

10 种牧草种子生物学特性和超低温处理对发芽的影响

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摘要: 【目的】研究 10 种牧草种子的生物学特性及超低温 (液氮) 处理后种子的发芽特性, 解析超低温处理对牧草种子萌发活力的影响, 探究牧草种子超低温处理前后热力学特征变化, 为牧草种质资源的超低温保存提供技术参考。【方法】以 10 种牧草种子为材料, 测定种子的千粒重, 种长、种宽、宽长比、表面积、饱满率及种子发芽率等生物学特性。采用减重法将种子含水量统一降至 5%, 测定超低温处理前后种子的发芽率变化。基于差示扫描量热技术, 分析牧草种子的热力学特征。【结果】1) 10 种牧草种子形态存在差异, 由大到小大致为“蒙燕 1 号”燕麦、“湘中”多花黑麦草、“科瑞”苇状羊茅、“吉生 1 号”羊草、“宁稷一号”湖南稷子、“腾格里”蒙古韭、“雅星”假木豆、“公农 2 号紫花苜蓿”、“公农”沙打旺、三叶草原始群体。2) 种子的饱满率和发芽率呈正相关关系。3) 10 种牧草种子经液氮超低温处理后发芽率没有下降, 但生活力会降低、发芽时间更长。4) 超低温处理前后差示扫描量热技术分析显示, 牧草种子的水分含量和水分状态没有发生变化。【结论】10 种牧草种子的生物学特征存在差异。种子饱满率在一定程度上可以作为衡量种子萌发能力的重要指标, 在保存种质资源时应当注意选择饱满率高的种子。将牧草种子含水量降低到 5% 时, 种子发芽率不会降低, 基于差示扫描量热技术可知, 种子超低温处理过程中水分状态不变, 因此能够实现超低温保存。

关键词: 牧草种子; 形态特征; 萌发; 超低温处理; 热力学分析

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Biological characteristics of 10 herbage species and effects of ultra-low temperature treatment on germination

Abstract: 【Objective】The biological characteristics of 10 herbage species seeds and germination characteristics of seeds after ultra-low temperature (liquid nitrogen) treatment were studied, the influence of ultra-low temperature treatment on the germination vigor of herbage seeds was analyzed, and the changes of thermodynamic characteristics of herbage seeds before and after ultra-low temperature treatment were explored, which provided technical reference for the cryopreservation of herbage species germplasm resources. 【Method】Ten herbage seeds

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were used as materials to determine the biological characteristics of seeds, the thousand grain weight, seed length, seed width, width-length ratio, surface area, plumpness rate and seed germination rate were measured. The moisture content of seeds was reduced to 5% by weight reduction method, and the germination rate of seeds before and after ultra-low temperature treatment was measured. Based on differential scanning calorimetry, the thermodynamic characteristics of herbage seeds were analyzed. **【Result】** 1) The seed morphology of 10 herbage species was different, which were roughly *Avena sativa*、*Lolium multiflorum*、*Festuca atundinacea*、*Leymus chinensis*、*Panicum intortum*、*Allium mongolicum*、*Dendrolobium triangulare*、*Medicago sativa*、*Astragalus adsurgens*、*Trifolium repens*. 2) There is a positive correlation between seed plumpness and germination rate. 3) The germination rate of 10 herbage seeds did not decrease after cryopreservation in liquid nitrogen, but the germination ability was decreased and the germination time was longer. 4) The differential scanning calorimetry analysis before and after ultra-low temperature treatment showed that the moisture content and water state of herbage seeds did not change.

【Conclusion】 The biological characteristics of 10 herbage species seeds were different. Seed plumpness rate can be used as an important indicator of seed germination ability. When preserving herbage germplasm resources, attention should be paid to selecting seeds with high plumpness rate. When the moisture content of herbage seeds is reduced to 5%, the seed germination rate will not decrease. Based on the differential scanning calorimetry technology, the water state of seeds will not change during ultra-low temperature treatment, so cryopreservation can be achieved for herbage seeds.

Key words: Herbage seed; Characteristics of morphology; Germination; Ultra-low temperature treatment; Thermodynamic analysis