Curing sweet potatoes right after harvest improves culinary quality and reduces postharvest losses caused by diseases and skinning. This practice, however, is seldom applied by growers in Mississippi suggesting suboptimal conditions and quality for marketing in addition to losses to postharvest diseases. This project was stakeholder driven and supported by the Mississippi Sweet Potato Council to show the benefits of curing sweet potatoes and encourage Mississippi growers to adopt proper curing practices. The objectives and activities were to: 1) conduct on-farm demonstration trials on curing sweet potatoes in Mississippi; 2) evaluate the effect of curing on diseases and culinary characteristics of Mississippi sweet potatoes; 3) disseminate information about postharvest technology through workshops and publications.

**FINAL REPORT**

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Evaluating Postharvest Practices to Improve Sweet Potato Storage and Culinary Characteristics in Mississippi

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Abstract

Curing sweet potatoes right after harvest improves culinary quality and reduces postharvest losses caused by diseases and skinning. This practice, however, is seldom applied by growers in Mississippi suggesting suboptimal conditions and quality for marketing in addition to losses to postharvest diseases. This project was stakeholder driven and supported by the Mississippi Sweet Potato Council to show the benefits of curing sweet potatoes and encourage Mississippi growers to adopt proper curing practices. The objectives and activities were to: 1) conduct on-farm demonstration trials on curing sweet potatoes in Mississippi; 2) evaluate the effect of curing on diseases and culinary characteristics of Mississippi sweet potatoes; 3) disseminate information about postharvest technology through workshops and publications. On-farm research and demonstration trials on curing sweet potatoes were conducted with three participating farmers. One of them adopted the process by building state of the art curing/storage facilities and another has contracted a “fast curing” service for his product. In addition, a shipper upgraded his storage facilities for optimal curing conditions and is providing a service to growers. The effect of curing on disease incidence and culinary characteristics were evaluated also evaluated as part of the thesis of a student in Food Science who graduated in the spring of 2011. Information about curing was disseminated through presentations at growers meetings and a workshop given by an invited speaker. The outcome of this project was the experience gained by the participating growers and graduate student and the availability of information about curing and its benefits. The full impact is still to be determined, but adoption of proper curing conditions by at least 3 farmers and the prospect of a farmer to contract a “fast curing” service suggest a positive impact.
Background and Justification

Proper curing of sweet potatoes (Ipomoea batatas) right after harvest improves culinary attributes and reduces postharvest losses caused by diseases and skinning. Curing sweet potatoes at 85°F and 85%-90% relative humidity for 3-5 days right after harvesting is recommended in the southern U.S. (Thompson et al., 2002; Edmunds et al., 2008). This practice, however, is seldom applied by sweet potato growers in Mississippi and suboptimal curing and storing conditions suggests excessive losses to diseases and dehydration, and suboptimal quality for marketing since curing enhances sweetness among other culinary characteristics. In fact, Mississippi sweet potato growers have been concerned about losses to diseases and shrinkage (moisture loss). The purpose of this project was to promote adoption of proper curing practices, reduce losses to decay and shrinkage, and improve culinary characteristics of Mississippi sweet potatoes.

This project was stakeholder driven and was developed with significant input and resources from sweet potato farmers in Mississippi. Among the main problems expressed by sweet potato farmers were postharvest diseases that reduce pack out efficiency (defined as the percent of salable weight packed after storage out of the initial stored weight), quality, and marketability. Losses over the last four years were estimated to exceed $20 million (Graves, personal communication). In 2008, a survey in Mississippi reported 10% to 60% sweet potatoes losses to tip rot (Burdine, unpublished). In addition, studies have estimated sweet potato losses to decay in 20% to 25% (Edmunds et al., 2008) and pack-out efficiency of 60% to 70% after 8-10 month storage (Boyette, 2009). Curing sweet potatoes is recommended to reduce postharvest disease incidence as well as moisture loss (Clark and Moyer, 1988; Edmunds et al., 2008), so adopting this practice will have a significant impact in the industry since Mississippi ranks second and third in the nation with 20,000 acres harvested and over $74.88 million production value in 2010 (USDA-ERS, 2011).

