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NaN₃ 处理对杉木种子发芽及幼苗生长的影响¹⁾

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摘 要 为了探讨 NaN₃ 处理对杉木种子发芽及幼苗生长的影响,以杉木第 3 代种子园收集的种子为供试材料,并设置 6 个 NaN₃ 浓度梯度(0、2、4、6、8、10 mmol·L⁻¹)、3 个处理时间(4、8、12 h),研究了 NaN₃ 溶液浓度及处理时间对杉木种子发芽率、发芽时间以及诱变苗早期生长的影响。结果表明:2~10 mmol·L⁻¹ 的 NaN₃ 溶液浸泡处理 4~12 h 会显著延迟杉木种子发芽,浓度越高所需发芽时间越长,10 mmol·L⁻¹ 诱变处理的种子完成发芽平均需要 25.33 d,是对照 12.56 d 的 2.02 倍;4~12 h 处理中,8 h 处理的种子所需发芽时间最长,平均为 23.78 d;NaN₃ 诱变处理显著降低了杉木种子发芽率,浓度越高处理时间越长发芽率越低,NaN₃ 溶液浓度由 0 增加到 10 mmol·L⁻¹ 时,平均发芽率由 40.89%降低到 12.11%,其中处理时间为 12 h 时发芽率仅为 3%;NaN₃ 诱变处理显著抑制了诱变苗生长,导致诱变苗群体株高矮化、茎粗变细、侧枝数量及各指标变异幅度发生明显变化;根据种子发芽及诱变苗生长情况,本研究确定 NaN₃ 诱变处理杉木种子的适宜条件为 10 mmol·L⁻¹ 处理 4 h 或 8 mmol·L⁻¹ 处理 12 h。

关键词 杉木;叠氮化钠;诱变剂处理;种子萌发;幼苗生长

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Effect of NaN₃ on *Cunninghamia lanceolata* Seed Germination and Seedlings Growth//Hu Ruiyang, Sun Yuhuan, Wu Bo, Duan Hongjing(Beijing Forestry University, Beijing 100083, P. R. China); Lin Huazhong, Fang Luming, Yu Xiaolong(Jiangle National Forest Farm); Li Yun(Beijing Forestry University) //Journal of Northeast Forestry University, 2018, 46(5): 6-11.

We investigated the effects of NaN₃ on Chinese fir seed germination and seedlings growth, with the seeds collected from the third generation Chinese fir seed orchard were chosen as test materials. Six contents of NaN₃ (0, 2, 4, 6, 8, 10 mmol·L⁻¹) and three treatment time (4, 8, 12 h) were tested to conduct studies on the effects of NaN₃ solution concentration and treatment time on the seed germination percentage, germination time, and the mutagenic seedling growth of Chinese fir. The germination time of Chinese fir seeds after soaked in 2-10 mmol·L⁻¹ NaN₃ for 4-12 h was obviously delayed, and the higher the concentration the longer the germination time. When the content of NaN₃ was up to 10 mmol·L⁻¹, 25.33 d were needed for the germination, which was 2.02 times as long as control 12.56 d, and the germination time of the seeds treated with NaN₃ solution for 8 h was 23.78 d on average which was the longest during in 4-12 h treatment. NaN₃ mutagenic treatment significantly reduced Chinese fir seed germination percentage, the higher content and the longer treatment time were, the lower seed germination percentage was. The average germination rate was decreased from 40.89% to 12.11% along with the concentration of NaN₃ solution increased from 0 to 10 mmol·L⁻¹, then only 3% germination rate was induced when treated with 10 mmol·L⁻¹ for 12 h. The NaN₃ mutagenesis treatment significantly inhibited the growth of the mutagenesis seedling, and resulted in seedling height dwarf, stem diameter attenuate, and a significant change in the number of lateral branches and the variation of the growth indexes. According to the mutagenesis of seed germination and seedling growth, the appropriate conditions of NaN₃ mutagenic treatment for Chinese fir seeds were 10 mmol·L⁻¹ for 14 h or 8 mmol·L⁻¹ for 12 h.

Keywords *Cunninghamia lanceolata*; NaN₃; Mutagenic treatment; Seed germination; Seedling growth

杉木(*Cunninghamia lanceolata* (Lamb.) Hook)是我国重要的人工用材林造林树种,栽培历史悠久,分布区域广,一直是我国林木遗传改良工作的主要研究对象^[1-2]。化学诱变育种借助具有诱变作用的化学物质诱发植物的基因突变,可显著提高诱变材料的突变频率,是改变林木不良性状以及选育新种

质的有效育种手段^[3]。化学诱变具有随机性,因此杉木诱变处理后可创造丰富的变异,获得大量种质遗传材料,为杉木新种质的筛选奠定基础^[4]。

叠氮化钠(NaN₃)是一种能够高效制造点突变的化学诱变剂,其作用机理是在酸性条件下 NaN₃ 产生呈中性的分子 HN₃, HN₃ 易透过细胞膜进入细胞内,进而以碱基替换方式影响 DNA 的正常合成,从而导致点突变的产生^[5-6]。目前,NaN₃ 已广泛应用于农作物和花卉,影响植物材料的生长发育,诱发植株表型发生明显变异。如 NaN₃ 处理显著降低小麦、大豆种子的发芽率和植株成活率,并诱导小麦叶色、穗型、育性、茎干高矮等表型发生多种类型的变异^[7-8],增加大豆诱变苗株高、主茎节数、分枝数等的变异范围^[9]; NaN₃ 处理还影响玉米、番茄、玉扇愈

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