

BEHAVIOR OF CERTAIN POTATO VARIETIES IN THERMO-HYDRIC STRESS CONDITIONS

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ABSTRACT. Environmental stresses result in water deficiency for the plants, thus impairing its numerous biological roles. Taking into account the need for production of early potato for consumption, we considered it necessary to test potato varieties, installing experience in the greenhouse. Watering was discontinued after three weeks of starting tuberization. The biological material used was plantlets and microtubers. We used five potato varieties: Christian, Roclas, Astral, Magic, Loial. Loial and Christian varieties achieved the highest values of tubers number / plant (3.65, 2.45 minitubers/ plant). Average weight of minitubers was influenced by planting material and varieties tested, ranging from 19.97 g / minitub at Christian variety, and 6.17 g / minitub at Loial variety.

Keywords: plantlets, microtubers, minitubers, thermo-hydric stress, greenhouse

INTRODUCTION

Plants are exposed throughout their lives, to many factors of stress, which cause changes in normal physiological function in all plants, including with important economic impacts on crops. Due to sedentary lifestyles, plants use a variety of strategies for different types of stress response to abiotic (drought, salinity, radiation, high or low temperatures, inundation, etc..) and biotic (pathogens, competition with other organisms), that changes the balance of plant-environment (Epstein et al., 1980) reduce the biosynthetic capacity of the plant and cause damage that can destroy the plant. Drought-stress leads to disruption of water potential gradients, loss of turgor, disruption of membrane integrity, and denaturation of proteins (Ingram and Bartels, 1996).

Global climate change manifested by increasing temperature, and rainfall regime change, have led in recent decades, an increase in drought affected areas worldwide.

Water deficit is a common stress in potato production, which leads to a lower production and quality of potato. Because potato drought sensitivity (Hassapanah et al., 2008, quoted by Sakthivelu et al., 2008), water is necessary to increase the quality and potato production. Water deficit is a problem in several regions, due to temperature changes (Sakthivelu et al.,

2008), being requiring study of drought resistance for different varieties.

In the moment of emergence, drought reduced growth of roots. Drought installed after plant emergence inhibits stoloning, reducing the number of tubers. These processes are irreversible, even though soil moisture recovers later. Drought between risen and buds, hinders development of plants and extended tubers development period (Ianos, 2002).

Because of the high percentage of clay, acid soils can hold, even during wet seasons, only a small amount of water from rainfall, so water supply is insufficient for long-term (Sand et al. 2008).

Taking into account the need for production of early potato for consumption, we considered it necessary to test potato varieties, installing experience in the greenhouse. Watering was discontinued after three weeks of starting tuberization.

MATERIALS AND METHODS

It have been studied experimental variations shown in the table 1, the experience is bifactorial, such as 5 x 2, made by combining two experimental factors, the number of variants investigated was 10. The experience was mounted in 2011, in Brasov INCDCSZ greenhouses, including variants presented in Table 1.

Table 1

Experimental variants

Variant	Variety (a)	Biological material (b)
V ₁	Christian (a ₁)	Microtubers (b ₁)
V ₂		„In vitro” plantlets (b ₂)
V ₃	Roclas (a ₂)	Microtubers (b ₁)
V ₄		„In vitro” plantlets (b ₂)
V ₅	Astral (a ₃)	Microtubers (b ₁)
V ₆		„In vitro” plantlets (b ₂)
V ₇	Magic (a ₄)	Microtubers (b ₁)
V ₈		„In vitro” plantlets (b ₂)
V ₉	Loial (a ₅)	Microtubers (b ₁)
V ₁₀		„In vitro” plantlets (b ₂)

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From Table 1 results that the experience bifactorial 5 x 2, with 10 variants was performed using the following factors graduations of study:

- experimental factor, the variety with five graduations:
 - a1-Christian
 - a2-Roclas
 - a3-Astral
 - a4-Magic
 - a5-Loial
- experimental factor b, the biological material with two graduations:
 - b1-microtubers
 - b2- "in vitro " plantlets

Research objectives are focused on implementing of new technological solutions and concepts for the production of early potatoes for consumption in thermo-hydric stress;

- checking termo-hidric's resistance to stress, of the early and semi-early potato varieties and validation of results

RESULTS AND DISCUSSION

Results regarding the number of tubers / plant

The total minitubers number obtained at harvest, as overall average is higher when using microtubers (2.62 minitub.) compared with plantlets (2.4 minitub), so using microtubers increases termo-hydric stress resistance. In terms of varieties obtained on calibration class (Table 2) predominant is fraction > 25 mm, which registered the highest number of minitubers, respectively 1.04 for minitubers, followed by fraction of 15-25 mm, resulting of plantlets using 0.98. minitub., and respectively 0.78 minitubers at microtubers using.

