

Seedling Vigor & Germination of Alfalfa Under Four Storage Times with Sterilization Treatments

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Question: Seeds are the end product of one generation of plants or strips, but they are also the beginning of the creation of a new generation of plants. The process of storing seeds from the time they mature in the mother until they are sown is referred to as seed storage. During this time, the seeds deteriorate irreversibly. It is widely accepted that seed deterioration begins at physiological maturity and results in a decrease in seed vigor. As a result, seed germination, seedling growth potential, and plant productivity all suffer. To promote seed germination, sterilization treatments were used to kill seed surface fungi. There are the aims:

- to demonstrate the external structure of alfalfa seeds (seed hilum, micropyle, etc.) over time, as well as the microorganisms surrounding the hilum.
- to clearly illustrate the alfalfa germination percentage and germination rate for each historical year, as well as to develop logistic regression model on germination.

Method and Materials: The tested seeds were selected from the years 2004, 2011, 2019, and 2021 which can be plotted by the Weibull distribution curve. All seeds were put under the 4°C for 2 d for a pre-cooling treatment. And they were placed in an artificial climate cabinet where the temperature was set between (20°C ~ 26°C); relative humidity was (50%±5%); the maximum illuminance is 250,000 lx. The seeds on paper substrates were divided into 4 portions of 25 seeds each. Each portion is a technical replicate. Each year of seeds has been taken two treatments soaked in 40 mg L⁻¹ NaClO and 75% (v/v) EtOH solutions for 15 min before the test start. A check was set with water treatment only. The seed umbilicus was examined using a Zeiss GeminiSEM 300 scanning electron microscope (SEM) from Germany.

Results and Conclusion: The 100-grain weight of seeds and the cumulative (maximum) germination percentage of seeds both showed a tendency to decrease with increasing storage time. When we used SEM to observe the exterior morphology of the seed, we discovered the explanation for lighter seeds: an increase in the number of fungal colonies in raphe and its surrounding tissues with seed age. Furthermore, the cross-section of the seeds revealed cavities, indicating significant amyloplast loss after long-term storage. On seeds that germinated, it is clear that the percentage of seeds that germinate decreases as storage age increases. It was shown that seeds with a storage age of 10 years or more had a germination rate of less than 50%. Furthermore, the germination speed index (GSI) was used to demonstrate the results of seed disinfection treatments, and the one-way t-test was used to test for differences between treatments. The results revealed that the germination rates of seeds from Huaiyang 4 and Yongchang, harvested in 2021 and 2019, respectively, showed statistically significant differences after different sterilization treatments; however, the seeds tested in the other three years did not differ significantly, indicating that sterilization did not affect germination rates. Chlorine-containing disinfectants and alcohol-based disinfectants (in the case of alcohol) did not improve seed germination rate in long-term storage. The logistic regression model also confirmed that seed germination rate decreased with storage age.

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