New theory 'sheds light' on plant growth

BELTSVILLE, Md. — Decades-old ideas about how light regulates the growth and flowering of plants are being challenged by a theory developed at USDA's Horticultural Science and Plant Physiology Institutes in Beltsville, Maryland.

Plants react to a continuous gradient of light and radiant heat, contrary to long-standing assumptions that they respond to only discrete bands and peaks of red and blue visible light, according to H. Marc Cathey, a world authority on growth regulation systems and culture of ornamental plants.

At a May symposium on "Strategies of Plant Reproduction" held by USDA's Science and Education Administration, Cathey explained that research he and colleagues Lowell E. Campbell and Richard W. Thimijan conducted shows that solar and other optical radiation outside the visible region contribute to plant growth.

While visible light and ambient temperature measurements correlate reasonably well for plants grown under fluorescent lamps, such measurements are inadequate outdoors and wherever plants are exposed to thermal (heat) radiation in addition to visible light.

These findings have important consequences for enhancing plant growth and reproduction. Cathey and other Beltsville scientists have already shown that the size, shape, color, pollution tolerance, and flowering of many plants can be influenced by manipulating chemicals, light, and temperature. The new theory could carry growth regulation research even further.

Cathey, Campbell, and Thimijan have found, for example, that many economically important crops (corn, soybeans, and others) can tolerate wide ranges of light and heat. Their growth and reproduction depends on the total amount of radiation they receive and not on the wavelengths of that radiation. Within reasonable limits, the warmer these plants, the better they produce

The theory divides plants into four groups depending on their thermal and spectral (light) requirements. Plants are either: spectral - and thermal-insensitive (for example, roses and snapdragons); spectral-insensitive and thermal-sensitive (tomatoes, geraniums); spectral-sensitive and thermal-insensitive (lettuce, strawberries); or spectral- and thermal-sensitive (chrysanthemums, woody plants).

Thermally sensitive plants will not tolerate high levels of non-visible, infrared irradiance, said Cathey. Spectrally sensitive plants require wavelengths of relatively low levels of blue and red light, depending, instead, on a broad band of the visible light spectrum.