SCRI Onion Postharvest Project Interim Report

August 2010

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SCRI project management in 2010

a. PI and advisory panel meeting in Savannah, Georgia on January 9, 2010.
Fourteen PIs, advisory panel members, and graduate students attended this meeting. We discussed the overall objectives of the Onion Postharvest SCRI Project. The meeting went well. PIs received many useful suggestions from the advisory panel members.

b. Regular subgroup meetings.
Four subgroups were formed based on the similarity of their objectives at the beginning of the 2010. They are: 1) Engineers group I for automated sorting/waste stream management (Li, Tollner, Thai, Gitaitis, Hawkins); 2) Engineers group II for disease detection in storage (Li, Cai, Li); 3) Pathologists and horticulturist for disease management and control (Gitaitis, MacLean, Schwartz, Mohan); 4) Social and economic analysis and sensory survey (Morgan, Shewfelt, Molnar). These four subgroups have held meetings regularly in the first six months of 2010. In total 10 subgroup meetings were held from January to June in 2010.

c. PI online meeting on July 9, 2010.
Eight out of 11 PIs attended this middle year PI meeting via Wimba online telecommunication program. Drs. Tollner, Hawkins, and Mohan were not able to attend. PIs reported their progress made in the first half year and received feedback from other colleagues. The meeting went from 12 PM to 4 PM (EDT).

d. Project website was launched.
With the help from Dr. Schwartz, our project website was lunched. It was linked with the Alliumnet.com which serves as the portal for onion research.
http://www.alliumnet.com/PostHarvestHandling.html

A detailed meeting times of four subgroups and whole group are shown in Table 1.
Table 1. PI subgroup meetings and PI group meetings in the first half year of 2010.

	1	2	3	4	5	6	7	8	9	10	11	12
Engineering I		X		X		X						
Engineering II		X				X						
Pathology/Hort	X				X							
Socioeconomic		X	X		X							
Group meeting	X						X					
Interim/Yearly report							X				X	

Changying Li SCRI project progress
(January to July 2010)

1) Output: (what did we do).

Since the start of this project last September, Changying Li has been working with his graduate student Weilin Wang to accomplish the following goals.

I. Developed a liquid crystal tunable filter (LCTF) based near infrared hyperspectral imaging (HSI) system.

The near-infrared hyperspectral imager consisted of a liquid crystal tunable filter (Model Varispec LNIR 20-HC-20, Cambridge Research & Instrumentation, MA, USA), an InGaAs camera (Model SUI320KTS-1.7RT, GOODRICH, Sensors Unlimited, Inc, NJ, USA), and an optical focusing lens (Nikkor 50mm f/1.4D AF, Nikon, Japan). The spectral response of the monochrome InGaAs sensor is from 900 nm to 1700 nm. The LCTF can tune wavelength continuously over the wavelength region of 850 nm to 1800 nm, with a minimum 1 nm interval and 20 nm FWHM (Full-Width at Half-Maximum). Coupled with a frame grabber (NI PCI-1426, National Instruments, Austin, TX, , USA), the HSI imager can capture 12-bit gray images of 320×256 pixels resolution at spectral bands from 900 nm to 1700 nm, with a maximum speed of 60 frame per second (fps). The HIS system was calibrated and characterized with the following parameters: system output, linearity, field of view (FOV), spatial resolution, lens distortion, spectral accuracy, spectral denoise.

II. Developed software to interface and control hardware.

The hyperspectral image acquisition software was developed by using LabVIEW 8.2 (National Instruments, Austin, TX) which was installed on a computer (OptiPlex 755, Dell, Round Rock, TX, USA) with a Intel Duo processor E8200 (6M Cache, 2.66 GHz, 1333 MHz FSB) and 4 GB of RAM (random access memory). The software was able to tune the LCTF band by band, controls the InGaAs camera to take images, and synchronizes data from the frame grabber to computer memory. After finishing the scans over all bands in the spectral region, it constructed a 3-D hyperspectral image cube based on collected grayscale images, and then automatically saved the image to predefined path. The digital color camera was also controlled by the software for color image acquisition before or after a hyperspectral image scan.

III. Detected onion sour skin using the HSI system.

near-infrared hyperspectral reflectance images of 40 Vidalia sweet onions were taken in 2 nm increments from 950 nm to 1650 nm, before and after they were inoculated with *B. cepacia.* Inoculated onion samples were scanned every day after inoculation for 7 days, while the hyperspectral images scanned before inoculation were used as controls. Spectral signatures of onion hyperspectral images were extracted from selected regions of interest. Based on principal component analysis conducted on spectral signatures of control and inoculated samples, two optimal spectral bands (1070nm and 1400nm) were selected to construct ratio images, which better revealed the difference between the control and inoculated samples. Three spatial features of onions, mean pixel gray values of onion flesh body area, root or neck area, and the whole onion area, were calculated on ratio images and used as inputs for classification models. Three spatial features obtained from bands ratio images were proved to be good indicators of sour skin-infected onions. In addition, back-propagation neural network (BPNN) models performed better (95% classification rate) than support vector machine (SVM) classifiers (85%-90%) for discriminate control samples and inoculated samples on day 6 after inoculation. The BPNN classifier using three spatial features of onion bands ratio images was applied to classify hyperspectral images of tested onion samples over the period of 1-7 days after inoculation, respectively. The results of tests showed that the near-infrared hyperspectral reflectance imaging technique could detect sour skin-infected onions effectively from day 4 to day 7 after inoculation by achieving overall classification accuracies of 80%, 85%, 95%, and 100%, respectively.

