

Research concerning the use of some seed and material preparation methods in the production of biological material in generative *Koelreuteria paniculata* LAXM

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Abstract *Koelreuteria paniculata* LAXM originates in China and Japan and it reaches 10 m in height. It prefers warm, sunny areas and it is resistant to drought but it is sensitive to frost while young. It vegetates well on fertile soils, fructifies frequently and abundantly.

Koelreuteria is increasingly used in green areas; this is why it needs seeding material in sufficient amounts and of high quality.

The author has made biometric measurements on the seedlings: crown diameter, stem height, root diameter, root number, and root length.

The trial aimed at producing generative seedlings using different methods of seed preparation, identifying the best variant of nutrient mixture and the best foliar fertiliser for the studied species.

Koelreuteria paniculata LAXM originates in China and Japan and it reaches 10 m in height. It prefers warm, sunny areas and it is resistant to drought but it is sensitive to frost while young. It prefers light soils [5].

The leaves are imparipennate-compound, with ovate folioles, unevenly dentate. The species blooms in summer: the flowers are yellow, small, united in lax, terminal, erect panicles. The fruits complete the decorative value: they are vesicle-like, ovoid-oblong capsules that are light green at the beginning, to turn rust-like, contrasting with the leafage [2].

Koelreuteria has been introduced in green areas due to its large leaves, rich panicles and capsules that keep on the stem during the winter [4].

Multiplication through seeds is difficult because of dormancy. Dormancy can be caused by the seed coat, by the embryo or by the combination of the two; this is why the seeds need to be well prepared before sowing [3, 4, 6, and 7].

Biological Material and Method

The seeds of *Koelreuteria paniculata* were prepared through such cultural value improvement methods as stratification, scarification, hydrothermal forcing and chilling.

Sowing was done on December 2011 in a nutrient mixture made up of 50% manure, 25% peat and 25% sand in a nursery greenhouse where the temperature was 18 °C and relative air moisture was 65%.

In the first trial stage, we prepared the seeds using four common methods such as stratification,

Key words

Koelreuteria paniculata LAXM, seeds, germination, nutrient mixture, fertilisers.

On January 15, 2012, 30 days after sowing, 98% of the plantlets sprouted.

Sixty days after sprouting (February 15, 2012), we made biometric measurements on some of the seedlings morphological features: stem height, crown diameter, root number, and root length, after which they were transplanted in different nutrient mixtures to identify the most suitable nutrient mixture for the *Koelreuteria paniculata* seedlings.

The trial variants were as follows:

V₁ – 30% manure, 40% peat, 30% sand;

V₂ – 40% manure, 20% peat, 20% sand;

V₃ – 60% manure, 20% peat, 20% sand;

V₄ – 50% manure, 40% peat, 10% sand.

On May 31, 2012, 106 days after sprouting, the seedlings were measured biometrically and transplanted into larger containers using the best variant of nutrient mixture.

Between June and September 2012, we fertilised four times every 30 days using Borocal 0.5%, Lithovit 0.5%, Radifarm 0.15-0.2% and Atonik 0.09%.

Two hundred and thirteen days after sprouting (October 3, 2012), we measured the seedlings biometrically a second time before the wood lignified and entered vegetative dormancy.

The observations were made using the current observation techniques, experimental data processing was performed using statistical and mathematical methods and the data regarding the production were calculated and interpreted based on variance analysis.

Results and Discussions

scarification, hydrothermal forcing and chilling. Sixty days after sprouting (February 15, 2012), we made

biometric measurements of the seedlings concerning such morphological features as stem height, crown diameter, root number, root length. A synthesis of trial

results concerning the influence of seed preparation on the morphological features analysed is shown in Table 1.

