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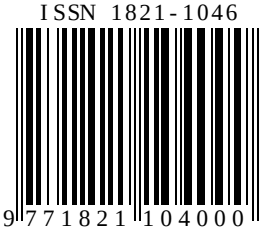

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SEED GERMINATION ANALYSIS IN ORDER TO IMPROVE THE PRODUCTION OF SEEDLINGS

Milorad VESELINOVIĆ[1], Dragana DRAZIĆ[1], Biljana NIKOLIĆ[1], Suzana MITROVIĆ[1], Nevena CULE[1], Marija NESIC[2]

Abstract: *Base of mass production of seedlings In the forest nursery production is the production from seeds. The mature seed dormancy is main problem in the production of seedlings of Tilia tomentosa Moench. Germination exceeds the usual period of several months, from the time of maturation, collecting and sowing seeds until next spring. If the sowing of the seeds is in the next spring after the harvest the problem is even greater. That type of seed germination results a numerous negative consequences for conducting of production process. Difficulties in growing of white lime caused to it lose from production in nurseries.*

The paper presents the results of research of mature seeds germination subjected to wet and cold stratification and immature seeds germination. The mature seeds subjected to wet-cold stratification had significantly less technical germination of seeds picked in immature stage. The results also indicate that the method of preparation of seeds through wet-cold stratification is much more complicated method of sowing the seeds at an early stage of maturing.

Key words: nursery plant production, white lime, seed dormancy, stratification.

1. INTRODUCTION

Since ancient times for the people of the Balkan Peninsula, the lime tree has had special value. For the Slavs was the sacred tree. As the material for the multiple use has greatly contributed to the development and progress the Slavic

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peoples. White lime submitted drier and less humus soil (Jovanović, 1985). With its roots and leaf fall which is fast degraded has the ability to improve the land (Lutz and Chandler, 1946). Thanks to the dense trees affect the microclimate environment.

Lime trees can be successfully grown in the habitats of community *Quercetum montanum serbicum* Ćer-Jov, *Quercetum conferte cerris* Rudski, *Carpinetum orientalis serbicum* Rudski which are usually highly degraded and is influenced by many extreme environmental factors. It can thrive only pioneering species of conifers and white lime is one of the few broadleaf species that can be used to create a mixed forest of deciduous trees and conifers. White lime should be one of the main species in the reclamation of degraded oak and beech forests. Because it white lime tree has far greater importance in forestry from the other lime species.

Wherever we want to contribute to the beauty of appearance and create the conditions for pleasant people, white lime is irreplaceable.

2. METHODOLOGY

Seeds „achene“ were collected each year from 10 locations during three years of research. Location of trees was in urban conditions of Belgrade. Collected seeds from selected of linden tree was sown right after harvest (autumn sowing) and in the spring after the cold-wet stratification.

According to the survey (Veselinović 1989) determined the state of collected seeds by monitoring the morphological characteristics and on the basis of them is divided in the six developmental stages.

During the three year study was carried out. Seed was sowed in all developmental stages from august to september. 100 of seed was sowed from each developmental stage and each location.

In the next spring seed, stratified by cold-wet stratification method to 5°C for a period of 5.5 months (Stilinovic, 1985) was sowed .

Germination depending on the picking time and stratification treatment were analyzed.

3. RESULTS AND DISCUSION

Percent of the germinated seeds from the field. during the tree year research is shown in tablele 1.

Table 1. *Result of seed germination (%) at the field*

stage	Date	First year										sum	average
		1	2	3	4	5	6	7	8	9	10		
1	06.08	0	0	0	0	0	0	0	0	0	0	0	0
2	15.08	0	0	0	0	0	0	0	0	0	0	0	0
3	22.08	8	13	11	10	12	12	13	11	9	10	109	10,9
4	04.09	12	29	19	23	14	23	25	24	19	26	214	21,4
5	11.09	56	60	53	55	58	60	54	58	57	55	565	56,5

6	19.09	6	12	11	13	8	9	11	12	8	10	100	10,0
		Second year											
		1	2	3	4	5	6	7	8	9	10		
1	03.08	0	0	0	0	0	0	0	0	0	0	0	0
2	11.08	0	0	0	0	0	0	0	0	0	0	0	0
3	20.08	14	21	17	22	19	18	20	16	21	15	183	18,3
4	29.08	48	32	36	33	45	37	44	47	35	43	400	40,0
5	07.09	60	64	65	62	61	64	62	63	60	65	626	62,6
6	17.09	13	21	19	18	17	16	15	20	14	17	170	17,0
		Third year											
		1	2	3	4	5	6	7	8	9	10		
1	06.08	0	0	0	0	0	0	0	0	0	0	0	0
2	14.08	0	0	0	0	0	0	0	0	0	0	0	0
3	23.08	8	11	18	9	5	15	16	13	6	12	168	16,8
4	04.09	37	41	30	23	40	35	43	39	44	29	361	36,1
5	14.09	60	62	53	49	46	55	59	50	61	57	562	56,2
6	22.09	13	13	11	10	11	12	11	10	13	12	116	11,6

The results showed that the germination varies by age and from tree to tree. According to many authors optimal time for white lime seed collecting can not determine with certainty, Soljanik (1961), Zaborovski and Varasova (1961), Stilinović (1985), Vanstone (1978), Nygren (1987), Dirr and Heuser (1987), Suszka Bet all., (1996), Hartman et all., (2002).

