PROCEEDINGS OF THE

24th ANNUAL

HORTICULTURE INDUSTRIES SHOW

HOLIDAY INN CIVIC CENTER
FORT SMITH, ARKANSAS

JANUARY 14-15, 2005
Fort Smith, Arkansas

Safe and Secure Food Begins on the Farm

PROCEEDINGS of the

24th ANNUAL HORTICULTURE INDUSTRIES SHOW*

January 14-15, 2005

Holiday Inn Civic Center
Fort Smith, Arkansas

Edited by:
Lynn Brandenberger

Assembled by:
Donna Dollins

Department of Horticulture and Landscape Architecture
Oklahoma State University
Stillwater, OK

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Oklahoma & Arkansas
Horticulture Industries Show
360 Ag Hall, OSU
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The 24th Annual Horticulture Industries Show in Ft. Smith, Arkansas was a great success! This is the first year that the show has been held in Ft. Smith. Attendance was good, and we had some great speakers and interesting exhibits.

The keynote speakers — addressing "Safe and Secure Food Begins on the Farm" — provided perspective on many issues and challenges facing farmers and communities. Dr. Kamyar Enshayan, an agricultural engineer and professor at the University of Northern Iowa presented an interesting topic dealing with local food systems. His talk focused on local markets supporting local food production systems. Saturday's keynote speakers were Dr. William McGlynn and Dr. Lynn Brandenberger, both professors at Oklahoma State University, who detailed important food handling and packing information in their talk, "Effective Strategies for Food and Safety on the Farm and in the Packing Shed."

This year's program featured two special changes. First, lunch on both days consisted of food items that were grown by Oklahoma and Arkansas producers. It was excellent both days, and we hope to continue this new tradition in Tulsa in 2006. Second, we had a wine and juice tasting event during the reception that was sponsored by the Post Familie Vineyards and Weiderkehr Wine Cellars of Arkansas. Everyone at the reception really enjoyed this feature and the opportunity to fellowship with other conference attendees.
We would like to give a special thanks to everyone involved in making these events a success.

We would like to thank all of the speakers for sharing their expertise and experiences at the horticultural meetings, as well as for the papers published in these proceedings. We would also like to extend our thanks to this year's exhibitors for showcasing their products and services that are so vital to our horticultural industry.

Also, a special thank you is extended to personnel at Tulsa Community College, Oklahoma State University, and Arkansas State Horticulture Society, as well as Horticulture Industries Show board members, all of whom volunteered their time to organize and facilitate this show.

Most importantly, isn't it wonderful to see so many new faces attending our program, as well as meeting old friends? The comradery among horticulturists is wonderful. Thank you for your attendance. We look forward to seeing you again next year!

Please join us at Tulsa for the 2006 show. I look forward to seeing each of you there.

Sincerely,

Alan Ware
President
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Keynote Speakers

Buy Fresh, Buy Local: How Communities are Investing in Food Security

Kamyar Enshayan
University of Northern Iowa
Cedar Falls, Iowa 50614-0293

There is much talk about bio-terrorism and how to safeguard our system of food and agriculture from terrorists. But if we look around us, we see that the forces systematically destroying American agriculture are almost entirely domestic: nitrogen pollution of our streams, atrazine in our drinking water, farm policies that kill independent businesses and small towns, genetic manipulation for profits and power, and monopolization of agricultural markets by a few global corporations.

One clear and troubling example of a domestic biological threat to our system of food and agriculture is the way the industrial meat giants raise and process livestock. Last year, roughly during the same time that snipers killed 12 people around the nation's capital, contaminated lunch meat killed more than 8 people and sickened many more in New England, prompting a record recall of 27 million pounds of meat. I asked my students what differences there were between the two tragedies. The class had just read Eric Schlosser's Fast Food Nation, which documents how packing giants repeatedly evade public health laws, leading to meat contamination and death. The only differences my class saw were that the shootings received massive news coverage but the poisoning victims died quietly in hospitals with little media attention, and while there was an extensive search for the snipers, there were no arrests in the meat industry.

