In Vitro Microtuberization in 30 Potato Varieties

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Introduction

Irish potatoes, *Solanum tuberosum*, regularly grown in the Caribbean islands of Jamaica and St Kitts, are planted in October. Harvest of seed Irish potatoes stateside is September through October. However, freshly harvested Irish potatoes require 2-3 months of cool storage, vernalization, to break dormancy to sprout and grow. Tissue culture can be used to induce microtubers. Microtubers can be induced in vitro by increasing the sugar concentration to 10% (Donnelly et al, 2003). The objective was to evaluate 31 Irish potato varieties to induce microtubers in tissue cultured on 10% sucrose medium.

Materials and Methods

Virus-free Irish potato varieties were obtained from the USDA germplasm repository. Three in vitro replicated cultures of 31 varieties were obtained in December, 2014. Nodal segments from the Irish potato cultures were transferred into shell vials on microtuber induction medium containing Murashige and Skoog salts with Gamborg vitamins, 10% sucrose and gelled with 8g/L agar. Cultures were grown on 5 ml medium at 25ºC under 16 hr photoperiod. The treatments were replicated 6 – 12 times based on the amount of the original material. Data on microtuberization was collected at two week interval for three months.

Results and Discussion

During the first month the active growth was minimal. Some had developed shoots while others seemed to be resting. During the second month, swelling normally at the base was evident and distinct microtubers could be seen. Microtuberization continued through the third month. Growth in microtuber size appeared to stop after four months from initiation. Varieties varied in their ability to form microtubers in culture from a range of 0% for six varieties to 100% for 'Cruza 148' (Table 1). This indicates that the conditions to induce microtuberization are not the same for all varieties and further studies are needed to refine the medium to enhance microtuber initiation and development to above 50% (Fig. 1). The microtuber size is also relatively small from 0.07 – 0.45 g when a size needed for direct planting under field conditions should be around one gram (Table 1). The size could be due to the small amount of medium in the vial, 5 ml. limited the supply of sugar needed for larger microtubers (Fig. 2). All varieties had abundant shoot growth which could be due to the 16 hour photoperiod. Limiting the light has been a factor found to enhance microtuber size and suppress shoot growth (Donnelly et al, 2003).

Table 1. Percentage microtuberization and average microtuber weight after three months in vitro on tissue culture medium with 10% sucrose.

Variety	# Vials	% Micrtubers	Avg Wt g
Century Russet	6	0	0
Kenya Akiba	6	0	0
Purple Valley	6	0	0
Russet Burbank	6	0	0
Saginaw Gold	6	0	0
Viking	6	0	0
Red Pontiac	12	8.33	0.190
Bake-King	6	16.67	0.190
Elmer's Blue	6	16.67	0.070
Tasty	6	16.67	0.093
Atzimba	12	25.00	0.236
Early Valley	12	25.00	0.159
Gui Valley	12	25.00	0.303
Bora Valley	6	33.33	0.201
Early Blue	6	33.33	0.348
Ranger Russet	6	33.33	0.175
Sante	6	33.33	0.150
Krantz	7	42.86	0.170
Belrus	9	44.44	0.445
La Rouge	6	50.00	0.207
Norland	12	58.33	0.208
Greta	6	66.67	0.230
Sangre	6	66.67	0.278
Taebok Valley	6	66.67	0.130
Bison	10	70.00	0.184
Russet Norkotah	9	77.78	0.248
Climax	6	80.00	0.060
Desiree	6	83.33	0.297
Frontier Russet	6	83.33	0.146
Gogu Valley	6	83.33	0.143
Cruza 148	6	100.00	0.270

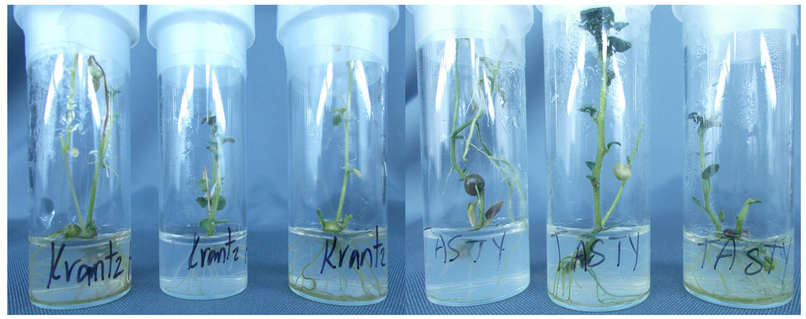

Figure 1. Varieties 'Krantz' and 'Tasty' with limited microtuberization.

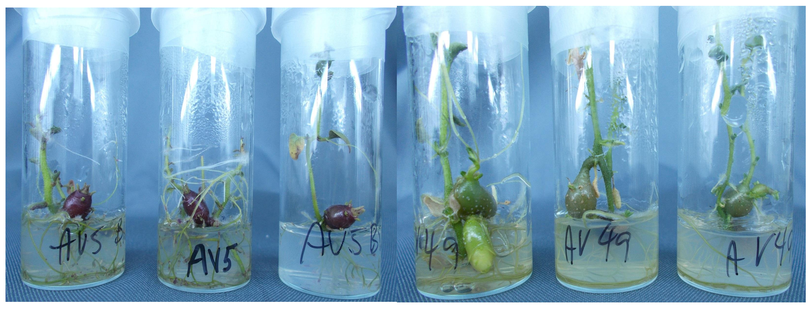

Figure 2. High rates of microtuberization obtained with 'Bison' (left) and 'Russet Norkota' (right) with a double microtuber.

Conclusion

In vitro microtuberization can be induced with 10% sucrose in the tissue culture medium for most Irish potato varieties. However the efficiency rate of microtuberization varies between varieties from 0 – 100%. The size of the microtubers were smaller than needed for direct field planting. Further studies need to be conducted to enhance both tuberization and size of microtubers formed by limiting light, increasing the volume of medium per vial and adding a plant growth regulator to stimulate microtuberization.

Acknowledgement

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Literature Cited

Donnelly, Dj, WK Coleman, SE Coleman. 2003. Potato microtuber production and performance: A review. American Journal of Potato Research. 80:103-115.