Table 2. *Seed germination in different phase of development*

stage	Seed germination
1	0,00
2	0,00
3	$13,50 \pm 1,83^{b}$
4	$32,50 \pm 0,87^{c}$
5	$58,13 \pm 0,67^{d}$
6	$12,87 \pm 0,84^{b}$

Multifactorial test in ranges – amounts recorded with the same letters in columnns do not show difference on a significance level of $p < 0,05$

Counting of germinated seeds was done in the next spring. Data from the Table 2. show that there were statistically significan influence of picking time on seed germination in development phase 4 and 5.

Linking these results of success rate of germination (Table 2) with morphological characteristics (Table 3), the greatests seed germination in the field is achieved in the development stage characterized by dark grey color of seed coat, yellowish white endosperm and embryo from the reddish color of cotyledons, define as stage 5.

During the three-year research seed picked in October were subjected to the cold-wet stratification of 5°C in the length of 5.5 months. Issues important to stratification of white lime seeds are numerous. Because of complexity of structure, mechanically disturbances (solid wooded pericarp, seedling soon after harvest becomes impermeable to water) and biochemical disturbances (creating

unfavorable conditions for the hydrolysis of fats, synthesis and breakdown of starch, protein and sugar).

Table 3. *Morphological characteristics of different stages of seed development and maturation (Veselinovic, 1989)*

stage	Pericarp			Seedcoat (testa)		Endosperm consistency	Embryo	
	Color		Consis-tence	Color	Consistence		Formed, %	Coty-ledon color
	egzo	endo						
1	pale green	white, grainy	soft, easy to cut	white, oxidize in brown	soft, easy to cut	liquid	0	-
2	pale green	white, grainy	soft, easy to cut	pale brown	soft, easy to cut	gel	10	green
3	pale green	white, grainy	soft, easy to cut	pale brown	soft, easily to separated from endosperm	tight as a rubber	100	green
4	olive	white, brown, open	easy to cut, harder	pale to dark brown	solid, difficult to cut and separated from endosperm	tight as a rubber, yellow and elastic	100	green
5	olive	brown	easy to cut, harder	dark brown	solid, difficult to cut and separated from endosperm	pale yellow, high consistency	100	yellow
6	olive	brown, woody	difficult to cut	black	solid, difficult to cut and separated from endosperm	tight, consistency resin	100	yellow

The seed was germinated in a very small percentage. The reason is the rapid draining ahenija swelling and loss of power due to anatomical changes in parenchima cells of seed. In order to identify the cause of this low germinaton, after completion of emergence, non germinated seed was picked up from the soil and analyse the cross section of the seeds (Table 4).

Table 4. *Anlise of non germinated seeds after cold-wet stratification process*

Tree	Germinated (%)	Not germinated (%)	Not germinated (%)		
			Solid	Poorly	Rotten
1	19	81	70	10	20
2	12	88	75	15	10
3	19	81	68	10	22
4	10	90	70	8	22
5	12	88	68	12	20

We can see that the 70% of non germinated seed was hard and not absorb moisture, so that most of the seeds could not be cut with a knife. Pericarp is easily took of, but the seedcoat was completely black, very hard and impermeable to water.

Fig. 1. *Microscop cross section of immature seed*

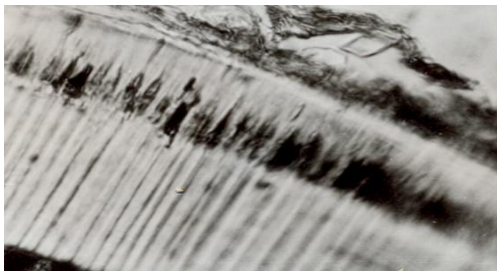

Fig. 2. *Microscop cross section of mature seed*

At the microscopic preparation can be observed (Fig. 1 and 2) that the parenchymal cells completely lost their protoplasm and cell walls are thicker (Fig. 1). Thus the failure of the stratification can be explained by a larger amount of hard seeds in a later picking, because only sweling „achene“ of immature seeds can be carried out biochemical processes that cause germination of seeds. .

The results indicate that the method of preparation of seeds through cold-wet stratification is much more complicated method of sowing the seeds and less succesful in germination compare with sowing the seed at an early stage of maturing.

4. CONCLUSION

Field experiments showed that the largest percentage of seed germination achieve when the seed was picked in the fifth stage of development witch is characterized with a dark grey color of seedling and yelow color of cotiledones.

On this basis we can conclude that seeds with dark grey color of seedling and yelow color of cotiledones is the reliable factor for determining the most appropriate time in practice for the collection of seeds for early autumn sowing.

Seeds collected in October as a mature and prepared with cold-wet stratification process at 5°C in the total length of 5.5 months have a lower technical germination of seeds harvested by the V development phase and immediately sown.

Since the seeds of white lime does not achieve fifth development phase for some time, it is not fixed a specific date, the practice may be required to recommend control seeds from 1-15 September. When the seed has the highest percentage of dark grey color of seedling and yellow color of cotyledons it is the right time for picking and immediate sowing.

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