Table 2

The average number of minitubers obtained

Size fraction (mm)	Average number of minitubers obtained from microtubers		Average number of plasntlets obtained from minitubers	
	Number	%	Number	%
<15	0.8	30.53	0.72	30.00
15-25	0.78	29.77	0.98	40.83
>25	1.04	39.69	0.7	29.17
Total	2.62	100	2.4	100

Statistical interpretation of minitubers number

Bifactorial statistical analysis was made of the number of minitubers obtained from the five varieties. The variety was the first factor examined, the second factor was the biological material. In terms of the influence of the variety (Table 3), we see that the four

varieties showed different results, from very significant negative for Magic and Astral varieties (-2.05 and -1.9 minitub. / pl) insignificant for Loial variety (1.2 minitub. / pl). It can be seen that Christian, Loial and Roclas are varieties with resistance to thermal hydric stress.

Table 3

Variety influence on the number of minitubers

Variety	Average number of minitubers, obtained / plant		Differences	Significance
	Number	%		
Christian (Ct)	3.65	65.75	-	-
Roclas	2.4	47.95	-1.25	0
Astral	1.75	67.12	-1.9	000
Loial	2.45	43.84	-1.2	n.s.
Magic	1.6	65.75	-2.05	000

DLa 5% =1,22 (minitub.) DLa 1% =1,33 (minitub.) DLa 0,1% =1,54 (minitub.)

By comparing the results obtained at the variants planted with microtubers and plantlets (Table 4) it is found that the average number of minitubers was close, difference being very significant negative, by

-0.5 minitub. / plant. Thus, to increase resistance to thermo-hydric stress for potato, it is recommended to use microtubers.

Table 4
Influence of biological material over the minitubers number

Variety	Average number of minitubers, obtained / plant		Differences	Significance
	Number	%		
Microtubers (Ct)	2,62	100,00	-	-
Plantlets	2,12	80,92	-0,5	ooo

DLb 5% =0,11 (minitub.)

DLb 1% =0,16 (minitub.)

DLb 0,1% =0,24 (minitub.)

In the case of the combined influence of the biological material and varieties studied (Table 5), were obtained differences very significant negative, statistically assured for Roclas Astral, Loial and Magic varieties, (-0.80

minitub. / plant, -0.50 minitub. / plant, -1.1 minitub. / plant) and a significant difference, negative, for Magic variety (-0.2 minitub. / plant).

Table 5
Influence of variety and biological material over the number of minitubers obtained/ plant

Variety / Biological material	Christian		Roclas		Astral		Loial		Magic	
	Nr.	Dif. Semn	Nr.	Dif. Semn	Nr.	Dif. Semn	Nr.	Dif. Semn	Nr.	Dif. Semn
Microtub (Ct)	3,60	-	2,80	-	2,00	-	3,00	-	1,70	-
Plantlets	3,70	0,1 ns	2,00	-0,80 000	1,50	-0,50 000	1,90	-1,1 000	1,50	-0,2 0

DLa 5% =0,20 (minitub.)

DLa 1% =0,28 (minitub.)

DLa 0,1% =0,41 (minitub.)

Results on the average weight of minitubers

From examining the results on the average weight of minitubers obtained (Table 6), it is observed that for biological material- microtubers, the highest value of weight was obtained at size > 25 mm, followed by 15-25 mm size.

In the case of plantlets were not obtained tubers > 25 mm for Roclas and Loial varieties;

At the five varieties studied, from use as biological material of microtubers, the highest values of average weight of minitubers formed, were obtained from size >

25 mm, representing 22.19 g / minitub for the Christian variety, and the smallest value, for the same size, is registered for Loial variety (7.09 g / minitub).

