The Influence of Regrafting at *Picea Pungens* Var. *Argentea* and its Economic Efficiency

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Abstract

Picea pungens *Argentea* could be obtained both by generative and vegetative way. Considering that the main important feature of this species, the needles' colour, could lose in intensity by generative way, the vegetative remain the most important. One of the *Picea pungens* *Argentea* vegetative obtaining methods is the grafting method. The main problem of this method is its lower success, because even a lot of grafted exemplars seem to survive, in time a part of them will die. The purpose of this study is to see whether the stocks grafted once can be reutilized, taking into account the grafting success and the costs of obtaining them. For that it was made a bifactorial experiment, one of the factors being the stock and the other being the grafting level. For processing the data obtained it was used the Duncan test. Also, this study contains a calculation of economic efficiency, to see if the regrafting method have economically advantages too.

Keywords. *Graft, rootstock, scions, Picea pungens, vegetative.*

INTRODUCTION

Decorative by needles' color and in some cases by their port (Șofletea and Curtu, 2000), *Picea pungens* varieties are used in our country as decorative species having no forestry interest (Dumitriu-Tătăreanu, 1960). This species was introduced with experimental intention in some dendrologic parks (Mihalache, 1956; 1989), with no satisfactory results. With the aging of the specimens they lose the needles' color, thus recommending gradual replacement of old specimens with younger ones.

Even *Picea pungens* is one of the exotic conifer species that reach the fructification in Romanian parks and green spaces, the biggest problem is getting varieties of this species seedlings. And this because, although at begin the obtained specimens have the color of the parental variety, with the passage of time the color disappears (Rubțov 1958, Hill, 1989). So, the vegetative propagation remains the only possible way in order to obtain the specimens capable to keep a long period the needles' color.

The first grafting experiment with significant importance was made in 1840 by Marvier du Boisdyver. There were grafted over 10,000 slips of *Pinus nigra* ssp on *Pinus sylvestris* laricio seedlings. The experiment was made in the forest Fontainebleau, France (Enescu, 1994).

Other grafting experiment is mentioned by Tyystijärvi and Karki (1969) cited by Enescu (1994), which in Finland, during 1962-1968, grafted a number of 300 000 specimens of *Picea abies*, with an average the clamp about 68%.

In Romania the softwood grafting is mentioned as practiced from the '50s (Rubțov, 1958), especially at the species *Picea pungens* var. *glauca* and *Abies concolor*.

Grafting experiments have been made recently with a clamping percent that reached about 70% or more (Mazăre, 2008; 2010; Posedaru, 2005). Although this percentage may seem high, the grafting costs are high too.

The purpose of this paper is trying to reducing the costs by reusing grafted seedlings. More specifically, this paper proposes the study of the

possibility of regrafting the specimens whose first graft failed and evaluation the economic efficiency of the operation.

MATERIALS AND METHODS

The experiences were made at the Mihai Viteazu nursery, belonging to Turda-Cluj, during three consecutive years.

Biological material used, consist of rootstocks and scions, came from species *Picea abies* and *Picea pungens* var. *Argentea*. The first species was used as rootstock seedlings, being used exemplars with a diameter between 4 and 6 mm. The graft was taken from the second species, having about 7 cm length.

As grafting method it was used the side grafting. For this, it was consulted the older literature (Cristescu, 1975; Enescu, 1975; Luban, 1959) and the recent too (Drăghia, 2000 Florescu, 1999; Mateescu, 2002).

The experimental factors were the rootstock type and grafting level. Regarding the first factor, we choose two graduations of them, the

grafting being made on the ungrafted rootstock and on the rootstock grafted once, in previously year. Regarding the grafting level, it had three graduations. So, the grafting was made on the first growth, on the second one and on the third one.

The behavior of grafted seedlings was followed throughout the growing season, with the work of care applied in the process, but the final inventory of survive grafting was not made until the end of the growing season. To interpret the results on grafting efficiency, expressed by number of alive slips, the data obtained from the measurements were statistically processed by variance analysis method, using the method of multiple comparisons (Duncan test, considering significant differences DS5%).

RESULTS AND DISCUSSIONS

Tab 1 presents the sample variances and F series of experiment executed in three years.

The second table (Tab 2) examines the influence of experimental years, rootstock type and their interaction on the number of living slips.

Tab. 1. The variance analyze for the 3 x 2 x 3 experience. The influence of experiences years, stock type and grafting level on number of living grafts

Variability cause	SP	GL	S ²	The F probe
Total	334.83			
Blocks	0.78	53		
The factor year	37.44	2		
The factor stock type	17.80	2	18.72	8.85>3.32
The factor grafting level	72.44	1	17.80	8.42>4.17
The interaction year x stock type	25.15	2	36.22	17.13>3.32
The interaction year x grafting level	80.78	2	12.57	5.95>3.32
The interaction stock type x grafting level	24.15	4	20.19	9.55>2.87
The interaction year x stock type x grafting level	4.41	2	12.07	5.71>3.32
Error	71.89	4	1.10	0.52<2.87
		34	2.11	

Tab. 2. The influence of experiences years and stock type on number of living grafts

Experiences year \ Stock type	Ungrafted (number of living exemplars)	Grafted once (number of living exemplars)	Average on experiences year (number of living exemplars)
First year	12.67 ^a	11.67 ^a	12.17 ^A
Second year	12.22 ^a	12.67 ^a	12.44 ^A
Third year	12.00 ^a	9.11 ^b	10.56 ^B
Average on stock type	12.30 ^M	11.15 ^N	

The results of rootstocks type's influence on grafting's efficiency have a higher influence than the experimental years, and that's because the regrafting have positive results. Even the percentage of regrafting success is lower than normal grafting, on rootstocks ungrafted before, it represent a success. The percentage of living grafts considering regrafting process is 55.7%. The difference of 5.7% compared with normal grafting, because of the lower value, is considered significant (Fig. 1).

