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Producing potato microtubers under the effect of food colorant

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Abstract Three Romanian potato genotypes (Solanum tuberosum L.) Roclas, Rustic and Zamolxis were induced to form microtubers under the influence of six food colorants red; yellow; blue; violet; green; colourless (control medium). The objective of this study was to investigate whether an adition of food colorant in Murashige & Skoog medium would improve microtuberization. It was analyzed two parameters: number of microtubers/plant and weight of a microtuber. Green food colorant registered good results regarding the second element had studied (wieght) for Rustic and Zamolxis varieties (0,6266 and 0,6129 g).

Key words

plantlets, varieties, microtubers, colorant food

Rapid multiplication is an intensive method used to increase the nuclear stock for production potato seed. This technique is widely used in many countries [2; 4] is very flexible and gives a high rate of multiplication. Conventional method for seed potato production shows a low coefficient and the material obtained has a high risk of infection with viruses. Using micromultiplication techniques opened up new prospects in production and multiplication of seed potato. These techniques allow better control and maintain the vigor of growth and a more efficient control of plant health [3].

Microtuber production is an important method of rapid multiplication, for obtaining pre-base stock germplasm exchange. Microtuberisation is a highly complex process, which modified in various ways, increases the capacity of plantlets to produce microtubers. Microtuberization is dependent on a number of factors, such as photoperiod, phytohormones combination, the composition of the nutrient medium, etc.

Conventional propagation of potato is done vegetatively by using seed tubers, to ensure uniformity of the crop in terms of growth and yield, but a common drawback is due to degeneration of the crop because of virus infections, the rate of degeneration varying from place to place and from a cropping season to another. The viruses are transmitted through different ways including planting of infected tubers. If the seed stock is not properly maintained or frequently replaced with fresh one, the virus infiltration can reduce to almost half or even one third of the yields[1].

General objective of this research is: identifying the best media which contains food colorant for microtuberization and identification of varieties suitable to microtuberization.

Materials and Method

Microcuttings resulting from uninodal segmentation were inoculated, in recipients containing Murashige & Skoog (1962) medium enriched with naphthyl acetic acid and 20 g / l sugar, and five food colorants (figure 1); the culture vessels were placed in the growth chamber, ensuring a light and temperature regime required for growth and development of the plantlets (figure 2). After 4 weeks, in recipients with developed plantlets and was applied microtuberization medium and consisted of ½ MS supplemented with sucrose, coumarin, kinetin and different food colorants (figures 3). The cultures were incubated in the dark at a temperature of 16-18ºC for 12 weeks. After microtubers were harvested.

The results were transformed by variation analysis; significance of differences was determined by the method of multiple comparisons (Duncan test).

In Laboratory of Vegetal Tissue Cultures of National Institute of Research and Development for Potato and Sugar Beet Brasov, in 2015, was undertaken a bifactorial experience such as: 3x6, divided on 3 repetitions. It was studied the influence food colorants (table 1) on microtuberization. For coloring the medium, can be use several types of substances. This must be tested and should satisfy the following requirements: not be toxic to plants; not cause coloring plant tissues; do not form toxic compounds by decomposition or reaction with other components of the culture medium; be stable and not discolored by autoclaving; to keep color under artificial lighting.

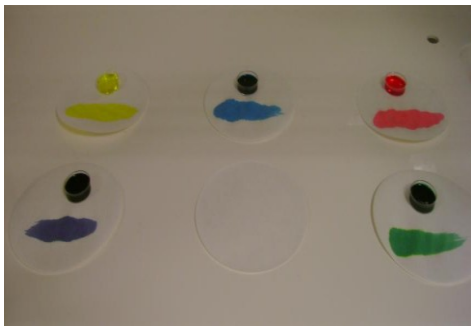

Fig. 1. Food colorant used.

Fig. 2. Plantlets developed on medium with different food colorants

Fig. 3. Medium of microtuberization with food colorants

Research was made using next factors:

– Experimental factor A- – variety with 3 degrees;

a_1- Roclas;

a_2- Zamolxis;

a_3 – Rustic.

– Experimental factor B – food colorant with 6 degrees

- b_1- red;
- b_2- yellow;
- b_3- blue;
- b_4- violet;
- b_5- green;
- b_6 – colourless.