Proper curing of sweet potatoes at recommended conditions is a rare practice in Mississippi mainly because growers don’t have firsthand knowledge and experience, and facilities, and therefore, are not confident it would pay off the investment in infrastructure and management. Sweet potatoes have been grown in MS for over a century, but production has increased dramatically only in the past 20 years (US$4-5 million the 1980s to over US$74 million in 2010) (USDA-ERS, 2011). In addition, local and overseas markets have increased demand for higher quality product. Growers in MS have lagged behind in adopting best curing conditions, but now they realize that to improve and maintain their businesses they need to adopt the best technologies. Currently, MS growers allow a natural cure based on existing environmental conditions that may take 4 to 6 weeks to complete wound healing. Variable weather conditions and low temperatures in September-October suggest inappropriate curing conditions. Low temperature reduces metabolic activity slowing down wound healing and increasing water loss and decay to diseases. It can also reduce overall quality (wrinkling and culinary characteristics). Therefore, sweet potato growers are interested in learning and experiencing optimal curing conditions to make an informed decision as to adopting the recommended practice.

The primary reasons for curing and storing sweet potatoes are to reduce losses to decay and to maintain good market quality during the winter and spring (Thompson et al., 2002).
Proper curing is considered an important step to supply the market with high-quality sweet potatoes year-round. It enhances wound healing which reduces water loss and disease incidence, sets the skin which reduces skinning and increases sweetness which enhances culinary characteristics (Edmunds et al., 2008). Therefore, promoting proper curing and handling of sweet potatoes in Mississippi will maximize storing and market life and improve supply of high quality roots to domestic and foreign markets. The sweet potato is known for its nutritional characteristics and is important in school lunch programs, production of baby food, and the health of the elderly. Therefore, adoption of proper curing and storage practices will not only reduce losses, but will have a positive impact in the economic return of farmers and in the quality of life of the community.

Goals and Objectives

The purpose of this project was to demonstrate and encourage growers to adopt proper curing practices to reduce postharvest losses and to improve sweet potato storage and eating quality in Mississippi. Our main hypothesis was that adoption of proper curing and postharvest handling practices would be facilitated when farmers experience the benefits of the process. To accomplish this, the following objectives were proposed:

1. Conduct on-farm demonstration trials on curing sweet potatoes in Mississippi
2. Evaluate the effect of curing on diseases and culinary characteristics of Mississippi sweet potatoes
3. Disseminate information about postharvest technology through workshops, presentations, and publications

Approach

To promote adoption of sweet potato curing practices in Mississippi, Mississippi State University conducted three on-farm research and demonstration trials (objective 1) to collect data and demonstrate the benefits of proper curing (objective 2) and disseminated information on curing and storage facilities and its benefits through field days, workshop, and presentations at growers meetings to promote adoption.

Objective 1: Conduct on-farm demonstration trials on curing sweet potatoes in Mississippi

On-farm research and demonstration trials were conducted with participating farmers (Mr. S. Bailey, Mr. C. Edmondson and Mr. T. Morgan in 2009, and at Penick Produce in 2010) because of their interest in improving sweet potato marketability (market life and culinary attributes). Trials in 2009 consisted of curing two 20bu bins of sweet potatoes in a micro-curing room (8ft by 8ft or 8ft by16ft constructed at each location) for 7 and 14 days and compare them with non-cured storage roots (kept at grower’s conditions) at three harvest times. After curing, storage roots were sampled from each bin and stored at 60°F for 1-2 months until evaluation. In 2010, sweet potatoes were cured for 7 days at the Penick Produce facility and evaluation continued for 6 months. Results in 2009 were taken cautiously because of the unusually rainy/wet conditions at harvest that resulted in 20%-30% of the harvest lost to soft rot in the first week in storage. Although optimal temperature and humidity in the tunnels were not reached, curing conditions were significantly better (closer to optimal) than under the farmer’s conditions. Average ambient storage (control) temperatures and humidity were 69°F, 62°F, and 67°F, and 70%, 72%, and 70% RH at the Bailey, Edmonson and Morgan locations, respectively. While
average curing temperatures and humidity were 82°F, 81°F, and 79°F, and 77%, 88%, and 82% RH, for the Bailey, Edmondson and Morgan locations, respectively. In 2010, curing studies were conducted at Penick Produce Co., Inc. to have better control of curing conditions. This facility was retrofitted with computerized controllers to maintain optimal temperature. Cured and non-cured storage roots were evaluated for disease incidence and moisture loss and chemical changes during storage. Also a semi-trained sensory panel at the Food Science Department, MSU, evaluated samples for organoleptic attributes.

