Software Helps Farmers and Ranchers Spot Critical Changes in Crop Growth Stages

Greg McMaster has built a computer program, PhenologyMMS (Modular Modeling System), that predicts the timing of plant growth stages so that Central Great Plains farmers and ranchers can know how their crop is progressing and when to apply pesticides, fertilizers, and water. PhenologyMMS also helps them time other management tasks. McMaster developed this decision-support tool after answering numerous calls from farmers and ranchers who wondered when their crop would be at the right stage to spray as required by the pesticide label.

McMaster is an agronomist at the Agricultural Research Service's (ARS) Agricultural Systems Research Unit in Fort Collins, Colorado.

The pesticide label gives the scientific name of the growth stage, but no other hints. McMaster's program gives common names to go with the scientific names and tells growers how to identify the stages and when to expect them, based on weather reports and soil moisture.

To find the right timing, farmers answer questions such as, "What is your planting date?" and "How wet was your soil at planting time?" To answer this question, farmers choose one of these descriptions of soil moisture: "optimum," "medium," "dry," or "planted in dust." The last step is identifying the nearest weather station to access weather data to run a simplified model of growth for each crop chosen. The driving force of the program is cumulative temperature.

The program then simulates crop growth stages for the entire growing season, giving farmers a good idea of when each stage should occur.

McMaster says the program is unique because it covers many crops. Most such programs cover only one crop. "This program includes corn, wheat, barley, sorghum, dry beans, sunflowers, and several millet varieties and is continually being expanded," McMaster says.

The program can be used independently or inserted into existing crop-growth models. It can be downloaded at tinyurl.com/PhenologyMMS.—By **Don Comis,** ARS.

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Market Lighting Affects Nutrients

Many people reach toward the back of the fresh-produce shelf to find the freshest salad greens with the latest expiration dates. But a new study led by Agricultural Research Service scientists may prompt consumers to instead look for packages that receive the greatest exposure to light—usually those found closest to the front.

The study was led by postharvest plant physiologist Gene Lester while in ARS's Crop Quality and Fruit Insects Research Unit, in Weslaco, Texas. Lester and colleagues Donald Makus and Mark Hodges found that spinach leaves exposed to continuous light during storage were, overall, more nutritionally dense than leaves exposed to continuous dark. Lester is now with the USDA-ARS Food Quality Laboratory in Beltsville, Maryland.

For the study, the researchers exposed spinach leaves to light similar to the 24-hour artificial fluorescent light received by spinach in packages located at the front of the display case. A second group was enclosed in two-layer-thick brown grocery-bag paper to represent the "dark treatment."

Both experimental groups were housed in market-type, light-transmissible polymer tubs with snap-tight lids and were kept in walk-in storage chambers at 4°C—the same temperature at which markets currently display packaged spinach. The light reaction of photosynthesis is not temperature dependent and can occur at 4°C in the right type of light.

The researchers found that the continuous light affected the leaves' photosynthetic system—resulting in a significant increase in levels of carotenoids and vitamins C, E, K, and B9, or folate.

While the simulated retail light conditions actually helped the stored leaves gain in content of several human-healthy vitamins, some wilting occurred after 3 days of storage in flat-leaf but not crinkled-leaf types.

Continuous light exposure during retail display combined with specific cultivar selection (crinkled-leaf types) and leaf maturity (baby-leafed size) appears to be the strategy for preserving and enhancing the concentration of spinach-derived human-health bioactive compounds.

Results from this work were published in the *Journal of Agricultural and Food Chemistry.*—By **Rosalie Marion Bliss,** ARS.

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