There are other ways of protecting our food and agriculture. My friend Mary Berry Smith who farms in Kentucky says "Our country, through its ruinous desire for cheap food, has nearly destroyed the safest food system we could have: farmers feeding the people closest to them." Her family sells most of their farm products direct to customers: "Our customers trust us to provide delicious, healthy, safe food; we trust them to pay us a fair price."

The unspoken slogan of the current food system is "Just eat it!" Do not ask any questions about where it was grown, how soil and water were treated. Whether the farm family made a living wage, or whether the animals were treated humanely. Do not ask what was in the feed, how the labor was treated,… what pesticides were used, … just eat it.

The slogan of the local/regional food movement is "Get yourself a farmer!" Do ask all those questions, "You know your doctor, you know your dentist, do you know your farmer?" There are many layers of food security and the we ought to be asking all sorts of questions about our food supply.

The people of Black Hawk County, Iowa, annually spend nearly $270 million on groceries and another $150 million on eating out. Most of these food dollars leave our county and state. Eight years ago, I approached the dining services directors of our university, our local hospital and the owner of a locally owned restaurant about buying a greater portion of their food from nearby farms. The aim was to keep a significant part of these dollars in our community and region, as well as to build local relationships. "Value-subtracting" industrial agriculture and the resulting "value-missing" markets create insecurities for the very people who grow our food.

Fourteen institutions we have worked with over six years have spent nearly $1.2 million of their food purchases locally. At Rudy's Tacos, one of our partners in Waterloo, 71 percent of the restaurant's food budget, $143,000, goes for fresh, locally grown ingredients. For most restaurants, that percentage would be in single digits, if any. Bartels Lutheran Home in Waverly, another partner, buys two to three cattle

each month, raised locally and processed at a local meat locker. Last year Bartels bought $40,000 worth of locally raised beef and vegetables. Three years ago the beef came from an unknown source, and the $40,000 left the region. The University of Northern Iowa, where I work, recently bought its first local cow!

This is "value-retained" agriculture, and we need more of it. If our county set a goal of retaining just 10 percent of our food dollars, that would amount to $40 million every year. And that would be real community economic development based on our best assets: our people and our land.

These institutional food buyers have come to understand that their decisions crucially affect the vitality of nearby farms and businesses. They not only get very high quality products while saving dollars, there are other key benefits:

Knowing the farmers who raised the animals. The food buyer can find out how the animals were raised (confinement, free, range, on pasture, …), what exactly was in the feed (i.e. were the ground up dead poultry, pigs and horses in the feed as currently allowed by FDA?), whether the animals were routinely treated with antibiotics, or whether the animals treated humanely. Local independent producers are open to show their operation to the food buyers. For example, the food buyers at Bartel's Luthern Retirement Community in Waverly knows that the cows they are buying were not given antibiotics or hormones.

Knowing the meat processors. The food buyers we have worked with have visited the meat lockers they do business with and know their style of operation, cleanliness and reputation. The meat lockers also offer custom processing of locally raised meats (curing, custom seasoning for sausages, brats, …). A growing business relationship among buyers, farmers and processor often leads to choice and flexibility for all parties involved.

Supporting local family farms and food businesses. The food buyers we have worked with understand and take pride in the fact that they are contributing to the well-being of local economy. They believe that it builds community and good will, and that will help them in the long run.

Ensuring food safety and accountability. When food buyers buy ground beef from local sources, they get ground beef from one cow, the very cow that the farmer they knew raised. But ground beef from conventional distributor comes from an unknown source, mixed from about 4000 cows. Journalist Eric Schlosser has documented in great details the problem with the current system of meat production, processing, inspection and marketing in the best selling book, Fast Food Nation: The Dark Side of the All-American Meal.

Dr. Robert Tauxe, head of the Foodborne and Diarrheal Disease Branch at the Center for Disease Control states that the current industrial meat production, processing and marketing has created a system that is more vulnerable to disease outbreaks across the nation.

Obviously, local inspected meat lockers can also be susceptible to contamination and must follow strict meat safety guidelines. The key is local accountability and traceability (to a farm, to a specific feed, etc.) that local meat production, processing and purchasing offers.

