

Study on the Influence of Several Biostimulants on the Germination capacity of Oak Seeds (*Quercus robur* L.)

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Abstract

This research aims to identify the role and influence of several biostimulants on the germination capacity of *Quercus robur* species, with the goal of enhancing the germination process, which is fundamental for the conservation and development of this ecologically and economically important species. Biological materials were collected from four different provenances in Romania: Prejmer (Brașov), Racășa (Maramureș), Căpâlna (Alba), and Orăștie (Hunedoara). The main phenotypic characteristics analyzed included seed length, diameter, and weight. Germination capacity was assessed using four different biostimulants treatments, testing 400 seeds for each provenance. Results showed significant differences between provenances regarding seed length, diameter, and weight. Additionally, significant differences in germination capacity were noticed among the applied treatments and studied provenances. Treatment with the biostimulant Atonik illustrated the best results in all provenances, followed by Nitrozym and Cropmax. In conclusion, this research provides essential insights for improving the germination capacity of *Quercus robur* species, emphasizing the importance of provenance and stimulation treatments in achieving efficient germination. These findings can be valuable for the conservation and sustainable management of this valuable species.

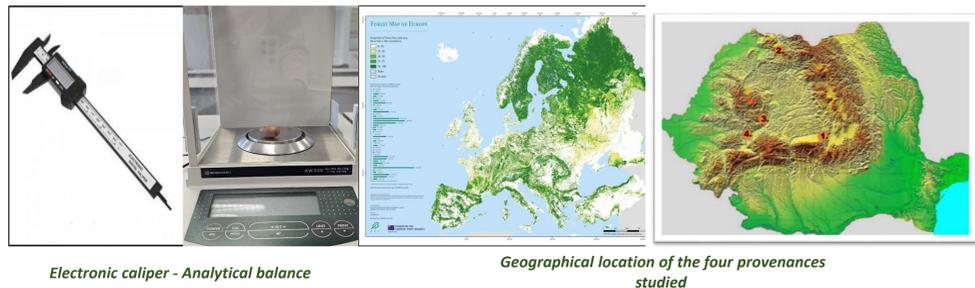
Introduction

Forested biomes around the world are vital for terrestrial biodiversity, yet the increasing demand for resources by humans has resulted in the conversion of natural forests to agricultural land and the degradation of forest landscapes through activities such as hunting, logging, fragmentation, pollution, and other anthropogenic effects. (Foley et al., 2005; Song et al., 2018). Effective regulation of plant growth and management of environmental stresses are vital for crop productivity. Abiotic stresses can be mitigated through optimal growth conditions, adequate water and nutrients, and plant growth regulators (PGRs). Recently, natural biostimulants have gained significant attention for their role in enhancing plant productivity. (Yakhin OI et al. 2017)

Material and method

This research aims to identify the role and influence of several biostimulants on the germination capacity of *Quercus robur* species, with the goal of enhancing the germination process, which is fundamental for the conservation and development of this ecologically and economically important species.

The biological material (acorns) was collected from seed source reserves found in the National Catalog of Forest Genetic Resources: Prejmer (Brașov), Racășa (Maramureș), Căpâlna (Alba), and Orăștie (Hunedoara).

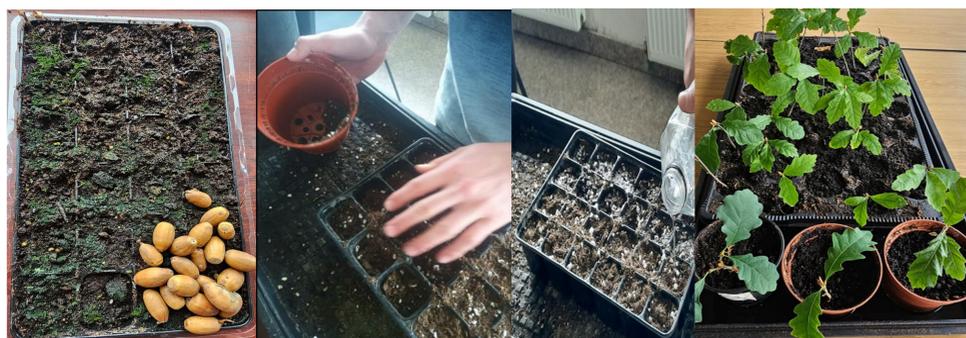


Electronic caliper - Analytical balance

Geographical location of the four provenances studied

The main phenotypic characteristics analyzed included seed length, diameter, and weight. Germination capacity was assessed using four different biostimulants treatments, testing 400 seeds for each provenance.

To determine the phenotypic characters of oak seeds, specific tools from the forestry laboratories of ICHAT - USAMV Cluj Napoca were used.



