow</i>	15,6	87,2	-2,3	—
V4	Sludge + sand (1:1) x <i>Tropical Rose</i>	11,5	64,2	-6,4	000
V5	Sludge + sand (1:1) x <i>Tropical Bronze Scarlet</i>	13,0	72,6	-4,9	00
V6	Sludge + sand (1:1) x <i>Tropical Yellow</i>	19,0	106,1	1,1	—
V7	Aquatic cult. x <i>Tropical Rose</i>	24,1	134,6	6,2	***
V8	Aquatic cult. x <i>Tropical Bronze Scarlet</i>	21,8	121,8	3,9	*
V9	Aquatic cult. x <i>Tropical Yellow</i>	33,9	189,4	16,0	***
	Average V1-V9, Control	17,9	100,0	-	-

LSD 5% = 3,04pieces

LSD 1% = 4,27pieces

LSD 0,1% = 6,02pieces

Table 6

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

Factor A graduations (substrate)	No. of buds / rhizome		± d	Signif. of difference
	Absolute (pieces)	Relative (%)		
Rotten manure	12,7	71,1	-5,2	00
Sludge + sand (1:1)	14,5	81,0	-3,4	00
Aquatic culture	26,6	148,6	8,7	***
Average V1-V9, Control	17,9	100,0	-	-

LSD 5% = 1,81pieces      LSD 1% = 2,99pieces      LSD 0,1% = 5,60pieces

Table 7

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

Factor B graduations (cultivar)	No. of buds / rhizome		± d	Signif. of difference
	Absolute (pieces)	Relative (%)		
<i>Tropical Rose</i>	15,7	87,7	-2,2	0
<i>Tropical Bronze Scarlet</i>	15,3	85,5	-2,6	00
<i>Tropical Yellow</i>	22,8	127,6	4,9	***
Average V1-V9, Control	17,9	100,0	-	-

LSD 5% = 1,75 pieces      LSD 1% = 2,46 pieces      LSD 0,1% = 3,48 pieces

## CONCLUSIONS

1. Rhizomes with the largest mass at the end of the growing season, were obtained in aquatic culture, for each of the three studied cultivars; among them, the best results were observed at 'Tropical Yellow' (758,8 g).

2. The longest rhizomes developed at 'Tropical Yellow' cultivar in aquatic culture (22,3 cm), and the highest values of rhizome diameter (2,3 cm) were registered at two cultivars: 'Tropical Yellow' in aquatic culture and sludge + sand (1:1), respectively 'Tropical Rose' in aquatic culture.

3. Regarding the number of buds clearly defined on rhizomes in plants harvesting at the end of growing season, the best results were observed at all three studied cultivars, in aquatic culture, the maximum number of buds occurring at 'Tropical Yellow' cultivar (33,9 pieces).

## REFERENCES

1. Ardelean M., 2008 - *Principii ale metodologiei cercetării agronomice și medical veterinare*. Ed. Academic Press Cluj – Napoca.
2. Cooke I., 2001 - *The Garden's Guide To Growing Cannas*. Timber Press, Portland, Oregon.
3. Shugeng Li, Kefang Zhang, Shaoqi Zhou, Liqiu Zhang, Qiuli Chen, 2009 - *Use of dewatered municipal sludge on Canna growth in pot experiments with a barren clay soil*. Waste Management, nr. 29: 1870–1876.