IV. Tracing algorithm development for rot onion detection in storage.

Modification of the initial model was made from the steady state model to the dynamic ventilation model in order to accommodate the real situation in onion storage when no fresh air exchange between indoor and outdoor. The theoretical analysis and model development has been largely done in the past several months. These models are general models without considering specific room ventilation conditions and onion containers. Gas sensor location optimization work has been done. One sensor scenario: is mainly for position/location optimization; multiple sensors scenario: is to optimize the quantity and location of sensors. When a theoretic model was build, the next step is to simulate the real onion odor release process; then conduct a computer simulation and smaller research cold room test with onion bins; the last step is to test the model in the real storage room. Prof. Xianting Li's group will send one student or postdoc to UGA in 2011 to conduct the test. Dr. Hao Cai is working on preparing manuscript to summarize the theoretical modeling work.

2) Outcomes/ Impacts (i.e., what were the results and practical implications).

- HSI hardware system
- Software developed under the LabVIEW
- Dynamic ventilation model was studied for indoor contamination source identification
- A M.S. student is preparing his thesis
- Several conference papers and several journal papers are in preparation
- Presentations in county agent training and growers meetings
- Extension reports

3) Publications.

1) Li, C., H. Schwartz, K. Mohan, J. Molnar, K. Morgan, R. Gitaitis, G. Hawkins, D. MacLean, R. Shewfelt, C. Thai, W. Tollner. 2010. Holistic approach to advance onion postharvest handling efficiency and sustainability. Invited poster presentation at ASHS annual meeting. Palm Desert, California, August 1-3, 2010.
2) Wang, W., C. Li, E.W. Tollner, R. Gitaitis, G. Rains, S. Yong. 2010. Near-infrared Hyperspectral Reflectance Imaging for Early Detection of Sour Skin Disease in Vidalia Sweet Onions. ASABE Paper No. 1009106. Pittsburgh, Pennsylvania, June 20-23, 2010.

3) Wang, W., C. Li, R. Gitaitis, G. Rains, C. Thai, E.W. Tollner. A Near-infrared Hyperspectral Imaging System for Quality Inspection of Specialty Crops. Poster. Southeast Regional Fruits and Vegetable Conference. Savannah, GA. January 7-10, 2010.
4) Li, C., R. Gitaitis, E.W. Tollner, P. Sumner, and D. MacLean. 2009. Onion Sour Skin Detection Using a Gas Sensor Array and Support Vector Machine. Sensing and Instrumentation for Food Quality and Safety 3(4): 193-202.

Onion SCRI Research Report (7/30/2010)

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Work done (January – June 2010)

A) Spectral Imaging Results (2009)

Last year (2009) spectral imaging work concentrated on reflectance and transmittance images of 1 to 5 onion leaves stacked on each other (see Fig. 1), showing essentially 2 spectral ranges of interest, the first one from 1050 to 1150 nm (usable up to 5-leaf thickness) and the second one from 1250 to 1350 nm (practical for up to 3-leaf thickness only).