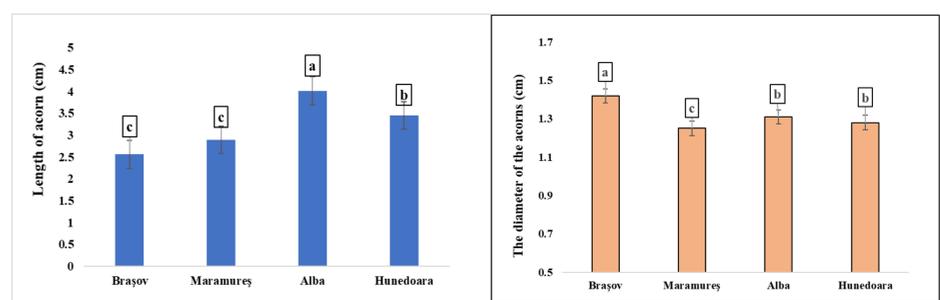
Quercus robur seedlings obtained in substrate

The germination capacity of oak seeds from different provenances in Romania was tested according to ISTA recommendations, using four treatments: T1 - Control, T2 - Biostimulator Cropmax, T3 - Biostimulator Atonik and T4 - Biostimulator Nitrozym. The seeds were prepared by keeping them for 24 hours in water or the solutions corresponding to the treatments, then put to germinate in a substrate composed of 70% earth, 20% perlite and 10% sand. The treatments lasted 28 days and germination was monitored on days: 0, 4, 7, 12, 15, 21 and 28.

The statistical analysis of the data was carried out by the method of multiple comparisons with the "Duncan test". Significant differences between treatments were tested by ANOVA at the 95% confidence level, followed by Duncan's post hoc test, with significant differences indicated by distinct letters at $p < 0.05$ (Todea et al., 2020).

Results and discussions

Phenotypic measurements for acorns, including diameter and length, showed that the provenance from Alba county had the highest values (4.01 cm), statistically significantly superior, and Brașov had the lowest values (2.56 cm). Regarding the diameter of the acorns, Brașov (P1) presented significantly higher values compared to the other provenances, while Maramureș (P2) had the lowest values.



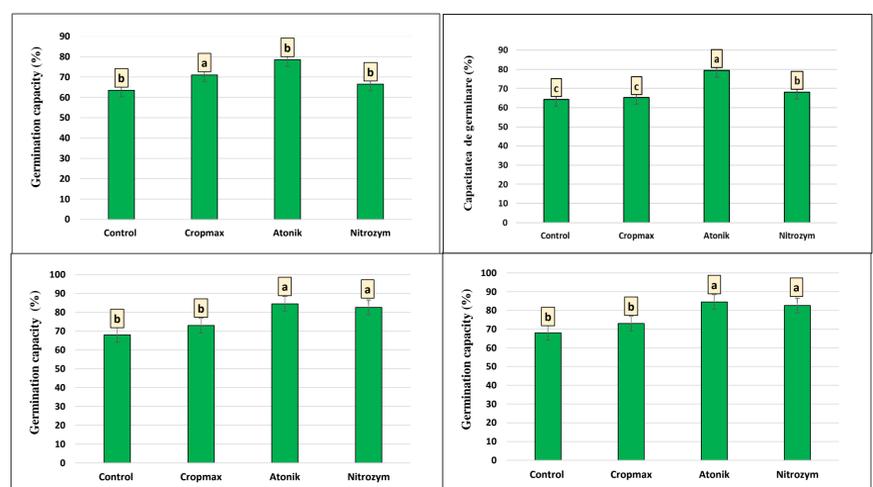
Synthesis of the results regarding the length (cm) of the acorns

Synthesis of the results regarding the diameter (cm) of the acorns

For the first provenance (Brașov), the seed germination capacity showed significant differences between treatments. Atonik (T3) had the highest value (78.5%), followed by Cropmax (T2) with 71% and control (T1) had the lowest value (63.5%).

In Maramureș, the Atonik and Nitrozym treatments gave the best results, followed by Cropmax, while the untreated seeds had the lowest germination percentage. For Alba, Atonik (T3) had the best germination percentage (84.5%), and the control (T1) had the lowest value (68%).

In Hunedoara, Atonik (T3) had the highest value (78.2%), and the control (T4) the lowest (65.0%). There were no significant differences between the control and Cropmax, nor between Atonik and Nitrozym.



Synthesis of the results regarding the germination of the oak seeds for the provenance P1, P2, P3 and P4 according to the 4 applied treatments.

Conclusions

The analysis of treatments on *Quercus robur* seeds showed that seeds from Alba had superior length and weight. Atonik (T3) was the most effective treatment, achieving the best germination rates across all provenances. Provenance 3 (Alba) had the highest germination percentage, from 68% under control to 84.5% with Atonik. These findings highlight Atonik (T3) as the most effective biostimulator and provide valuable information for the conservation and improvement of *Quercus robur*. These results are valuable for both theoretical research and practical applications, providing essential insights for future forest tree breeding programs aimed at conserving and improving *Quercus robur* species.