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Wet or dry?

Impact of conditioning seed in germplasm conservation strategies

Introduction

Seed deterioration is a continuous process and we need techniques that prolong longevity. A combination of 3-7% seed moisture content (mc) and a storage temperature below 0°C is suitable for long-term preservation of germplasm samples. When crop seeds are dried to low moisture levels, they decrease in weight and volume, and might develop seed coat cracks if dried too rapidly. Dried seeds are susceptible to mechanical injuries, especially when they absorb water too quickly, and suffer what is called imbibition injury.

Humidification

Imbibition injury occurs in standard germination tests. The aim of humidification is to increase seed mc slowly to 16–18% by absorption of water vapor instead of liquid water. Seeds at 8% mc and below, irrespective of species, should routinely be humidified before germination tests.

In genebanks, humidification of large numbers of seed samples (sometimes in thousands) is necessary for germination tests, but the recommended procedure is rather difficult and resource demanding. Considering these limitations an experiment was conducted using pearl millet (Pennisetum glaucum) seed accessions conserved in ICRISAT's genebank in India to test the impact of conditioning on seed viability.

What we did

Pearl millet can be safely dried to about 5% mc at 15°C and 15% RH. A set of 30 accessions from the global pearl millet collection was used for the study. Freshly harvested and cleaned seed samples were first held in cloth bags under short-term storage conditions (25°C and 40% RH). For drying, about 200 g seed was placed in perforated muslin bags and kept in a seed drier maintaining 15°C and 15% RH until the seeds reached equilibrium moisture levels. Separate samples of about 20 g dry seed were collected in paper bags with open covers and equilibrated under ambient conditions (25°C and 50% RH) for 72 hours. Two sets of dry seeds were humidified for 24 hours and 48 hours before testing viability. Seed moisture contents in all treatments were estimated following oven-dry method.

Results

Changes in seed mc among humidification treatments were significant. Humidification for 24 hours increased seed mc from 6.1 to 13.8% and further to 16.5% in 48 hours. The number of accessions losing viability gradually increased with 24-hour humidification and further with 48-hour duration compared to dry seeds.

When dry seeds were tested for germination, 16 accessions had 95% viability and two accessions had <90% viability.

The seed viability levels of 72-hour ambient stored seed samples were not significantly different from those of dry seeds and majority of the accessions had maintained the initial viability levels. Non-occurrence of hard seeds across the treatments was an important observation in this study and hence indicated no benefits from humidification in pearl millet.

Conclusions

Diverse pearl millet seeds can be safely dried and germinated over wide moisture regimes (5–11%). Such processes save time, space and resources for handling large numbers of germplasm accessions during testing/monitoring seed viability. However, for pearl millet seed stored at ultra dry moisture levels, there is a need to identify humidification requirements.

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