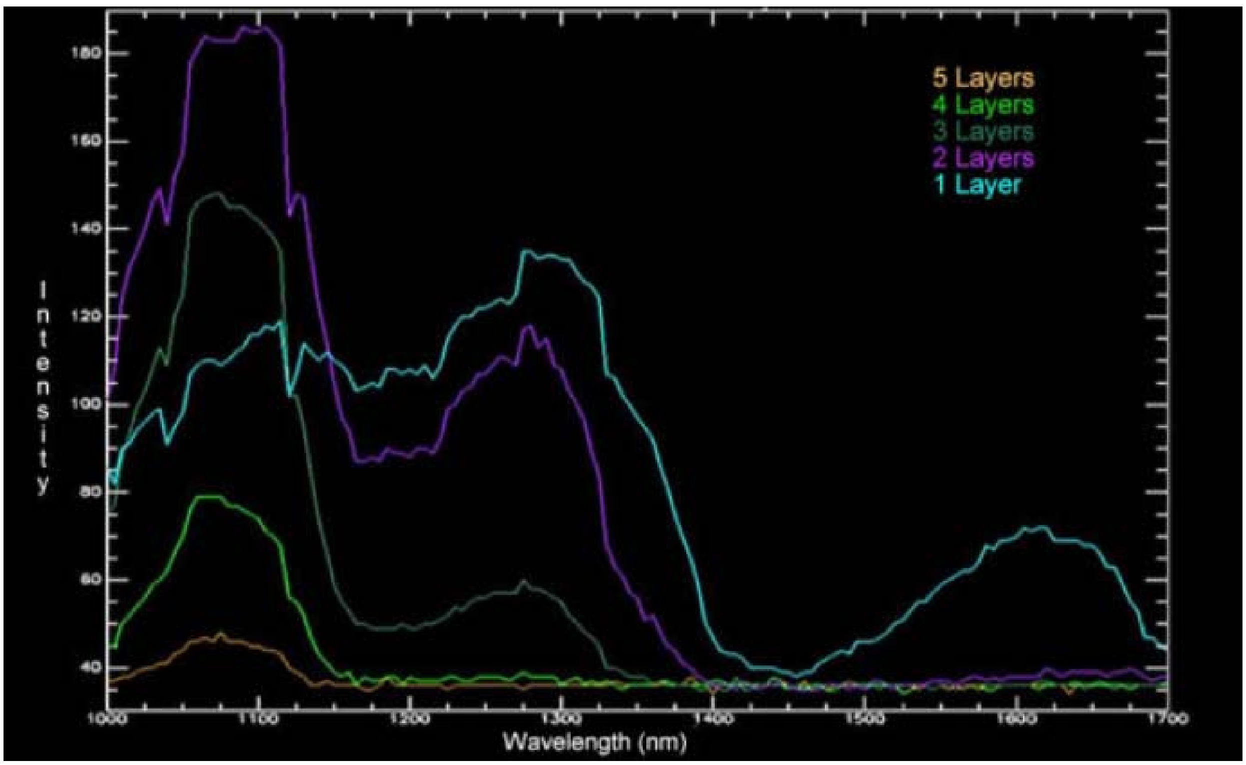

Fig. 1 – Mean spectra from hyperspectral transmittance images of sweet onion bulbs from 1 to 5 leaves stacked together.

This work was performed on half-cut and quarter-cut onion bulbs leading to an important discovery about the mechanism of light transmission through the different leaves of a typical bulb: the spongy part of a leaf mainly supported the transmission mode of light transport, while the inter-leaf membrane behaved as a light diffuser (see Fig. 2).

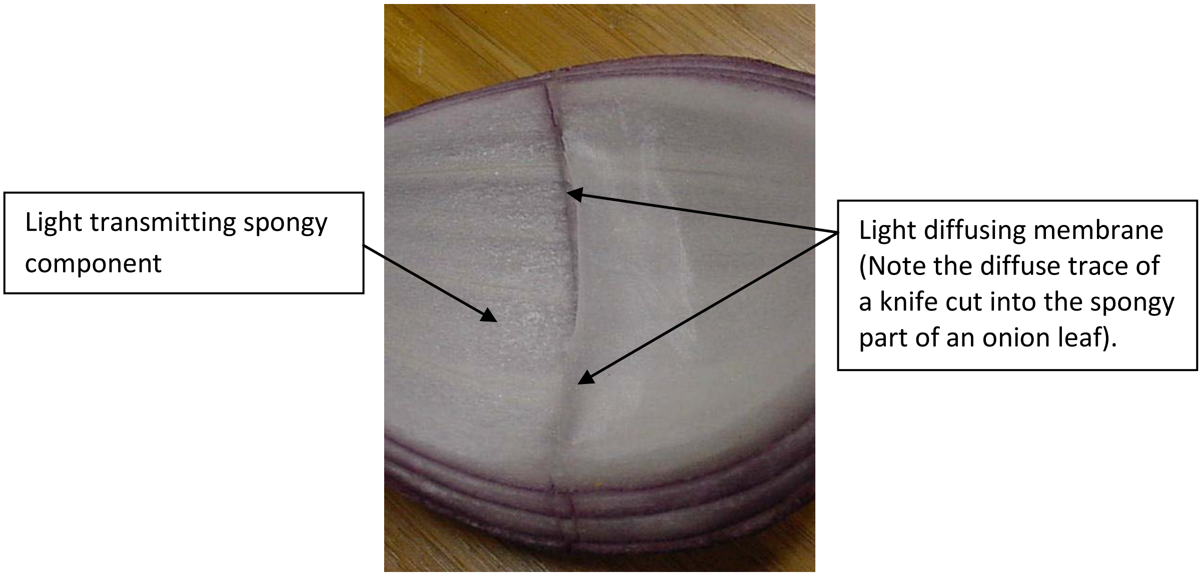

Fig. 2 – Inter-leaf membrane acting as a light diffuser while spongy component mainly transmitting light.

Future work in spectral imaging will be shifted to the Engineering Group in Tifton because of the availability of newer and better equipment on the Tifton campus.

B) Large Aperture Spectrometry Results (June 2010)

This project's goal is to determine the possibility of linking NIR spectrometry in the 1000-2200 nm range to human sensory perceptions of sweetness, pungency and bitterness. The more specific objectives are:

- Use Large Aperture Spectrometry as a complementary physical measurement for sensory panel modeling.
- Identify dominant wavelengths in the 1000-2200 nm range that best correlate to pungency, sweetness and bitterness of onions.
- Develop a quantitative tool mapping onion transmittance to sensory panel evaluation results.

A more detailed description of the sensory tests can be found in Dr. Robert Shewfelt's report (UGA Food Science Department). This report concentrates on the spectrometry technical aspects and some preliminary data and correlation results found at this point in time.