In 2009, the growers were unable to experience the curing effect because of the high rot incidence under wet harvest conditions. Participating growers, however, realized that conditions were not ideal for curing and storage sweet potatoes. In 2010, however, the effect of curing on postharvest diseases and moisture loss were clearly experienced by the growers. At Penick Produce, estimated total losses were reduced from about 20% in 2008 to 8% in 2010 after they retrofitted their curing and storage facilities to an automatic system of temperature control. Moreover, they expect to reduce the losses even more after they installed a humidifier in their rooms. This experience, and the visit of Dr. Boyette in 2010 (see below), prompted another grower/shipper, Mr. Edmondson, to install automatic controller systems to optimize curing and storage conditions beginning with the harvest of 2011. In addition, other growers have requested a curing service for their sweet potatoes. In conclusion, the on-farm trials had a positive impact on participating growers/shippers and motivated them into improving their curing practices to reduce losses. Therefore, this project has completed Objective 1 with better than expected accomplishments on promoting adoption of proper curing practices.

**Objective 2: Evaluate the effect of curing on diseases and culinary characteristics of Mississippi sweet potatoes**

The effect of curing sweet potatoes on disease incidence and culinary characteristics was evaluated with storage roots from the on-farm trials in 2009 and 2010. At each harvest date in 2009, two bins (1,000 lbs each) of sweet potatoes were cured for 7 days and two bins for 14 days (2009 only), while two others were left at grower’s storage conditions. In 2009, the incidence of Rhizopus soft rot and bacterial soft rot in the first week was high across the treatments most likely due to the rainy/wet conditions at harvest. At the end of the curing treatments, samples (1bu) of apparently healthy storage roots were removed from the center of each bin and stored at 60°F for 1-2 months, and evaluated for soft rot, end rot and tip rot. Over all locations, soft rot incidence decreased as temperature increased (r=–0.48). Soft rot was higher in the control conditions at all locations ranging from 1.4 to 7.5%. The average soft rot incidence in cured roots was 1.3%, 0.7%, and 0.3% for the Edmonson, Morgan, and Bailey locations, respectively. In contrast, end rot was similar in the cured and non-cured roots. There was higher incidence of end rot at Morgan’s (11.5%) than at the Edmonson and Bailey sites (3.5% and 2%, respectively). In 2010, cured and non-cured storage roots were evaluated for tip and end rot incidence after 6 weeks. Curing reduced tip rot incidence from 2.2% to 0.6% and end rot incidence from 6.4% to 1.2%.

Curing accelerates wound healing reducing the losses during storage. Skinning is common at harvest and is a venue for moisture loss and disease infections which affect directly the economic return. Moisture loss of skinned storage roots at three temperatures was evaluated in a controlled environment to generate information about the economic benefits of curing sweet
potatoes. Skinning without curing and low relative humidity (50%-60%) increased moisture loss to 12% in 6 weeks. Differences in weight between cured and non-cured roots ranged between 3% and 9% depending on the level of skinning and conditions. If we add the reduction in losses due to rots, the potential loss reduction (or pack out efficiency improvement) due to curing can range between 9% and 20% of the harvest. Cost analysis indicated that adoption of proper curing practices is economically feasible. The cost of curing sweet potatoes varies according to size of the facility, so the costs used were based on: a) estimating the cost of retrofitting a small storage shed to be used for curing 30,000bu/year (100 acres) and b) contracting the service from a packer/shipper. The cost for a farmer to cure his/her own sweet potatoes in a small curing facility was estimated in $0.33/bu while a shipper charges $1/bu. The return to the additional investment depends on the price of the sweet potatoes, the increase in the pack out efficiency, and other costs that vary due to packing and marketing. Based on MS sweet potato budget sheet for 2011, a fair breakeven price for packed US#1 sweet potatoes with an average yield of 240bu/ac (considering 80% pack-out efficiency) is $14. At this price and considering additional costs that varied, the pack out efficiency needed to increase 4% and 10% when curing in own facility and contracting curing service, respectively, to pay for the additional investment (breakeven). These results suggest that the reduction in losses are economically significant and may justify adoption of the practice.

