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Perspective

Seed Germination Biochemical Mechanism in Plants

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ABOUT THE STUDY

Germination is the process of a seed growing into a plant, which eventually ends in the production of a seedling. The emergence of the radicle and plumule is also due to the reactivation of the seed's metabolic machinery. A seed is a microscopic packet created by the union of male and female reproductive cells in a fruit or cone of a vascular plant. In most plant species, fully formed seeds contain an embryo and a stockpile of food reserves, which are wrapped in a seed coat. Some plants produce a variable number of seeds without embryos; these are non-germinating empty seeds. Dormant seeds are viable seeds that do not germinate because they need specific internal or external stimuli to reactivate their growth. The seed germinates under ideal conditions, and the embryo resumes its growth, eventually growing into a seedling.

Seed germination is influenced by both internal and external forces. The most important exterior factors are the right temperature, water, oxygen or air, and sometimes light or darkness. Various plants require different variables for optimal seed germination. This is often determined by the seed variety and is directly tied to the plant's native habitat's biological conditions. Environmental influences influence the final germination response of some seeds during seed development; most of these reactions are seed dormancy.

The germination rate is a phrase used in agriculture and gardening to describe how many seeds of a particular plant species, variety, or seed lot will germinate in a given amount of time. It is a percentage that indicates how many seeds will germinate under perfect conditions during the germination period. For example, an 85% germination rate indicates that 85 out of 100 seeds will most likely germinate under ideal conditions during the germination period. Genetic makeup, physical traits, and environmental circumstances all influence seed germination rate. The germination rate can be used to determine how many seeds are required for a given area or number of plants. Seed physiologists and seed scientists describe "germination rate" as the reciprocal of the time it takes for the germination process to complete from sowing. The germination rate refers to the number of seeds capable of complete germination in a population (i.e. seed lot).

Light, as previously noted, can be an environmental factor that encourages germination. The seed must be able to determine when the optimal moment to germinate is by recognizing environmental signals, which it does by detecting environmental cues. When germination starts, the nutrients that have accumulated during maturation are absorbed, allowing cells to expand and multiply. In light-stimulated germination, the photoreceptor Phytochrome B (PHYB) is important for the early phases of germination. When red light is present, PHYB transforms into its active form and goes from the cytoplasm to the nucleus, where it up regulates the degradation of PIF1. PIF1, or phytochrome-interaction-factor-1, prevents germination by up regulating the expression of proteins that stop gibberellin (GA), a critical hormone in the germination process. HFR1, which accumulates in light in some way and forms inactive heterodimers with PIF1, is another factor that promotes germination. Although nitric oxide (NO) has a role in this pathway, the exact mechanism is uncertain. NO is thought to help germination by suppressing PIF1 gene expression while also stabilizing HFR1.

CONCLUSION

When latent Arabidopsis seedlings were exposed to NO gas, 90% of the seeds broke dormancy and germinated after 4 days, according to Bethke et al. The researchers also investigated how NO and GA influences the vacuolation process in aleurone cells, which permits digested nutrients to flow around. The transition from seed dormancy to germination must take place when the seed has the highest chance of surviving, and light is a key factor in seed germination and plant growth.

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