

NCERA-101 Station Report March-2010

The University of Tennessee

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### **Impact Nugget:**

A web page was posted to disseminate research information on Controlled Environment Culture to commercial producers, and a blog was created to interact with growers and potential growers on design and operation of protected culture production systems.

### **New Facilities and Equipment:**

Two new glass greenhouse ranges were constructed over the past two years with a total of 13,800 sq ft ( in 16 individually controlled sections) of production space under glass. The new ranges have Priva Control systems and provide excellent environment control. All space has HID lighting and two sections have blackout curtain controls. These ranges are on Campus in Knoxville and are available to research, extension and teaching faculty. Over 18,000 sq ft of double poly covered quonset style houses with 8 to 10 foot side walls have been constructed at the East Tennessee and the Plateau Research and Education Centers. These will be used for applied research and extension projects to develop protected culture production systems. They are also used for grower education and demonstration projects. Lab facilities at Knoxville provide HPLC, GC, ICP-MS, HPLC-MS and GC-MS capability to support plant nutrition and secondary metabolism research projects to improve crop yield, quality and nutritional value.

### **Accomplishment Summaries:**

In 2009 we had the following three goals: 1) Continue to develop an interactive web page for Protected Culture in Tennessee, 2) Investigate production strategies that optimize fruit size and yield, reduce production cost, and optimize profit for vegetable and small fruit crops grown in protected culture, 3) Determine the impact of environmental and cultural factors on the production of key secondary metabolites that are important in human nutrition and develop production systems to optimize the concentration of these compounds to improve the functional food value of crops grown in controlled environments. Related to the first objective, we have posted information on greenhouse strawberry and tomato production experiments and began working on setup of a blog with the intent of interacting with protected culture growers. We completed several experiments for objective 2. We researched the impact of plant spacing from 12 to 28 inches on tomato yield and quality in a bag culture hydroponic production system. Fruit size and yield per plant were positively correlated with spacing. However, maximum yield per square foot of production area occurred at within row spacing between 14 and 18 inches. We also compared production systems with one single leader plant per bag, two single leader plants

per bag or one two leader plant per bag. The system with two single leader plants per bag produced the highest yield per square foot. We evaluated the impact of grafting hardy rootstocks on to Hybrid varieties in a bag culture hydroponic production system in the absence of disease pressure. There were no statistical differences in yield among the rootstock/scion combinations tested in these experiments. These plants were grown in hydroponic bag culture (with restricted root volume), and no disease pressure was present. We investigated the impact of propagation date of plug plants on the yield and quality of several varieties of strawberries grown in protected culture. Yield of five cultivars propagated in July was approximately 35 percent more than the yield of the same cultivars propagated in August. Evie-2, Carmine, and Camarosa yielded approximately 900 g/plant for the entire harvest period. Fruit of Evie-2 were relatively large but had poor flavor and ripened unevenly. Carmine and Camarosa had acceptable flavor and fruit size. Ventana plants yielded slightly less fruit but had the best fruit quality throughout the trial period. We are currently evaluating the potential economic impacts of these results on protected culture production systems. We are currently developing manuscripts from each of these experiments. For objective 3, our emphasis was on understanding the impact of pre- and postharvest cultivation management on nutritionally important vegetable crop secondary metabolites. We evaluated the impact of Selenium on phytonutrient content of herbal crops. We also researched the impact of foliar applications of chelated titanium (Ti) on quality and nutritional factors in dwarf tomatoes; determined the impact of applying abscisic acid (ABA) on quality and nutritional factors in dwarf tomatoes; and investigated the impact of UV light on phytonutrient accumulations in chive and bunching onions.

### **Impact Statement:**

We joined the NCERA-101 project in the fall of 2009, and, thus, this is our first project report. One significant impact in 2009 has been increased stakeholder interest in the project web page and the production research we have posted during the first year of the project. We have had over 250 interested stakeholders (current and potential growers) visit the production research greenhouses at the Plateau Research and Education Center, The East Tennessee Research and Education Center and on the UTIA Campus in Knoxville. We have presented these results at state, regional, national and international meetings to both grower and professional groups. The data collected as part of the project will be critical in determining whether these systems will be economically feasible for growers as potential protected cropping systems. We are also currently training students in greenhouse management at both undergraduate and graduate levels. This student training will provide knowledgeable graduates to work in the growing greenhouse production industry. We are developing agent and grower training materials based on the results of these projects that will assist in training interested growers in profitable protected culture production systems. The results of the phytonutrient experiments will provide information useful in developing protected culture production systems that not only optimize crop yield and quality but also improve nutritional value and flavor. One significant impact this past year is the results

of our research indicating that sugar content and flavor of tomato may be improved in low light conditions by applying stress modulating compounds at critical stages in fruit development.

### **Published Written Works (2009):**

Barickman, T.C., D.A. Kopsell, and C.E. Sams. 2009. Impact of nitrogen and sulfur fertilization on the phytochemical concentration of watercress, *Nasturtium officinal* R. Br. *Acta Horticulturae* 841:479-481.

Kopsell, D.A., G.R. Armel, T.C. Mueller, C.E. Sams, D.E. Deyton, J.S. McElroy, and D.E. Kopsell. 2009. Increase in nutritionally important sweet corn kernel carotenoids following mesotrione and atrazine applications. *Journal of Agricultural and Food Chemistry* 57(14):6362-6368.

Kopsell, D.A., C.E. Sams, T. Casey Barickman, D. E. Deyton, and D.E. Kopsell. 2009. Selenization of basil and cilantro through foliar applications of selenate-Se and selenite-Se. *HortScience* 44(2):438-442.

Sams, Carl E. , Anita Hayden, Susannah Stoffer, Dennis Deyton, John Cummins, Casey Barrickman and Dean Kopsell. Updates to the Web Page for Greenhouse and Protected Culture of Small Fruit and Vegetables in Tennessee. 2009. [www.utprotectedagsolutions.tennessee.edu](http://www.utprotectedagsolutions.tennessee.edu).

### **Scientific and Outreach Presentations:**

Deyton, D.E., Carl E. Sams, F. Takeda and J.C. Cummins. 2009. Off-Season Strawberry Production. *HortScience* 44:1003 (Abst.)

Sams, Carl E., S. Amundson, T. Barickman and D. Deyton. 2009. Greenhouse tomato Production Systems. Tennessee Fruit and Vegetable Growers Association Annual Meeting. Nashville, TN Jan. 2009.