The effect of curing on culinary characteristics and associated physiochemical changes were evaluated at the Department of Food Science at Mississippi State University as part of a graduate student thesis. Results from the analytical evaluation of storage roots indicated that total sugars, sucrose, and phenolics compounds increased in cured roots. Phenolics are antioxidants with beneficial health attributes and based on this results curing can improve marketability of sweetpotato as a healthy food choice. However, the taste panel found no differences between cured and uncured sweet potatoes. An unexpected factor was the incidence of internal discoloration after baking that may have affected the rating. Flesh color is one of the quality attributes investigated in this study. Although curing didn’t improve flesh color, roots from one farmer were lighter than the other two. A nutrient analysis indicated that flesh color (hue angle in the CIELAB color space) was associated with nutritional status. Ca had the highest correlation with hue \( r = -0.71 \) followed by Cu \( r = -0.58 \), P \( r = -0.55 \), Al \( r = -0.53 \), K \( r = -0.48 \), and B \( r = -0.48 \). Nitrogen was not correlated with hue. Therefore, it is possible to improve quality and marketability of sweet potato by proper fertilization.

**Objective 3: Disseminate information about postharvest technology through workshops and publications**

Current research and extension programs at Mississippi State University aim to develop and disseminate information on new technologies to assist the clientele. The outputs of this project are summarized in here. A workshop was offered on August 9, 2010, and Dr. Mike Boyette from North Carolina State University was invited as the main speaker. His presentation included sweet potato curing and storage conditions and design and construction of curing and storage facilities. He also spent a day visiting one-on-one with three growers/shippers to discuss plans to build/improve curing facilities in Mississippi. The visit of Dr. Boyette had an impact on two grower/shippers (Penick Produce Co., Inc. and Mr. Carter Edmondson) since they have invested in new automatic monitoring and controlling systems for optimal curing and storage conditions. Proper curing will positively impact the sweet potato industry by reassuring the
quality of Mississippi sweet potatoes in the fresh market and by opening the processing market (sweet potato fries) that has high quality expectations. Also, results from this project have been presented to sweet potato growers at the MS Sweet Potato Council meeting on January 7, 2011, Pittsboro, MS, the Annual United States Sweet Potato Council Convention on Jan. 23-25, 2011, Orange Beach, AL, at the Northeast-MS Producer Advisory Committee meeting on Feb. 17, 2011, Verona, MS, and at the MS Sweet Potato Production meeting on Feb. 24, 2011, Pittsboro, MS. In addition, results were presented to and discussed with sweet potato researchers at the National Sweet potato Collaborators Group meeting on Jan. 22-23, 2011 Orange Beach, AL, and at the ASHS annual meeting on September 25–28, 2011, Waikoloa, Hawaii. Additional dissemination activities are planned that includes extension and journal publications. Participating packers/shippers and the Mississippi Sweet Potato Council (http://www.mssweetpotato.org), a grower organization that promotes marketing and education of sweet potato, have also assisted in disseminating the information generated by this project.

**Project Evaluation and Impact**

This project produced positive outcomes that have facilitated adoption of curing practices benefiting the sweet potato growers and the industry. Growers, packers, and shippers had an opportunity to experience the benefits of curing through on-farm studies and were encouraged to adopt proper curing practices through a workshop, presentations, and one-on-one discussion. The visit of Dr. Boyette was of particular importance since he provided additional information on construction of curing and storage facilities. Attendance to the workshop (16 persons) was less than expected, but since Dr. Boyette visited three additional packer/shippers and was involved in the upgrade of their curing/storage facilities, his visit was a complete success. The impact of this project was measured by the gained interest in adopting proper curing practices. Since these two growers/shippers installed automatic control systems to maintain optimal curing and storing conditions and other farmers are interested in contracting the service, the main goal of the project was achieved. Therefore, our hypothesis was proved right since adoption of proper curing and postharvest handling practices was facilitated by the experience participating growers/shippers obtained that demonstrated the benefits of the process.

This project assessed the economic benefit of adopting proper curing practice as well as demonstrated that curing can improve culinary and health attributes in sweet potato, but the benefits of these results on marketability is yet to be determined. Reducing losses and improving pack out efficiency was welcomed by the growers, packers, and shippers that prompted them to install curing facilities. Even though the taste panel could not find differences due to curing in this study, increases in sugars may reassure consumer valuations of product origin. The increase in phenolics is an improved health attribute that has not been reported previously and may be used for marketing purposes. Consequently, improving postharvest practices is expected to have a positive impact in the quality of the product, on marketing and sales that eventually will benefit the sweet potato industry.

