

X-RAY DOSE EFFECTS ON SEEDS GERMINATION AND SEEDLING PERFORMANCE OF EUROPEAN BEECH

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Abstract

The aim of the study was to assess germination dynamics and post-germination adaptation in two populations of European beech (*Fagus sylvatica* L.) seeds collected in autumn 2023 in the 'Plaiul Fagului' State Nature Reserve, Republic of Moldova with contrasting initial viability levels (PF-23_{high} – 97% and PF-23_{low} – 57%) under X-ray exposure at doses ranging from 25 to 300 Gy. Germination parameters, including total germination, mean daily germination (MDG), mean germination time (MGT), and germination rate index (GRI), were recorded alongside seedling development under solarium conditions. PF-23_{high} exhibited a more enhanced response: exposure to 25–125 Gy stimulated earlier and more intense germination (MDG up to 1.55; GRI up to 2.00), with a peak germination of 77.33% at 125 Gy and a 21-day advancement relative to the control. In contrast, PF-23_{low} showed only moderate stimulation at 25 Gy (germination 65.67%, 13 days earlier than control), and was markedly more sensitive to doses ≥ 100 Gy, with reduced germination and delayed dynamics (MGT up to 122 days; MDG and GRI consistently lower across treatments). At high doses (200–300 Gy) both populations demonstrated a pronounced decline in germination parameters. Seedling survival under solarium conditions revealed a uniformly negative impact of irradiation: both PF-23_{low} and PF-23_{high} showed rapid post-germination mortality, particularly between weeks 6 and 10 at doses ≥ 50 Gy. Despite the initially higher physiological resilience of PF-23_{high}, neither population exhibited stable adaptation under prolonged post-irradiation stress. These findings may suggest a high level of radiosensitivity in European beech during early ontogenetic development, regardless of initial seed viability.

Keywords: *Fagus sylvatica* seeds, high-viability, low-viability, X-ray irradiation, germination traits