Table 1

Food colorants concentrations used in medium of microtuberization

Induced color to medium	Colorant	Colorant to 100 ml medium
BLUE	Liquid food colorant	1ml
YELLOW	Powder food colorant	0,01g
GREEN	Mixture of blue and yellow colorants	1ml+0,01g
VIOLET	Mixture of blue and red colorants	1ml+0,01g
RED	Powder food colorant	0,01g

Results and Discussions

It was made statistical analysis of experimental results obtained on the number of microtubers and their weight (fig. 4). Regarding the influence of variety, it highlights the variety Roclas (1,646 microtubers), this significantly differing by Zamolxis and Rustic varieties (1.271 and 0.9167 microtubers) in the number of microtubers produced / culture vessel. Examining the second parameter, weight of microtubers can be observed that Roclas variety recorded the highest value (table 2).

In experience was used as the control sample the colourless medium. Medium which contained food colorant violet and blue determined obtaining the grandest number of microtubers (1.708 and 1.542 microtubers) with the same degree of significance. Regarding the second characteristic analyzed, the weight of microtubers, using green food colorant, determined production of microtubers with the high weight values (0.4693g), which was significantly different from the other variants (table 3).

From examination of microtuber number depending on food colorant used in microtuberization medium are highlighted blue and violet colorant for Roclas variety (2.250, 2.125 microtubers/plantlet) and green for Zamolxis (1 microtuber). Yellow colorant transmits for Rustic variety obtaining of a low number of microtubers (0.625 microtubers). For the influence of interaction variety – food colorant over average weight of a microtuber, the highest values were obtain for Rustic and Zamolxis varietis (0,6266 and 0,6129 g), by using green colorant (table 4, figure 5).

Fig. 4. Microtubers obtained on microtuberisation medium with different food colorants

Fig. 5. Microtubers obtained on medium microtuberisation medium with green food colorant

Table 2

The average number of microtubers / plantlets and weight of a microtuber

Variety	Average number of microtubers/plantlet	Duncan test	The average weight of amicrotubercul (g)	Duncan test
Roclas	1.646	A	0,1757	A
Zamolxis	1.271	B	0,3378	A
Rustic	0.9167	B	0,3626	A

Media that are in the same column followed by the same letters are not significant, according to Duncan test ($p \leq 0.05$).

LSD=0.3620 microtubers LSD=0,2378 g

Table 3

The effect of food colorants introduced into the microtuberization medium over average number of microtubers / plantlets and weight of a microtuber

Food colorant	Average number of microtubers/plantlet	Duncan test	The average weight of amicrotubercul (g)	Duncan test
Red	1.208	B	0.2438	B
Yellow	1.000	B	0.3047	B
Blue	1.542	A	0.2449	B
Violet	1.708	A	0.1982	B
Green	1.208	B	0.4693	A
Colourless	1.000	B	0.2915	B

Media that are in the same column followed by the same letters are not significant, according to Duncan test ($p \leq 0.05$).

LSD=0.3620 microtubers LSD=0,2378 g

Table 4

The combined influence of variety and food colorant on the number and weight of microtubers

Variety	Food colorant	Average number of microtubers/plantlet	Duncan Test	The average weight of a microtubercul (g)	Duncan test
Roclas	Red	1.250	CDE	0,1637	B
	Yellow	1.250	CDE	0,3322	AB
	Blue	2.250	A	0,1183	B
	Violet	2.125	A	0,0992	B
	Green	1.750	B	0,1685	B
	Colourless	1.250	CDE	0,1726	B
Zamolxis	Red	1.500	BC	0,2675	B
	Yellow	1.125	CDE	0,4010	AB
	Blue	1.000	CDE	0,2446	B
	Violet	2.125	DEF	0,0989	B
	Green	1.000	A	0,6129	A
	Colourless	0.875	DEF	0,4018	AB
Rustic	Red	0.875	EF	0,3001	B
	Yellow	0.625	EF	0,1808	B
	Blue	1.375	CD	0,3718	AB
	Violet	0.875	EF	0,3963	AB
	Green	0.875	EF	0,6266	A
	Colourless	0.875	EF	0,3001	B

Media that are in the same column followed by the same letters are not significant, according to Duncan test ($p \leq 0.05$).

LSD=0.3537 microtubers LSD=0,2740 g

Conclusion

Weight of microtubers produced under the influence of food colorant, was significantly higher for green colorant compared to the other, when it was applied for Rustic and Zamolxis varieties. In the future will try to perfect this method and identify food colorant to produce microtubers with a high average weight and with a high average number/plantlets.

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