The "Large-Aperture" spectrometry technique simply uses a large lens coupled to a regular optical fiber (so as to capture a larger surface area of the onion) attached to an InGaAs (Indium Gallium Arsenide) grating-based spectrometer (see Fig. 3). The original experimental set up had hoped to be able to capture transmittance spectra through an entire onion as shown in Fig. 3. Unfortunately we found that we cannot use a continuous light source with enough power to go through an entire onion without damaging it due to heating of the sample.

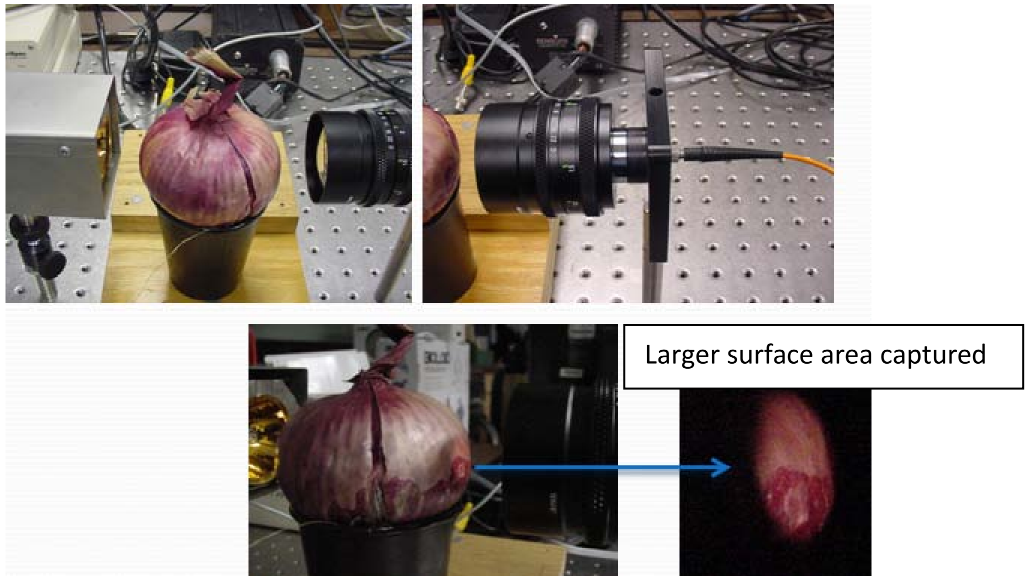

Fig. 3 – Original experimental setup.

Consequently, this original procedure was modified to capture transmittance through a single onion leaf as shown in Fig. 4, starting from the leaf next to the dry skin (Leaf 1), and testing 4 more consecutive inner leaves (Leaf 2 to Leaf 5).

Fig. 4 – Actual single-leaf experimental setup.

At this point in time, we are still in the process of analyzing the spectral and sensory data, thus we have only some preliminary data to share. Fig. 4 shows typical spectra obtained for red and yellow onions that were tested.