The impact of curing sweet potatoes on marketability is yet to be investigated. This was beyond the scope of this project, but investigating consumer perception of cured sweet potatoes would help the industry to improve quality. Sweet potatoes are marketed based on two credence attributes: health attributes and product origin. However, the sweet potato is a product that combines both credence (based on the belief that the attribute exists) and experience attributes
(valuations resolved after consumption). Health advertising is used by the National Sweet Potato Council to increase demand based on “healthy” dietary attributes such as high beta-carotene content and low in starch and sugars. In contrast, sweet potato producer organizations from each producing state use product origin as a marketing strategy to indicate the underlying quality of their product. In this regard, growers suggest that MS produces a sweeter product. Taste is actually a consumer experience attribute, but at the time of purchasing, it is based on a belief. Therefore, optimizing curing conditions would improve the consistency between credence and experience attributes and may impact consumer valuations of product origin before and after consumption.

Since matching funds for this project were provided by the Mississippi Sweet Potato Council, comprised by stakeholders representing different segments of the sweet potato industry, they have been assessing the outcome of this project. Communication has been maintained on a regular basis through meetings and presentations ensuring that the information reaches to the stakeholders for evaluation and adoption. The Mississippi Sweet Potato Council (http://www.mssweetpotato.org) was founded in 1964 to promote Mississippi sweet potatoes and to educate growers on the latest practices to improve their production systems and their livelihood. It has about 150 members and represents 104 commercial operations and 24 packing facilities (at least 95% of MS sweet potato industry). Growers/shippers that participated in this project represent collectively about 6,000 acres (approximately 26% of the MS sweet potato acreage). These include the ones that adopted proper curing practices by upgrading their facilities that represent about 5,000 acres with the intent to expand even more. They are active members (officers/directors) of the MS Sweet Potato Council and therefore their experience has and will continue to be passed to other growers.

Mississippi sweet potato production has increased from 4,000 to 23,000 acres over the past two decades and is second in the nation after North Carolina. Production has increased across the United States due to a demand from both fresh market and processing. The health conscious consumer has driven this market due to the nutritional benefits of sweet potato, which provides a source of antioxidants, vitamins, dietary fiber, and sugars with reasonable glycemic index. In addition, sweet potatoes have been ranked number 1 for lowering cholesterol. All this attention has led to new ventures beyond the traditional fresh market typically consumed during the holidays. In an effort to create a more stable market throughout the year, the processing industry has expanded into frozen sweet potato fries. The most recent and highly publicized construction of a $210 million facility by ConAgra Foods Lamb Weston in Delhi, LA, has received attention from sweet potato growers. Therefore, postharvest losses associated with skinning, diseases, and shrinkage have become economically significant and the need to cure sweet potatoes properly is warranted to maintain profitability. This project has successfully promoted adoption of proper curing practices to ensure product quality for the future of the Mississippi sweet potato industry.

Publications

Literature Cited

 Commercial Sweetpotato Production in Mississippi. Mississippi State University Extension Service. MSU-CARES Publication 1678
(http://msucares.com/pubs/publications/p1678.html)
**Losses to skinning**

- Moisture loss that result in weight loss ($$$)
- Between 3% and 10% in 30 days depending on the conditions
- Soft rot mainly caused by *Rhizopus* and bacteria that enter through wounds
Understand the etiology and pathogenicity of the emerging tip/end rot disease

- Isolation and identification of associated pathogens (Dr. Woolfolk)
- Association of ethephon with tip rot incidence
- Six trials (station and on-farm with and without history)
Results: Tip/end rot incidence

- Tip rot was observed mainly in Ethephon (PREP) treated storage roots.

- For Beauregard, higher rate of ethephon resulted in higher tip rot incidence: well correlated ($r=0.78$).

- Field history did not influence tip rot incidence.

- End rot was observed in both treated and non-treated roots.
Optimal curing conditions after harvest (CSREES-AMS-FSMIP with MDAC)

- Reduced tip and end rot incidence was observed in cured roots (85°F and 85% RH)
Curing effect on culinary characteristics

- Trend to increase sucrose by use of fructose and glucose
- Increase sucrose over time
Thank you
Sweetpotato tip rot disorder is enhanced by pre-harvest applications of ethephon and reduced by curing

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Introduction
Tip rot is a new sweetpotato (Ipomoea batatas L.) disease/disorder in Mississippi with unknown etiology. This disorder is manifested as a small sunken and irregular area of ½” to 1” in diameter at or close to the proximal end of the storage root and appears after 2-4 weeks in storage (Fig. 1). In many cases necrosis continues internally. Since pathogen isolations have been inconsistent, a relationship of this disorder with stress has been suggested. Since ethylene is produced in plants under stress/injury, the hypothesis that ethylene may be triggering this necrosis is been proposed.