Table 1

Mean values of some morphological features in *Koelreuteria paniculata* LAXM seedlings (Didactic Base Timișoara – 2012)

Seed preparation variant	Stem height				Crown diameter			
	Mean value (cm)	Relative value (%)	Difference (cm)	Significance	Mean value (mm)	Relative value (%)	Difference (mm)	Significance
stratification	6.78	91.38	-0.63	-	3.25	92.78	-0.25	-
scarification	7.89	106.44	0.47	-	3.58	102.12	0.07	-
hydrothermal forcing	8.14	109.81	0.72	-	3.80	108.32	0.29	*
chilling	6.85	92.35	-0.56	-	3.39	96.77	-0.11	-
average (Mt)	7.41	100.00	0.00	-	3.50	100.00	0.00	-
	LSD _{5%} = 0.92 cm LSD _{1%} = 1.32 cm LSD _{0.1%} = 1.95 cm				LSD _{5%} = 0.26 mm LSD _{1%} = 0.37 mm LSD _{0.1%} = 0.55 mm			
	Root number				Root length (cm)			
	Mean value	Relative value (%)	Difference	Significance	Mean value (cm)	Relative value (%)	Difference (cm)	Significance
stratification	3.77	84.71	-0.68	-	3.83	57.71	-2.80	ooo
scarification	4.75	106.59	0.29	-	7.47	112.63	0.83	*
hydrothermal forcing	5.22	117.25	0.76	-	9.66	145.67	3.03	***
chilling	4.07	91.44	-0.38	-	5.57	83.97	-1.06	o
average (Mt)	4.45	100,00	0,00	-	6.63	100.00	0.00	-
	LSD _{5%} = 0.88 LSD _{1%} = 1.27 LSD _{0.1%} = 1.86				LSD _{5%} = 0.80 cm LSD _{1%} = 1.15 cm LSD _{0.1%} = 1.69 cm			

Preparing the seeds before sowing using different methods is an alternative in improving their cultural value. Literature presents trial results of research carried out using some of the methods assessed quantitatively and presented in Table 1. This determined the assessment of the seed preparation variants compared with the trial mean.

The comparative analysis of trial results after using the four seed preparation methods shows that hydrothermal forcing results in a very significant positive increase of the root length compared to the control variant (trial mean).

Seed hydrothermal forcing in this species results in a significant increase of the seedlings crown diameter (+2.9 mm) compared to the trial mean.

In the second trial stage, we monitored the influence of the composition of the nutrient mixture used in

transplanting the *Koelreuteria paniculata* LAXM seedlings. Thus, graduating the four basic components of the nutrient mixture (manure, peat and sand) we obtained the four trial variants. One hundred and sixty days after sprouting and 60 days after transplanting, we made biometrical measurements of some morphological features; trial results are presented in Table 2.

Trial results presented in Table 2 show that the nutrient mixture made up of 60% manure, 20% peat and 20% sand has a significant influence on the seedling crown diameter (+0.28 mm) and a very significant influence on the root system length increase (+3.19 cm). This composition of nutrient mixture also had a considerable influence on stem height and root number, but it was not ensured statistically.

Table 2

Mean values of some morphological features of *Koelreuteria paniculata* LAXM seedlings after transplanting (Didactic Base Timișoara – 2012)

Nutrient mixture variant	Stem height				Crown diameter			
	Mean value (cm)	Relative value (%)	Difference (cm)	Significance	Mean value (mm)	Relative value (%)	Difference (mm)	Significance
V ₁	8.06	95.19	-0.40	-	3.42	94.09	-0.21	-
V ₂	8.79	103.77	0.32	-	3.68	101.02	0.03	-
V ₃	9.19	108.49	0.72	-	3.93	107.89	0.28	*
V ₄	7.84	92.53	0.63	-	3.53	96.98	-0.11	-
average (Mt)	8.47	100.00	0.00	-	3.64	100.00	0.00	-
	LSD _{5%} = 1.19 cm LSD _{1%} = 1.72 cm LSD _{0.1%} = 2.53 cm				LSD _{5%} = 0.26 mm LSD _{1%} = 0.38 mm LSD _{0.1%} = 0.56 mm			
	Root number				Root length (cm)			
	Mean value	Relative value (%)	Difference	Significance	Mean value (cm)	Relative value (%)	Difference (cm)	Significance
V ₁	6.50	96.02	-0.26	-	4.88	64.69	-2.66	ooo
V ₂	7.15	105.63	0.38	-	8.39	111.29	0.85	*
V ₃	7.35	108.58	0.58	-	10.73	142.31	3.19	***
V ₄	6.07	89.75	-0.69	-	6.16	81.69	-1.38	ooo
average (Mt)	6.76	100,00	0,00	-	7.54	100.00	0.00	-
	LSD _{5%} = 0.83 LSD _{1%} = 1.20 LSD _{0.1%} = 1.76				LSD _{5%} = 0.67 cm LSD _{1%} = 0.97 cm LSD _{0.1%} = 1.43 cm			

In the third trial stage, we used four foliar fertilisation products; trial results are shown in Table 3.