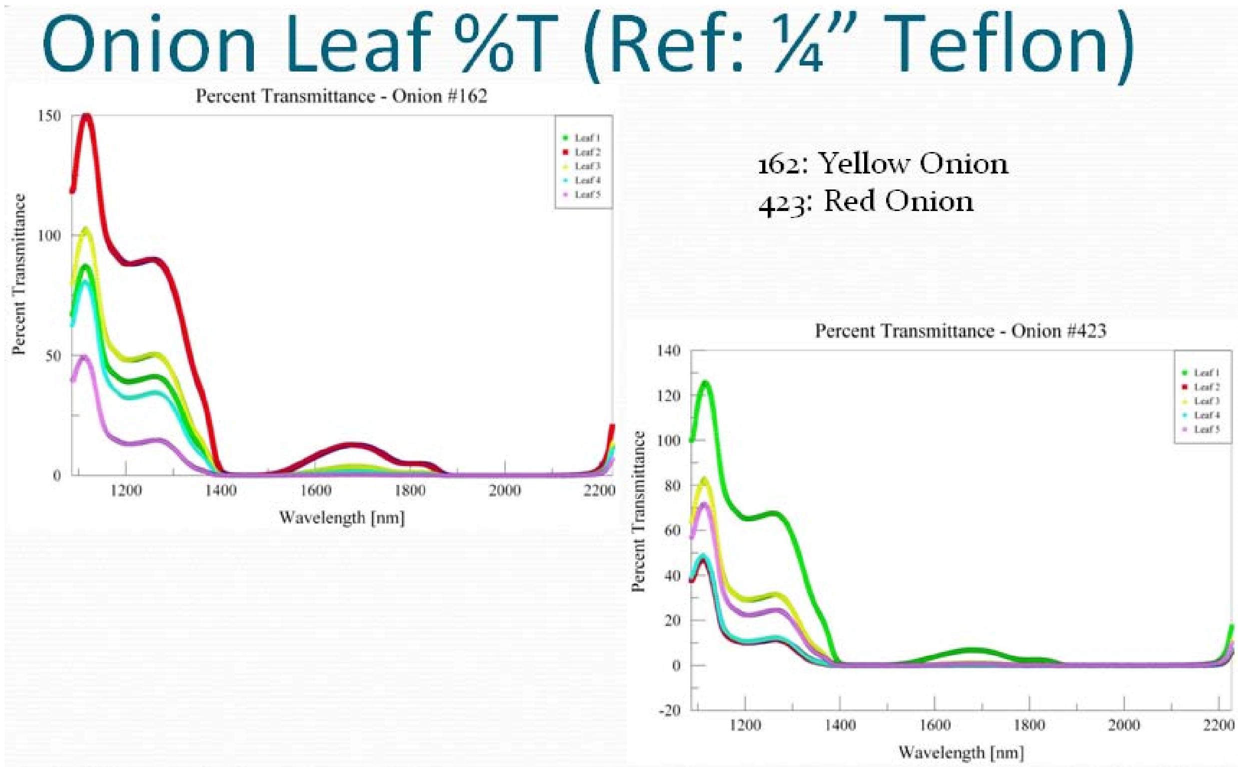

Fig. 5 – Typical transmittance spectra obtained from June 2010 tests.

The 1600-1800 nm range was usually only applicable to the outer leaves (Leaf 1 and Leaf 2) as they were thinner than the inner leaves which may also have higher chemical contents and biomass. The range of 1050 to 1150 nm is still the dominant one, the range of 1250 to 1350 nm is the next useful region. Essentially the large-aperture spectrometry data correlated well with the data obtained from the hyperspectral imaging experiments of 2009.

C) Sensory Panel Results

At this time, we only had initiated the basic statistics and correlation analyses among the 9 panel judges and their responses for three sensory features sweetness, pungency and bitterness (scaled from 1 to 4). The full range of 1-4 was obtained in our data set and Table 1 represents the basic statistical results for these 3 sensory features.

Table 1. Basic statistics for June Onion Sensory Data

	No. of Data	Arithmetic Mean	Std. Deviation	Median
Sweetness	743	2.31	0.95	2
Pungency	743	2.37	0.93	2
Bitterness	742	1.99	0.93	2

When considering the responses from **all judges**, the Pearson Correlation Coefficients Matrix was:

	Sweetness	Pungency
Pungency	-0.2424	
Bitterness	-0.3201	0.4525

While the individual judge's correlation results were as follows:

Judge 1

	Sweetness	Pungency
Pungency	-0.3434	
Bitterness	-0.3380	0.5296

Judge 2

	Sweetness	Pungency
Pungency	-0.1992	
Bitterness	-0.2068	0.1942

Judge 3

	Sweetness	Pungency
Pungency	-0.2203	
Bitterness	-0.5150	0.5527

Judge 4

	Sweetness	Pungency
Pungency	-0.4873	
Bitterness	-0.4595	0.4936

Judge 5

	Sweetness	Pungency
Pungency	-0.1856	
Bitterness	-0.3049	0.3678

Judge 6

	Sweetness	Pungency
Pungency	-0.2228	
Bitterness	-0.5411	0.3291

Judge 7

	Sweetness	Pungency
Pungency	-0.0788	
Bitterness	-0.1602	0.3811

Judge 8

	Sweetness	Pungency
Pungency	-0.2426	
Bitterness	-0.3166	0.4351

Judge 9		Sweetness	Pungency
	Pungency	-0.0689	
	Bitterness	-0.3509	0.1876

These results showed some weak negative correlations between Sweetness vs. Pungency and between Sweetness vs. Bitterness, and a medium positive correlation between Bitterness and Pungency. Judges 2 and 9 responses seemed to have put them in a different category than the rest of the judges.

C) Future work

- Determine spectral derivatives characteristics.
- Whole spectra analysis with the Unscrambler software.
- Develop multiple wavelength indices to adjust for varying thicknesses of onion leaves.
- Developing a Genetic-Algorithm based tool to determine best wavelengths and best "formula" for indices.

D) Publications

None for this time period.

Robert Shewfelt

A total of 22 varieties of Vidalia onions grown at the University of Georgia research station in Lyons, GA were used. Onions were cut in half and spectrometry was performed on the five outer leaves of five onions per day. Immediately after, onions were transported to the food processing lab and sensory analysis was done on the remaining halves of the onions. Onions were chopped and placed in two ounce soufflé cups. A total of nine panelists, five female and four male, evaluated the onion samples for sweetness, pungency, and bitterness. Sensory and instrumental data will be analyzed to develop a predictive model for each attribute. The experiment will be repeated to test the validity of the model.

Bill Tollner

1) Outputs (i.e., what did you do)
We have engaged a graduate student to do sensor development for onions and to do simulation modeling of the process for purposes of assessment of sensor economics.
2) Outcomes/ Impacts (i.e., what were the results and practical implications)
Pending
3) Deliverables: Publications and presentations.
You have the outputs that Weilin presented.