This work has expanded the web of local relationships, which is the essence of local economy and local life. This is the kind of homeland security I think about.

Kamyar Enshayan works at University of Northern Iowa, Cedar Falls, Iowa. Many thanks to the Leopold Center for Sustainable Agriculture and NCSARE for supporting the institutional marketing project.

Local food expenditures by institutions,
Cedar Falls / Waterloo, Iowa

Year	Institutions	Local Food Expenditures, $
1998	Rudy's Tacos UNI Dining Services Allen Hospital	$110,773
1999	Rudy's Tacos UNI Dining Services Allen Hospital	$134,573
2000	Rudy's Tacos UNI Dining Services Allen Hospital Bartels Retirement Community Mercy Medical Center	$173,406
2001	Rudy's Tacos Allen Hospital UNI Dining Services Bartels Retirement Community Waverly Hospital Wartburg College Covenant Medical Center Mercy Medical Center	$165,588
2002	Rudy's Tacos Allen Hospital UNI Dining Services Bartels Retirement Community Western Home Root's Market Garfield Café	$200,730
2003	Rudy's Tacos Garfield Café Martin's Brandenburg Steamboat Gardens Bartels Covenant Medical Center	$226,954

Friendship Village
UNI Dining Services
Allen Hospital
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Root's Market
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Prepared by: University of Northern Iowa Local Food Project 319-273-7575
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Good Agricultural Practices to Reduce Risks of Microbial Contamination

William G. McGlynn and Lynn Brandenberger
Department of Horticulture and Landscape Architecture
Oklahoma State University

Good Agricultural Practices (GAPs) are an important concept for producers of fresh fruits and vegetables to understand and utilize in order to assure the microbial safety of produce that is grown in their operation. GAPs involve many things, but suffice it to say that they are practices used during planning, production, harvest and after harvest to safeguard fresh produce. One point that we should all understand is that there is not a one size fits all plan for food safety and that GAPs must be uniquely tailored to crops and management practices for each farm.

Consumption of fresh fruits and vegetables in the U.S. increased 24% during the 27 year period between 1970 and 1997. As consumers, we have been listening to messages about the importance of increasing our uptake of fresh produce. Yearly consumption has increased from 577 lbs to 718 lbs per person during this time period. As with any change, eating more fresh produce has brought us good things and a few not-so-good things. The good things include improved diet and better health. One not-so-good thing is an increase in foodborne disease outbreaks associated with fresh produce, which doubled between 1973 and 1987 and doubled again between 1988 and1998. A case study should help us to understand how such outbreaks occur. In 1996 the Centers for Disease Control (CDC) investigated an outbreak of E. coli 0157:H7 associated with a fresh mesclun lettuce mix. Sixty one people were infected and of those, twenty one required hospitalization. The outbreak was traced to a single grower-processor and the investigation brought to light a number of serious food safety problems in his operation: The packing shed and lettuce field were located adjacent to a beef feeding operation; free-range chickens were allowed unrestricted access to the lettuce field; composted manure was applied to the field, but no records to verify composting process, application dates or rates were kept; no hand-washing facilities or gloves were available to packing shed workers; and the lettuce was washed in a poorly maintained wash tank and packed in unwashed containers. As you can tell, this operator was doing a poor job of maintaining the microbial safety of this fresh lettuce mix, and some sixty people became seriously ill as a result.

So, what can we do about these risks? Basically, we need to focus on reducing the risk of contaminating fresh produce. It is not possible at this time to eliminate food safety risks; in fact the Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables states that "current technologies cannot eliminate all potential food safety hazards associated with fresh produce that will be eaten raw."

