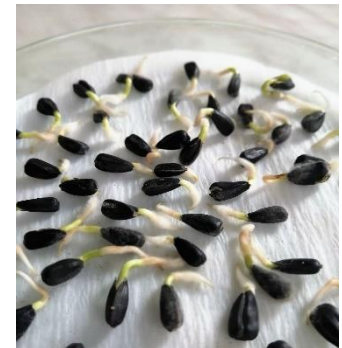


THE DIFFERENT INVIGORATION TECHNIQUES FOR SUNFLOWER SEEDS

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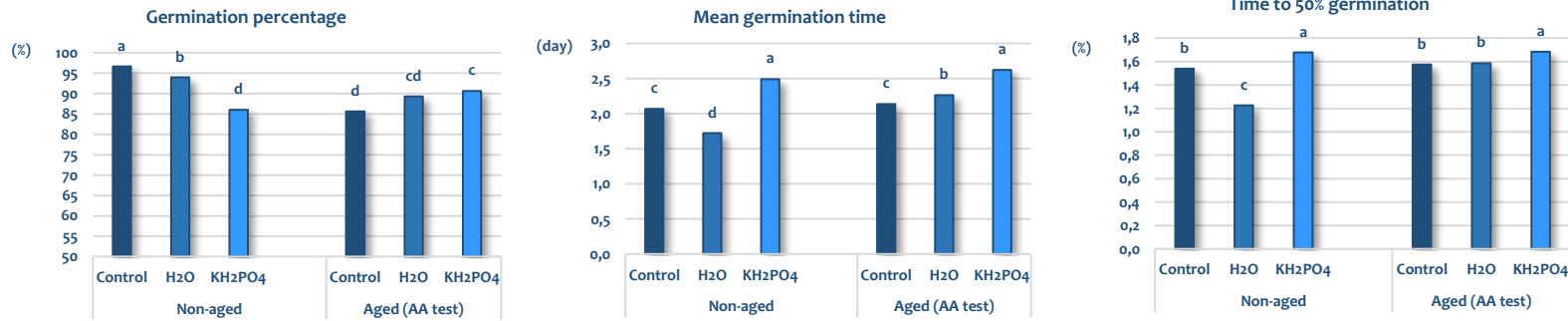
- Seed germination and seedling emergence - are the most important and vulnerable phases of crop production.
- The chemical composition of sunflower seed is an aspect that should be highly considered regarding the physiological quality during seed ageing.
- Seed invigoration involves useful pre-sowing seed treatments, which improve its overall field performance (seed germination, seed emergence, early seedling growth).
- Invigoration techniques cover hydration - uncontrolled (presoaking) and controlled (seed priming), thermal treatments (chilling or drought treatment) and coating – it can potentially have a positive effect on germination and early seedling growth and can alleviate the damage caused by seed ageing and various abiotic factors.



AIM - This study aims to determine whether different invigoration techniques improve sunflower morphophysiological attributes of seed germination and alleviate the damages of accelerated seed ageing, concerning physiological and biochemical changes that might have occurred in seeds.

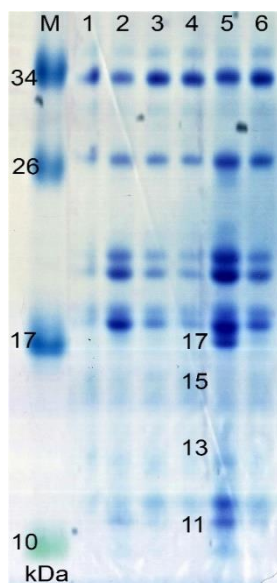
Material and methods

- ✓ Sunflower hybrid Fantazija
- ✓ Invigoration techniques (H_2O , KH_2PO_4 , 24hr at 25°C)
- ✓ Ageing treatment (high relative humidity, 41°C for 36 hours)
- ✓ Germination assay (germination percentage (GP), mean germination time (MGT), the time taken to 50% germination (T50))
- ✓ Protein analysis (sodium dodecyl sulfate-polyacrylamide gel electrophoresis - SDS-PAGE)



- The combined stress conditions of high temperature and relative humidity during the AA test significantly reduced seed germination (by 11.3%), while at the same time prolonging the time necessary for germination. In non-aged seeds, invigoration reduced the germination percentage by 4.12% (water) and 9.3% (KH₂PO₄).
- The water was effective in MGT while KH₂PO₄ prolonged this parameter. In aged seeds, both invigoration agents extended germination time - A possible reason for this is considered to be that delayed water absorption during the invigoration process in conditions of limited available water due to the presence of salt affects slowed metabolic processes and the germination process.
- The invigoration techniques have a minor effect on the seedling shoot length in both aged and non-aged seeds. Pre-soaking with water in both aged and non-aged seeds induced an increase in root length, compared to KH₂PO₄ invigoration and control.

SDS PAGE profile



SDS PAGE profile

M - molecular marker

1-control non-aged

2-non-aged invigorated with water

3-non-aged invigorated with KH_2PO_4

4-control aged

5-aged invigorated with water

6-aged invigorated with KH_2PO_4

- The analyses of SDS-PAGE profiles of seed proteins in the crude extracts revealed an alike number of protein bands in all treatments.
- Two prominent features can be observed - the low molecular weight proteins that produced high-intensity bands, and in contrast, the high molecular weight proteins in low concentrations.
- After the accelerated ageing followed by H_2O treatment, some bands of proteins appear in the region of 2S albumins. Taking into consideration the significantly higher percentage of germination percentage in this treatment, it is possible that changes in protein profile under these conditions positively affected the germination process.

When taken together, the invigoration treatments were more effective in the low vigor seed (aged), which can provide wide practical benefits, especially when seeds that have been stored for a long period are used. Selected invigoration agents have certainly mitigated the consequences caused by accelerated seed ageing.