<u>SCRI interim report on bacteriological research R.D. Gitaitis Lab.</u>

Detection of sour skin of onion, caused by *Burkholderia cepacia*, using zNose technology. Sour skin of onion, caused by *Burkholderia cepacia*, is an important pre- and postharvest disease of onion. In Georgia, this disease can be responsible for the loss of entire storage units that may have as much as a 40,000 bushel capacity. Removing and re-grading onions can be an effective management strategy if the disease is detected early enough. zNose technology was explored as a new approach for the rapid detection of sour skin in stored onions. The zNose is a portable gas chromatograph used to rapidly identify volatile compounds in head space and can produce a volatile gas profile for the air in the storage room. Research was conducted in the spring of 2010 using Spanish sweet onions and zNose technology to evaluate the differentiation of healthy onions from onions separately infected with 10 different strains of *B. cepacia*. Results indicate that the zNose can quantitatively differentiate healthy onions from onions infected with *B.cepacia* after 3 days of incubation. There were no differences among volatile profiles produced by the 10 different strains of *B. cepacia*, which essentially means variability among volatile profiles produced by the species does appear to be a limiting factor in using zNose technology for detecting early onset of sour skin. Further analysis with other onion pathogens is planned. Experiments are also being conducted to evaluate the impact of the ratio of diseased onions with healthy onions on detection as well as the effects of inoculum density of the pathogen on zNose sensitivity.

Management of sour skin of onion in the field prior to harvest: 1.Effect of double-cropping onions behind pearl millet (*Pennisetum glaucum*) or corn (*Zea mays*). Previous work indicated that pearl millet (*Pennisetum glaucum*) decreased soil-borne populations of *B. cepacia* in contrast with corn (*Zea mays*) which increased bacterial populations. Anecdotal evidence from growers' observations also indicated that there were increased levels of sour skin in onions double-cropped with corn. When onions were double-cropped behind either pearl millet or corn, there were no significant differences in yield. However, sour skin levels were significantly less in onions following pearl millet when compared to disease levels in onion following corn in soils with a long-term history of onion production. In contrast, there were no significant differences disease levels in onions grown in soils with no history of onion production. Results are encouraging and there is potential to incorporate double-cropping management in to an overall strategy with pesticide applications, grading technologies, and storage sensors to reduce sour skin losses.

2. Application of cupric hydroxide immediately following a novel method of harvesting onions. Onions were clipped in the field using a modified transplant clipper instead of using the traditional method of undercutting onions followed by hand-clipping. Onions were slightly immature so the foliage remained upright for mechanical clipping. Onions were clipped to a height so that approximately 2-3 inches of onion neck remained. Immediately following clipping cupric hydroxide was applied at a 2 lb/A rate as an over-the-top spray to cover the wounded onion neck. A challenge inoculation with *B. cepacia* was conducted after the bactericide application was allowed to dry for 1 hr. Sterile water was applied to onions clipped in a similar manner, which served as a control. After field-curing, onions were stored under ambient temperatures on a pallet on the packinghouse floor for 2 wks. Onions then were cut and graded for disease incidence and severity. There were no significant differences between treatment and control.

SCRI Onion Project: Progress Report (07-27-10)
Colorado State University (Dr. Howard F. Schwartz)

Field Experiment:

During harvest time (September), a sample of 100 onion bulbs (medium and larger) will be collected from each of four varieties (two transplanted and two seeded) at our university research farm. The varieties are: Charismatic – transplanted 04/21/10; Ranchero – seeded 03/30/10; Rumba – transplanted 04/28/10; and Belmar – seeded 03/30/10. Two samples of 25 bulbs each from each fungicide treatment (control or IPM treated) will be shipped from Colorado and Idaho to Georgia (Charlie Li/Ron Gitaitis) for use in their studies. The IPM treatment will be initiated after bulbing begins, by alternating the following fungicides on a 7-day interval: ManKocide @ 2.5 lb, Scala @ 18 fl oz, ManKocide @ 2.5 lb, Switch @ 14 oz, ManKocide @ 2.5 lb, and Pristine @ 18.5 oz in 25 gal of water/acre. Near the end of the growing season (at least 2 weeks pre-cropping), inoculate all plants 2-3 times in treatments 1 & 2 with Botrytis allii at 10^{7-8} conidia/ml

The 100 bulbs from each variety/field will be divided into four samples of 25 bulbs each, inoculated with local isolates of neck rot (*Botrytis* sp.) fungus inoculum (at 10^{6-8} conidia/ml), and incubated for 2-4 weeks at room temperature. One sample of the control and IPM-treated bulbs from each variety/field will be rated on-site in Colorado or Idaho for neck rot (and any other bulb rot) incidence and severity, and the other sample of the control and IPM-treated bulbs from each variety/field will be shipped to Georgia for further use in different aspects of project investigation (e.g., scanning, volatiles). Results will be summarized and reported early next year.

Outreach (Web Site) Development:

During the last year, we have activated an online reporting site and link at the alliumnet.com Portal to promote our SCRI Project: http://www.alliumnet.com/PostHarvestHandling.html

Goal to: Enhance onion postharvest handling efficiency and sustainability by integrating more efficient online sorting, reducing storage losses, and managing the waste stream of onions in relation to the following **objectives to**: Enhance the efficiency of onion quality sorting by a multimodal sensing platform using X-ray and hyperspectral imaging technologies; Develop a gas sensing and tracing method for disease detection in storage and evaluate onion postharvest disease management practices; Manage the onion waste stream and mitigate environmental pollution using an anaerobic digestion system; Evaluate social implications and economic impacts of these technologies; and Engage in outreach and technology transfer with stakeholders.

