
13) FEATURES OF PAULOWNIA PLANTS POST-SEPTIC ADAPTATION

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Abstract

In Ukraine, Paulownia is a new crop characterized as fast-growing and quick to fill up with high quality wood with light weight, low water-absorbing properties and high heat output. Given its advantages, it can be argued that this plant is promising for industrial and decorative use as well as an energy culture. The aim of the research is to study the influence of the main factors of root formation on the stages of rhizogenesis and post-septic adaptation to optimize the technological process of commercial MKR.

The research tasks are to determine the optimum composition of the nutrient medium and temperature for cultivating the regenerants at the stage of rhizogenesis induction, to establish the technologically optimal age of the regenerants for their transition *in vitro-ex vitro*, the medium, depth of planting, the number of post-septic engraftments. The object of the research is the plants of the Paulownia, namely *Paulownia tomentosa* × *Paulownia elongata* hybrid. Studies were conducted under standard laboratory conditions.

In order to select the optimal age of *in vitro* plants for planting in a greenhouse on a peat substrate, the use of 15-day regenerants was established. Rapid growth rates of both the shoots and the root system are typical for the post-septic adaptation of the Paulownia, as well as for natural conditions. Paulownia plants *in vitro* juvenilization is inherited for several generations under post-septic grafting. After planting the regenerants grown "on agar", they can be re-grafted 2 or 3 times. There has been established the influence on rhizogenesis and morphometric parameters of size and shape of cassette cell / pot used for plants adaptation. It was found out that in order to improve the technological process at the stages of rhizogenesis induction and post-septic adaptation of the Paulownia it is necessary:

1. To use vermiculite in a nutrient medium instead of agar at the stage of rhizogenesis.
2. To use deep pots of 0.5 l at the stage of planting in a greenhouse on a peat substrate, plant 15-day old regenerants to a depth of 2-3 mm. An in-depth landing negatively affected the plants establishment.

Introduction

In Ukraine, Paulownia is a new crop characterized as fast-growing and quick to fill up with high quality wood with light weight, low water-absorbing properties and high heat output. Given its advantages, it can be argued that this plant is promising for industrial and decorative use as well as an energy culture.

Despite this, Paulownia remains a rare plant on the territory of Ukraine, primarily due to difficulties in its reproduction. In recent decades the technology of in-vitro Paulownia propagation started to be developed (Matskevych & Lisovyi, 2017).

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Material and Methods

The object of the research is the plants of the Paulownia, namely *Paulownia tomentosa* × *Paulownia elongata* hybrid. Studies were conducted under standard laboratory conditions (Kushnir & Sarnatska, 2005). Sample

number - 60 plants. The sequence of experiments is as follows: the best version of the previous experiment was taken as a control in the next experiment. The extraordinary fragility of the regenerants stem in the root cervix area and its pubescence, which requires cautious irrigation, were taken into account while planted in a humid chamber on a peat substrate (substrate Alonet [<http://www.alonet.pl/>]). Previkur® Energy 840 SL fungicide tested for post-extraction of other cultures was used to protect the plants against fungi infection (Taran et al., 2015).

Results and Discussion

In order to select the optimal age of *in vitro* plants for planting in a greenhouse on a peat substrate, the effectiveness of the use of regenerants of the following ages was compared: 15 days; 20 days; 30 days; 40 days. It was established that the vitality did not differ significantly in 15, 20, 30 days variants and remained within 73-77%. In older regenerates (40 days), half of the *in vitro* planted plants established (52%). The first three variants also did not differ in height. Therefore, you can use 15-day regenerants and thus save the resources.

The negative influence of the residual agar medium on the root system is established. For example, the establishment of the regenerants planted without washing the medium from 77% to 31%. We have tested a non-agar medium, with the agar replaced with vermiculite at the stage of rhizogenesis. The research results reveal no difference in establishment of plants grown on the agar medium and washed away from it. Also, the number of injured plants decreased.

The rooting and establishment of the regenerants was also influenced by planting depth (Table 1). It was established that the largest number - 77-83% - of live plants was observed for the depths of 2-3 mm. An in-depth planting negatively affected the establishment. The lowest rates - 30-50% - were observed in the variant of planting on the substrate surface.

Rapid growth rates of both the shoots and the root system are typical for the post-septic adaptation of the Paulownia, as well as for natural conditions (Fig. 1). If the influx formation is noted in the basal part on the fifth day, several roots have already formed on the 10th day.

Table 1. Effect of planting depth on the number of living plants

<i>in vitro</i> planting depth, mm	Live plants for observation date, %		
	5 day	10 day	15 day
0 mm (on the substrate surface)	50	32	30
2-3 mm (control)	83	79	77
5-6	80	57	41
8-10	71	54	33



Figure 1. Paulownia *in vitro* rhizogenesis (the first post-septic fermentation).

In two weeks, the regenerants are suitable for their transplanting in larger containers or in open soil, provided drip irrigation and mulching.

Paulownia plants *in vitro* juvenilization is inherited for several generations under post-septic grafting. After planting the regenerants grown “on agar”, they can be re-grafted 2 or 3 times. After 4-5 graftings, juvenility and therefore the regenerative properties including and the formation of adventitious roots are lost. There has been established the influence on rhizogenesis and morphometric parameters of size and shape of cassette cell / pot used for plants adaptation.

Thus, planting plants in small cells volumed 0.1 l negatively affected the rhizogenesis, and, as a consequence, their growth and vitality (Table 2). Plants formed a low, thin stem, the leaflet plate was poorly developed, the establishment was 64%. There was a dropout (bumping) of plants from the cassette cells.

Table 2. Influence of cassette cell shape and size on Paulownia plants survivability and morphometric indices

Index	Volume and form		
	cassette cell 0.1 l	0.5 l pot	0.5 l pot deep
Establishment, %	64	5	98
Plants height, mm	19	168	341
Leaflet plate size, mm	26	45	78
Stem diameter in the radical area, mm	0.8	2.7	4.6

Planting in deep pots contributed to a well-developed root system formation, the plants establishment was the best - 98%. The plants formed a thickened stem with three internodes (on average) and well-developed leaf plates. Plants in shallow pots of the same volume, yielded for their morphometric indices and establishment. According to our observations, in contrast to the previous version (with deep pots), these plants had a larger number of truncated internodes (5 pcs.), their stem stiffening and the auxiliary buds awakening took shorter time. Hereby, it can be assumed on the induction of the synthesis of abscisic acid under adverse conditions (the root system can not grow deep) for the development of the root system, since under natural conditions, Paulownia forms the root system of 6-9 m depth.

Conclusions and Outlook

It was established that in order to improve the technological process at the stages of rhizogenesis induction and post-septic adaptation of the Paulownia it is necessary:

1. To use vermiculite in a nutrient medium instead of agar at the stage of rhizogenesis.

2. To use deep pots of 0.5 l at the stage of planting in a greenhouse on a peat substrate, plant 15-day old regenerants to a depth of 2-3 mm. An in-depth landing negatively affected the plants establishment.

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