At plantlets, the highest weight of minitubers, from class > 25 mm was recorded also at the Christian variety (11.48 g / minitub) and the lowest value, was recorded for Magic variety (5.99 g / minitub).

For size fractions <15 mm and 15-25 mm, values differ from variety to variety and biological material used (table 6).

Table 6
The average weight of minitubers on fraction size (g)

Variety/ Size fraction (mm)	Christian	Roclas	Astral	Loial	Magic	Averagr
	Weight (g)	Weight (g)	Weight (g)	Weight (g)	Weight (g)	Weight (g)
Microtubers						
<15	0.48	0.66	3.83	0.54	0.60	1.22
15-25	2.21	2.62	2.75	2.36	2.99	2.58
>25	22.19	8.69	15.43	7.09	8.85	12.45
Plantlets						
<15	1.52	0.51	0.81	0.54	0.51	0.78
15-25	2.06	4.43	1.75	1.82	1.60	2.33
>25	11.48	0.00	7.40	0.00	5.99	4.97

Statistical interpretation of the minitubers weight

In the case of bifactorial statistical analysis of minitubers average weight (Table 7), we can be said regarding the influence of variety over this, that the Astral variety (15.98 g / minituber) produce minitubers with an average weight close to the Christian variety

(19.97 g / minituber) (the difference is insignificant); the Roclas and Magic varieties, because they have produced a large number of minitubers, have an average weight of minitubers low (8.46 g and 10.26 g / minitub) with significant differences -11.51 g, -9.71 g / minitub).

Table 7

Influence of variety on average weight of minitubers obtained

Variety	The average weight of a minituber		Differences (g)	Significance
	g	%		
Christian (Ct)	19.97	100	-	-
Roclas	8.46	42.36355	-11.51	0
Astral	15.98	80.02003	-3.99	n.s.
Loial	6.17	30.89634	-13.80	00
Magic	10.26	51.37707	-9.71	0

DLa 5% =10,52 (g) DLa 1% =12,39 (g) DLa 0,1% =13,84 (g)

In the case of comparing the biological material used (Table 8), good results were obtained using microtubers, this material having thermo-hydric stress tolerance.

The statistical interpretation of the results shows that at plantlets, significant differences are obtained in the negative sense of -8.18 g / minitub., statistically assured.

Table 8

Influence of biological material used on the average weight of minitubers obtained

Variety	The average weight of minitubers		Differences (g)	Significance
	g	%		
Microtubers (Ct)	16,26	100,00	-	-
Plantlets	8,08	46,69	-8,18	ooo

Statistical analysis of the combined influence of the biological material and the variety used (Table 9) over the average weight / minitub., shows that the results obtained per varieties were very different, and between the biological material used in planting, for each variety,

the differences obtained were between insignificant for Magic variety (-2.17 g / minitub) to very significant, but negative in all other varieties, the largest difference occurring at Astral by -12.05 g / minitub.

Table 9

Influence of variety and biological material on the average weight of minitubers

Variety/ Biological material	Christian		Roclas		Astral		Loial		Magic	
	Weight (g)	Dif. (g) Semn.	Weight (g)	Dif. (g) Semn.	Weight (g)	Dif. (g) Semn.	Greutate (g)	Dif. (g) Semn.	Greutate (g)	Dif. (g) Semn.
Microtubers (Ct)	24,88	-	11,97	-	22,01	-	9,99	-	12,44	-
Plantlets	15,06	-9,82 000	4,94	-6,96 000	9,96	-12,05 000	2,36	-7,63 000	8,1	-2,17 n.s.

DLa 5% =2,77 (g) DLa 1% =4,09 (g) DLa 0,1% =6,01 (g) n.s. = not significant

CONCLUSIONS:

Loial and Christian varieties achieved the highest values of tubers number / plant (3.65, 2.45 minitubers / plant).

Number of minitubers obtained depending by the planting material is more at microtubers planting compared to plantlets being by 2.62 tubers / plant (by using microtubers) and 2.12 tubers / plant (by using plantlets).

Average weight of minitubers was influenced by planting material and varieties tested, ranging from 19.97 g / minitub at Christian variety, and 6.17 g / minitub at Loial variety.

Research has established genotypes resistant to stress, knowing that at potato plants are exposed throughout their lives, to many stressors, which cause changes in normal physiological function in all plants, including important economic impacts on plants culture.

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