This page allows users to navigate between various resources posted there, and includes an overview on our project, its members, reports, talks and presentations. As we continue to make progress on our various project objectives, summaries and updates will also be posted there.

UNIVERSITY OF IDAHO

Semi-annual progress report – 07/29/2010

Project Title: Advancing Onion Postharvest Handling Efficiency & Sustainability.

Personnel: S. Krishna Mohan, Co-PI.

During this period, we have collected four samples of 25 onions each, from 2009 harvest (untreated plots) that were held in storage for five months. The bulbs did not show any external symptoms/signs of neck rot or any other soft rot. These bulbs were shipped to the project cooperators in Georgia (Dr. Gitaitis, MacLean, Li) for their use in different aspects of the project work (e.g. scanning, volatiles). Plans are in progress for collecting field samples from the 2010 crop and inoculating with the local isolates of neck rot fungus along with corresponding uninoculated controls. Half the number of bulbs from each treatment will be shipped to Georgia for use by other investigators, and the other half will be examined and rated for neck rot incidence and severity after appropriate length of incubation. We are also collaborating with the Socio-Economic Survey of Onion Growers in the Treasure Valley, being conducted by Dr. Kim Morgan.

No presentations or publications during this reporting period.

Onion SCRI project interim report

Prepared by Dan MacLean

Objective: To study postharvest harvest and handling strategies in order to minimize the amount of loss due to pathogen activity.

Experiment I: Sulfur dioxide and ozone treatments for the postharvest control of storage disorders of Vidalia Sweet Onion

Manish Bansal (M.Sc. Candidate), Randy Hill (VOVRC Superintendent), Denny Thigpen (VOVRC Research Technician), Anthony Bateman (Research Professional), Reid Torrance (UGA Area Onion Agent)

Three cultivars of sweet onion (WI-129, Caramelo and Sapelo) were either field cured (0 or 72 hours) or heat cured (72 hours; 37°C), then graded and sorted into 20 bulb bags (4 reps). Bulbs were placed into one of four rooms; regular air storage (1°C, 70% R.H.), controlled atmosphere storage (3% O_2, 5% CO_2, 1°C, 70% R.H.), Ozone (O_3, 0.5 to 1 ppm, continuous atmosphere), or sulfur dioxide (SO_2, one time application, 100 ppm/hr, then flushed with nitrogen). Bulbs were removed after 0, 2 and 4 months, and evaluated 1 and 15 days after removal from storage. Upon removal, bulbs weighed, and evaluated for storage disorders and other quality defects. Furthermore, a subsample of tissue was collected for determination of total phenolic and total antioxidant content. Experiment is in progress.

Experiment II: Evaluation of late season, preharvest practices towards minimizing postharvest losses of Vidalia Onions.

Rajagopalbabu Srinivasan (Entomology), Manish Bansal (M.Sc. Candidate), Dan MacLean (Horticulture), Ron Gitaitis (Pathology), David Riley (Entomology), Anthony Bateman (Research Professional)

Two cultivars of sweet onion (Century and Savannah Sweet) were treated one month PHI with numerous chemistries in order to determine the effect of preharvest in-field management practices on the postharvest shelf-life of the onions. Two to three applications each of Actigard (SAR), Provado and Radiant (insecticides), Mancozide (bactericide), or Boscalid and two unregistered numbered fungicides were evaluated on separate plots (8, including water control) containing 4 replications. Bulbs were undercut and field cured (72 hours), then stored in regular air storage (1°C, 70% R.H.). Bulbs were removed after 0, 2 and 4 months, and evaluated 1 and 15 days after removal from storage. Upon removal, bulbs weighed, and evaluated for storage disorders and other quality defects. Experiment is in progress.

Experiment III: Evaluation of postharvest application of fungicide towards minimizing postharvest losses of Vidalia Onions.

Manish Bansal (M.Sc. Candidate), Hunt Sanders (Pathology), Ron Gitaitis (Pathology), Dan MacLean (Horticulture), Anthony Bateman (Research Professional)

One cultivar of sweet onion (Savannah Sweet) was drenched postharvest with numerous chemistries in order to determine the effect of postharvest application of fungicides or bactericides on the incidence of Botrytis or Sourskin, respectively. Bulbs were undercut and harvested from the field then graded and sorted into 20 bulb bags (4 reps). Bags were then drenched with Scholar, Pristine, or Luna (fungicides), or Kocide (bactericide), then either placed directly into regular air storage (1°C, 70% R.H.), or heat cured (72 hours; 37°C) prior to storage. Bulbs were removed after 0, 2 and 4 months, and evaluated 1 and 15 days after removal from storage. Upon removal, bulbs weighed, and evaluated for storage disorders and other quality defects. Experiment is in progress.

