

Light, temperature effect seed germination

BELTSVILLE, Md. — Refrigeration of imbibed, dormant seeds that require light for germination for 24 hours prior to planting can greatly improve their germination, USDA plant physiologist William VanDerWoude reported at a USDA symposium on plant reproduction.

VanDerWoude, a scientist with USDA's Science and Education Administration, reported that chilling lettuce seeds, at 39 degrees Fahrenheit, then warming them to 68 degrees Fahrenheit, made them up to 10,000 times more sensitive to light. So sensitive do the seeds become that even far-red light, which normally inhibits germination, promotes germination.

VanDerWoude said the chilling period followed by normal temperatures makes the seeds' cell membranes a better environment for the action of phytochrome, a

complex molecule that enables plants to respond to light.

Phytochrome, a plant protein first discovered at the Beltsville Center in 1952 by H.A. Borthwick, S.B. Hendricks, M.W. Parker, F.H. Toole, and V.K. Toole, was believed until recently to be a molecule composed of a single subunit existing in either an inactive form, red-light-absorbing phytochrome (Pr) or in an active form, far-red-light-absorbing phytochrome (Pfr). Dr. Lee H. Pratt, University of Georgia, reported in 1980 that phytochrome is in fact a molecule having a pair of subunits—a dimer.

Working at the Seed Research Laboratory at Beltsville, VanDerWoude compared the enhancement of light sensitivity in lettuce seed germination by chilling and warming treatments and compared this to a mathematical

model of phytochrome's action as a dimer and identified the physiological significance of its existence in this form. VanDerWoude observed that two of the three possible photochemical forms of the dimer (Pr:Pfr and Pfr:Pfr) lead to germination responses. His work indicates that the action of Pr:Pfr in germination and other plant growth responses is controlled by the membrane properties around the receptor in the cell to which it binds.

VanDerWoude, who coordinated a session on "Photo Control Systems in Plant Reproduction" during a recent Beltsville Symposium VI, STRATEGIES OF PLANT REPRODUCTION, also highlighted related presentations by other speakers.

He said that Daphne Vince-Prue of Glasshouse Crops Research Institute, West Sussex, England,

would review the impact of artificially manipulating day length on plant growth, flowering, and crop production. Then Gerald Dietzer, of the Radiation Biology Laboratory, Smithsonian Institute, discussed ways of altering the internal biological clocks of plants through the use of red and far-red light, VanDerWoude said.

VanDerWoude called attention to work by Lee H. Pratt, of the Department of Botany at the

University of Georgia, who presented research on the differences between inactive and active phytochrome and the evidence for the existence of membrane-bound receptors for phytochrome. He said Pratt would describe how phytochrome's photochemical properties control plant growth and development in the natural environment, and how shading by other plants affects germination and growth beneath a canopy of leaves.



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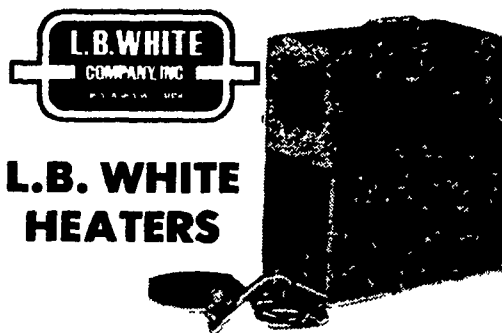
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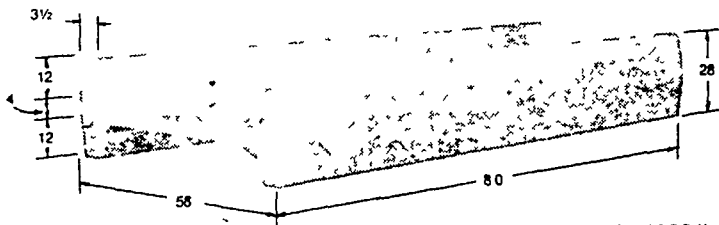
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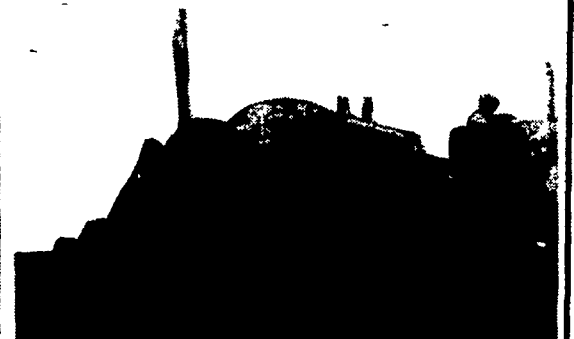
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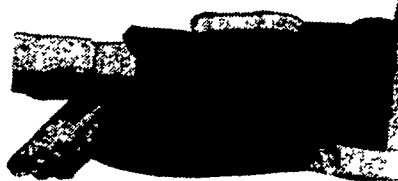
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