Objective
- To determine the association of pre-harvest application of ethephon with postharvest tip rot incidence in sweetpotato storage roots.

Materials and Methods
- Six fields, with and without tip rot history, within the Mississippi sweetpotato production area were used.
- To simulate stress, ethephon was applied with a CO₂ sprayer calibrated to 140 L/ha.
- 3 rates (0.84, 1.68, and 2.52 kg ai/ha) depending on the field.
- Ethephon treated and untreated control were devined the day of harvest.
- Devining was done using a 2 row flailing knife mower.
- Roots were harvest using a 1 row chain digger.
- Curing was completed at 29.4 C and 85% RH for 5 to 7 days until skin was set.
- Control and storage after curing was at 16 – 18 C.
- Treated and non-treated as well as cured and non-cured storage roots were stored for 4-8 weeks and evaluated for tip rot incidence.
- Total phenolic content was determined by modification of the Folin-Denis method (Swain and Hillis, 1959) and expressed as milligrams of chlorogenic acid equivalents (CAE) per gram fresh weight.

Results and Conclusions
- Tip rot was observed mainly in Ethephon treated storage roots (Fig. 2 and Fig. 3).
- Higher rates of ethephon resulted in higher tip rot incidence; well correlated (r=0.78) (Fig. 2).
- Lower tip rot incidence was observed in cured roots (Fig. 3).
- Pre-harvest applications of ethephon increased the phenolic content in the stele and cortex by 86%, and 57% respectively (Fig. 4).
- Tip rot incidence was associated with ethephon application.
- Foliar applications of ethephon appears to signal a stress response that results in higher total phenolic content.
- The higher phenolic content seems to be a factor in the appearance of the tip rot disorder
- Curing minimizes tip rot incidence.

Reference
Sweet potato tip/end rot incidence in Mississippi with pre-harvest applications of ethephon. 2010

Ramon A. Arancibia and Jeff Main

Funded by USDA-AMS-FSMIP, MDAC and MSSPCouncil

Approach:
- Field trials were set up to determine the relationship between tip rot incidence and pre-harvest applications of ethephon (PREP)
- Six fields, with and without tip/end rot history, within the Mississippi sweet potato production area were used:
  - Stephen Bailey, Norman Clark, Kenneth Alexander with Rob Langston at Penick, Tony Morgan and the Pontotoc Research Station.
  - We thank them and the Council for their collaboration and support.

Results:
- Tip rot was observed mainly in Etohphon (PREP) treated storage roots
- End rot was observed in both treated and non-treated roots
- For Beauregard, higher rate of ethephon resulted in higher tip rot incidence: well correlated (r=0.78)
- Lower tip and end rot incidence was observed in cured roots

Fig 1. Tip rot in Beauregard

Fig 2. Tip rot in B-14

Fig 3. End rot in B-14

Fig 4. Etohphon effect on tip rot incidence

Fig 5. Etohphon effect on end rot incidence

Fig 6. Curing and ethephon on tip rot incidence

Fig 7. Curing and ethephon on end rot incidence
PREHARVEST ETHYLENE AND POSTHARVEST CURING EFFECTS ON BAKED SWEET POTATO (Ipomoea batatas L. Lam) QUALITY
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ABSTRACT
The effect of preharvest foliar applications of ethylene (an ethylene generating product) and postharvest curing on baked sweet potatoes (Ipomoea batatas) were analyzed. Ethylene had negative effects on appearance of baked roots while curing increased the total phenolics in sweet potatoes. Panelists preferred the non-ethylene treated and green or cured over ethylene treated sweet potatoes with respect to texture, color and flavor. However, no differences in chemical or color properties were found between treatments. The effect of curing time (0, 7, 14 days) on baked sweet potatoes was also studied. Curing also caused more browning on flesh of sweet potatoes. Moreover, panelists preferred the texture of the green over the cured roots but did not find any differences in flavor sensory quality.