Semi-Annual Status Report
Gary L. Hawkins, Biological and Agricultural Engineering, UGA
Work for Objective number: #3

Progress Report:
Outputs:

Onions from various parts of the country have been measured and will continue to be measured during the time period of the project. Onions have been received from Georgia, New York and Colorado. The onions were tested for pH, COD, alkalinity (if possible), brix, moisture content and ash content.

A screwpress has been installed to separate onion juice from pulp for use in anaerobic digesters. Digesters have been designed and installed and are in the initial stages of receiving onion juice. The early stages will blend onion juice with dairy waste in a 1:3 ratio. Also, the pH of the juice is low and test has been run to determine the proper amount of buffering needed for stability of the digesters. Current digesters available for onion testing are 90 liters and 4000 liters. The 90 liter digesters are anaerobic filters (High Rate fixed film systems) and a anaerobic sequencing batch reactor (ASBR which is a high rate suspended sludge digester). Date should be forthcoming on the degradation efficiency of both systems.

Presentations have been completed at locations such as the Association of Natural Resource Extension Professionals, a Webinar to energy professionals (http://www.youtube.com/watch?v=od-8Z9e8oxo), Southeastern Region Fruit and Vegetable Conference, and Extension trainings/production meeting.

Outcomes:

The design and installation of the anaerobic digesters will provide us the needed information on the amount, time and feed rate that can be maintained for degradation and treatment of onion waste. The installation of a screwpress provided a means to separate juice from pulp on a large scale.

The presentations of information, concept and progress have provided various groups, organizations and individuals with information on a concept that is feasible. Continual collection of data will provide information on specific parameters of how to manage the digesters to extract optimum amounts of energy from the onions.

Publications:

Hawkins, G.L. 2010. Managing Fruit and Vegetable Waste. UGA Extension Publication number C988.

Kim Morgan (Mississippi State University) –SCRI Onion project

1) Outputs (i.e., what did you do)

I attended the Southeast Fruit and Vegetable Association Annual Meeting & joint SCRI Onion PD meeting where I presented Year One plan of work and met Advisory Panel members and attended vegetable production sessions (Jan 7-10, 2010). I have participated in three socio-economic group webinars in February, March and May 2010 along with Drs. Li, Shewfelt, Molnar and Hawkins. During each hour-long session, the PIs discussed research needs, shared concerns and timelines, and offered constructive suggestions and materials for ongoing Year One work. Meeting notes were prepared and distributed to participants that served to guide individual tasks. I emailed a sample executive interview script to my co-PIs in May for their review and received suggestions prior to finalizing the script for IRB approval.

I attended the semi-annual PI webinar on July 9, 2010 via Wimba and presented historical onion production, market and price trends for the US and specifically our five project states. Existing survey results related to the new technologies under development by my co-PIs were summarized to provide direction for my planned executive interview work. Proposed survey topic areas and question types were presented to the group for comments and feedback.

I have conducted extension research on the onion industry which included onion production practices, onion growing area-specific budgets, historical input and market prices for each project state, review of Federal Marketing Order programs, and onion industry websites and university extension and research publications. I have completed literature review concerning those factors affecting producer willingness to adopt new technologies (such as installation of xray disease detection devices and waste management systems) in related specialty crop industries.

2) Outcomes/ Impacts (i.e., what were the results and practical implications)

Time spent at meetings and completing literature reviews have provided opportunities to better understand the economic challenges and opportunities faced at the individual, state, regional and industry levels. Communication and support from co-PIs, project cooperators, and advisory panel members has resulted in the contact database population necessary to conduct meaningful survey research. Review of the existing budgets and market trends provided information and knowledge needs specific to geographic location, onion varieties and markets, farm sizes, packing-line and storage needs and technologies, and other important indicators of technology adoption levels. The final onion industry executive interview script has been submitted to MS State University Institutional Review Board and has received approval (July 2010). Onion industry interviews are scheduled for Colorado, Idaho and Arizona from July 26-August 1, 2010 and are planned for NY in September 2010 and for GA in January 2011. Literature review findings and co-PI suggestions were used to guide interview script design and development.

3) Publications

No publications are complete at this time.

Joseph Molnar, Auburn University

We hired Jolene Glenn as a graduate student on the project. She has begun to review the literature and become familiar with the technologies and approaches of branded onions and consumer acceptance of advanced technologies.

Jolene Glenn and I made two trips to East Georgia to visit with farmers, county agents, and onion processors.

The first trip in July first stopped at the biosystems engineering unit at UGA-Tifton where we met with Changying Li and other colleagues to discuss the onion storage and production process, as well as the research on onion x-ray and quality assessment. We then visited with county agents who took us to Bland Farms process and another processor to view the onion storage and handling.

The second trip in August took us to the UGA onion research field day at the onion and vegetable research center at Reidsville. We met producers and UGA personnel working with Vidalia onions. We heard presentations on the results of variety trials, new diseases, and weed control cultivation tools for organic producers. We also were able to visit to facilities that processed and sold onion food products.

Our next phase of research will be to articulate objectives and a draft questionnaire for some online surveys with onion-knowledgeable consumers. We are still considering the sampling strategy.