Tab 3 shows the influence of rootstock type, grafting level and their interaction on grafting efficiency.

From the data presented in Table 3 it can be seen that the rootstocks which had not been previously grafted provide a grafting success

higher than regrafting case, excepting the grafting on first level. Also, a larger number of living slips were recorded on normal grafting on second growth, respectively the grafting on the previous level in regrafting case. Considering that, the regrafting process is less expensive by reutilizing rootstocks from previous unsuccessful grafting, the difference of only 1.15 alive exemplars considered as significant is a real success.

Of all the variants, the best results are provided by grafting on the second growth made on the rootstock that has not previously been grafted. The worse results, with a difference of 22.8% from the upper variant were registered on the grafting of the third growth on rootstocks that had been grafted on previously year (Fig 2).

Fig. 1. The percentage of living grafts by experiences years, depending on stock type

Tab. 3. The influence of stock type and grafting level on number of living grafts

Grafting level \ Stock type	Ungrafted (number of living exemplars)	Grafted once (number of living exemplars)	Average on grafting level (number of living exemplars)
First growth	11.33 ^d	11.44 ^{cd}	11.39B
Second growth	13.56 ^a	13.00 ^{ab}	13.28A
Third growth	12.00 ^{bc}	9.00 ^e	10.50B
Average on stock type	12.30M	11.15N

Fig. 2. The percentage of living grafts by grafting levels, depending on stock type

Tab. 4. Economical efficiency of regrafting method

Grafting type	Grafting success (%)	Costs (Eur/100 pieces)	Average sales price (Eur/piece)	Gross income (Eur/100 pieces)	Net income (Eur/100 pieces)	Net income rate (%)
Normal	61.5	93.6	2.3	139.8	46.1	49.3
Regrafting	55.7	73.0	2.3	126.6	53.6	73.5

In this experience is required an economic efficiency account to see whether regrafting, even if it have a lower success less than normal graftings, could be economically advantageous.

Regarding the cost of grafted seedlings in both versions, the difference lies only in the price of rootstock, and that because a spruce sapling must be led up to age 3.

Workmanship for grafting is considered being the same. In regrafting case, even the percentage is smaller comparing with normal grafting, with rootstock ungrafted before, the economic calculation shows that this version brings an increase about 36 lei at 100 grafted rootstocks. This represents a rate of return of 73.5% (Tab 4).

CONCLUSION

If we talk about grafting on first growth and grafting on third growth, the grafting level does not significantly influences the grafting success. Regarding the graft on second level, we can see an advantage of grafts placed on this level comparing with the other levels. The grafting on third growth is significantly weaker compared to second growth.

Even the regrafting on third level have no big success, regarding the number of alive exemplars, if we have a look on the table 4 we can conclude that it worth to make that kind of regrafting. So we can still consider regrafting method a real success, and that's because, even the grafting success is

lower, we gain a year at the height of grafted plants and you could eliminate some costs.

Regrafting at *Picea pungens* var. *Argentea* ensure satisfactory results. Although, compared with the normal grafting with ungrafted rootstock, the difference of surviving grafts is significantly lower, this representing a gain by allowing rootstocks' reusing.

Regrafting the rootstocks that had no success following year is recommended in order to eliminate their manufacturing costs.

REFERENCES

1. Cristescu *et al.* (1975). Modern technologies for planting material (II). In: Horticulture, 2: 41-43.
2. Drăghia L (2000). Production of planting material. Ed. „ Ion Ionescu de la Brad”, Iași, 212 p
3. Dumitriu-Tătăreanu I (1960). Ornamental forest trees and shrubs grown in RPR. Ed. Agrosilvică, București
4. Enescu V (1975). Improving main forest species. Ed. Ceres, București, 314 p
5. Florescu Gh (1999). Afforestation - Forest nurseries. Transilvania Brasov University, 151 p
6. Enescu V (1994). Vegetative propagation of forest trees. Ed. Ceres, București, 336 p
7. Hill L (1989). Christmas trees: growing and selling trees, wreaths and greens. Storey Publishing, LLC, 152 p
8. Luban E (1959). Vegetative propagation of conifers. In: Garden, orchard and vineyard. 8: 48-50.
9. Mateescu R (2002). Ornamental trees and shrubs. Ed. M.A.S.T., București, 218 p
10. Mazăre G (2008). Researches conducted in order to obtain *Picea pungens* var. *Argentea* by grafting. Bulletin USAMV Cluj-Napoca. Horticulture, 65(1): 402-406
11. Mazăre G (2010). Research on improving *Picea* species' planting material production technologies and diversify its valorification. University of Agricultural Sciences and Veterinary Medicine Cluj Napoca, PhD Diss. Abstr. 113-220
12. Mazare G *et al.* (2010). The care in the first years of life of blue spruce obtained by grafting. Bulletin USAMV Cluj-Napoca. Horticulture, nr. 67(1): 524
13. Posedaru A (2005). Studies and research on effective methods of propagating ornamental varieties of the genera *Abies*, *Picea* and *Chamaecyparis*. University of Agricultural Sciences and Veterinary Medicine București, PhD thesis.
14. Mihalache A (1956). Aspects of acclimatization and enrichment of the collections of woody species in Hemeiusi and Dofteana forests, Bacau. In: Studies and researches- Forestry.
15. Mihalache A (1989). Hemeiusi forest's monography. RDPTA București, 248 p
16. Șofletea N and Curtu L (2000). Dendrology. Editura Pentru viață, Brașov, Romania.
17. Rubțov Șt (1958). Culture of woody species in nurseries (forest and decorative). Ed Agro-Silvică de stat, București, 448 p.