INTRODUCTION
- Ethephon® (2-chloroethyl) phosphonic acid (an ethylene generating product) is widely used to promote pre-harvest ripening of soft fruits and tomatoes. Ethephon® is applied to the surface of plants. It is absorbed and ethylene formation commences immediately as shown below:

$$\text{C}_2\text{H}_5\text{P(O)}\text{OH} \rightarrow \text{C}_2\text{H}_5\text{P=O} + \text{H}_2\text{O}$$

- Ethylene is produced by many fruits especially during ripening and is considered a natural ripening hormone but it regulates many phases of plant growth and development. Ethephon® application at 250 ppm increases sweet potato (Ipomoea batatas L. Lam) root yield per year. Ethylene enhances the biochemical content and pheromone inducing enzyme activity in sweet potatoes. Spraying Ethephon® right before harvest when soil is dry, has been studied to reduce skinning injury, but the effect on sensory characteristics and other quality is yet to be determined. Moreover, the combined effect of ethylene and curing has not been reported.

- Curing is one of the most important postharvest treatments of sweet potato. Curing involves control of temperature, relative humidity and ventilation. Sweet potatoes are cured by holding them for about 4 to 10 days at 30°C and high relative humidity (85-90%). The main purpose of curing is to heal injuries to the root and to improve sensory characteristics. There are a few studies done on curing time effects on quality of sweet potato especially on sensory qualities.

OBJECTIVES
- To study effects of preharvest ethylene treatment and postharvest curing on color, chemical and sensory attributes of baked sweet potatoes.
- To investigate changes in color, chemical attributes and sensory attributes of baked sweet potatoes as affected by different curing times.

MATERIALS AND METHODS

- Color was measured with a Hunter Lab 6000 (L=45°) Spectrophotometer (Hunter Associates Laboratory, Fairfield, VA)
- pH was measured with a Fisher Scientific Accumet® Basic, USA
- Soluble solids (Brix) were measured using a Brix Refractometer (Wescor Model AB-32, Kirkland, WA)
- Total Phenols: Folin-Ciocalteu (1951) method, 750 nm using a UV/VIS spectrophotometer.
- High Performance Liquid Chromatography was used to check if any differences between the sugar contents of the samples.
- Descriptive Sensory analysis: 10 semi-trained panelists were used.

RESULTS AND DISCUSSIONS

- Soluble solids concentrations (Brix) was highest (p<0.05) for NG and lowest (p<0.05) for EC roots. The no ethylene, cured roots (NG) had higher (p<0.05) fructose than green roots (NG and EG). Glucose and sucrose were highest (p<0.05) in NG compared to ethylene treated roots (EC and EG); however, maltose content was unaffected by these treatments.

- Total phenolics were highest (p<0.05) for ethylene treated and cured roots (EC) and lowest (p<0.05) for NR roots. Curing seems to influence total phenolics in sweet potatoes, whereas ethylene appearance affects hue value.

- Panelists preferred (p<0.05) color intensity of NG samples over all other treatments. Panelists preferred (p<0.05) color uniformity of NG over other treatments. Panelists found less (p<0.05) discoloration or browning in NG than other treatments, but they did not find any significant differences (p>0.05) between all the others.

- In general, scores were higher (p<0.05) in texture for non-ethylene treated roots. The texture results suggest that ethylene induces hardening of the core resulting in lower acceptability of sweet potatoes after harvesting.

- Panelists also preferred (p<0.05) the overall flavor of NG and EC treatments over ethylene treated roots. Panelists found non-ethylene treated (NG and EC) roots sweeter (p<0.05) than EG roots. Panelists preferred the caramel taste of NG and EC over EG.

- There were no significant changes (p>0.05) in Hunter color values, pH, SSC, fructose, sucrose and maltose of sweet potatoes green or cured for up to two weeks.

- For freedom from discoloration, panelists scored two-week cured roots lower (p<0.05) than green roots. It seems that spots and streaks in the flesh increased with increased curing time which may result of enzymatic browning and oxidation of polyphenols in sweet potatoes.

- They scored uncured roots more acceptable and smoother than the cured roots while, there were no significant differences between the one-week and two-week cured roots.

- Flavor ratings (sweetness, caramel, overall flavor) did not change (p>0.05) with curing time.

CONCLUSIONS

- Ethylene had negative effects on color appearance, texture and flavor of sweet potatoes.
- Curing increases the total phenolics.
- The color, pH, sugar contents of sweet potatoes was not affected by curing time; however, moisture loss increased with curing time.
- Curing caused more browning on flesh of sweet potatoes.
- No flavor differences existed among all treated sweet potato roots.
- Panelists scored all treatments as acceptable.

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