Table 3

Mean values of some morphological features in *Koelreuteria paniculata* LAXM seedlings upon decantation (Didactic Base Timișoara – 2012)

Fertilisation product	Stem height				Crown diameter			
	Mean value (cm)	Relative value (%)	Difference (cm)	Significance	Mean value (mm)	Relative value (%)	Difference (mm)	Significance
Borocal	11.73	92.44	-0.95	-	3.62	94.04	-0.22	-
Lithovit	14.14	111.46	1.45	*	3.94	102.41	0.09	-
Radifarm	12.86	101.39	0.17	-	4.13	107.48	0.28	*
Atonik	12.01	94.69	-0.67	-	3.69	96.05	-0.15	-
average (Mt)	12.68	100.00	0.00	-	3.84	100.00	0.00	-
	LSD _{5%} = 1.14 cm LSD _{1%} = 1.64 cm LSD _{0.1%} = 2.41 cm				LSD _{5%} = 0.24 mm LSD _{1%} = 0.35 mm LSD _{0.1%} = 0.52 mm			
	Leaf number				Foliolate number			
	Mean value	Relative value (%)	Difference	Significance	Mean value	Relative value (%)	Difference	Significance
Borocal	7.95	90.34	-0.85	-	8.05	87.73	-1.12	o
Lithovit	10.57	120.17	1.77	*	11.60	126.43	2.42	***
Radifarm	8.50	96.59	-0.30	-	8.95	97.54	-0.22	-
Atonik	8.17	92.89	-0.62	-	8.10	88.28	-1.07	o
average (Mt)	8.80	100,00	0,00	-	9.17	100.00	0.00	-
	LSD _{5%} = 1.30 LSD _{1%} = 1.87 LSD _{0.1%} = 2.75				LSD _{5%} = 0.91 LSD _{1%} = 1.32 LSD _{0.1%} = 1.94			

Table 3 (continuation)

Mean values of some morphological features in *Koelreuteria paniculata* LAXM seedlings upon decantation (Didactic Base Timișoara – 2012)

Fertilisation product	Foliolate length				Foliolate width			
	Mean value (cm)	Relative value (%)	Difference (cm)	Significance	Mean value (cm)	Relative value (%)	Difference (cm)	Significance
Borocal	3.87	80.98	-0.90	ooo	1.86	78.13	-0.52	oo
Lithovit	6.08	127.25	1.30	***	3.15	132.45	0.77	***
Radifarm	5.12	107.12	0.34	-	2.59	108.86	0.21	-
Atonik	4.04	84.64	-0.73	oo	1.92	80.54	-0.45	-
average (Mt)	4.78	100.00	0.00	-	2.38	100.00	0.00	-
			LSD _{5%} = 0.40 cm LSD _{1%} = 0.58 cm LSD _{0.1%} = 0.86 cm				LSD _{5%} = 0.32 cm LSD _{1%} = 0.46 cm LSD _{0.1%} = 0.68 cm	

Trial results presented in Table 3 concerning the influence of fertiliser products on some seedling morphological features of show that the product Lithovit has a very significant influence on foliar area (foliolate number, length, and width) and significant positive on stem height, crown diameter, and leaf number.

Conclusions

Trial results of generative biological material production in *Koelreuteria paniculata* LAXM allow us to draw the following conclusions:

1. Hydrothermal forcing is the best method of preparing seeds in order to improve their cultural value: it has a very significant influence on root length;
2. Using a nutrient mixture made up of 60% manure, 20% peat and 20% sand has a very significant influence on root system growth;
3. Applying four Lithovit foliar fertilisations (0.5%) every 30 days has a very significant influence on foliar area growth and development.

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