Times for producers to reduce food safety risks include prior to planting during the planning stage, during production, and during and after harvest. Before planting, growers should complete a grower risk assessment. Cornell University has a great publication to help with this titled "Food Safety Begins on the Farm – A Grower Self Assessment of Food Safety Risks". This publication is available on-line at http://www.gaps.cornell.edu/index.html. The document includes 24 sections that provide GAPs and checklists for every thing from worker hygiene to petting zoos. Working through the assessment will help producers to develop their own food safety plan for their operation. Proper site selection is another important step that should be carried out prior to planting vegetable and fruit crops. Growers should review and record the land history i.e. previously-grown crops and other prior land uses, evaluate the site's proximity to animal operations with an eye toward preventing contamination from dust or drainage

water from those operations, and develop a detailed environmental plan for the site. If manure is to be applied to the field prior to the production season, growers should consider the source, storage and handling of the manure. It is best to apply manure at the end of a production season to allow time for soil microbes to break down human pathogens before planting a fruit or vegetable crop. A good rule of thumb is to have at least 120 days from manure application until harvest, or better yet to follow manure application with a grain or forage crop rotation. Just remember that manure = fecal matter = microbial contamination, you should do everything possible to keep manure off of produce.

During production good water management will help reduce food safety risks. Make certain that you know the source of water, test water quarterly for fecal coliforms and record results for future reference. If water has questionable safety, drip irrigation will reduce the potential for contamination by keeping water from above ground parts of the crop. Often overlooked, spray water quality is an important consideration. Producers have been known to prevent contamination from irrigation and then have contamination problems from water used for pesticide applications. To prevent problems use potable (drinking) water for pesticide applications or when not available, test water quality and keep records.

Plan to exclude both wildlife and domestic animals from production fields and packing-shipping areas. Manage rodents and birds in packing sheds and storage areas and keep dogs and other pets out of field areas. If you need help in controlling wildlife or want help in developing a control plan contact Oklahoma Dept of Ag Food & Forestry Wildlife Services 405-521-4039 http://www.oda.state.ok.us/wls-staffhome.htm. In Arkansas contact U of A Cooperative Extension Service Arkansas Natural Wildlife 501-521-4039 http://www.arnatural.org/wildlife/damage.asp

During production, harvest, and after harvest make certain to plan for farm worker hygiene. Teach workers about food safety and their role in preventing contamination and provide clean restrooms with all the necessities for maintaining good hygiene. Follow this up with enforcement of GAPs for good hygiene practices and make it a priority. If you operate a U-Pick operation, don't assume that you don't need to be concerned about worker hygiene. Invite your customers to wash their hands prior to entering fields both verbally and with good signage. Provide clean and convenient restrooms along with well maintained hand washing facilities for their use. Remember, if U-Pick customers become ill they probably won't blame themselves, but will assume it's your fault.

Things to consider at harvest would include picking fruit or vegetables dry to prevent the spread of contamination, leaving produce with bird droppings on it in the field, cleaning and sanitizing harvest totes each day, and cooling produce quickly. Additionally you should clean and sanitize storage facilities prior to harvest and clean and sanitize the packing area and equipment daily. A majority of the fresh produce industry has switched to the use of plastic bin boxes for harvest and distribution. This is an improvement to the wooden boxes and baskets used in the past, which were nearly impossible to clean and sanitize. But, even though these containers are superior in several aspects, they still need to be cleaned and sanitized daily and common sense should be used to prevent contamination in the field and packing facility.

Maintaining food safety is a continuous process that begins in the fields and continues into the packing shed. The packing shed is a particularly hazardous environment where fresh produce food safety may be compromised simply because the produce is concentrated in a small area and much of the product may pass through the same contaminated hands or equipment. Therefore, a comprehensive food safety system is necessary to ensure the continuing safety of the produce as it moves through the packing shed on its way from field to fork.

In designing a good food safety system for fresh produce, it is important to address all of the hazards that may contaminate food and render it unsafe for human consumption. Many of our efforts are focused on minimizing risks from biological hazards such as pathogenic bacteria, including E. coli 0157:H7 and salmonella. There are other biological hazards as well. Viruses such as hepatitis and protozoans such as cyclospora have been implicated in well known food illness outbreaks involving strawberries and raspberries. In addition to biological hazards, there are also physical and chemical hazards that should be addressed in a food safety plan. Potentially dangerous chemicals should be stored in a secure location well away from food handling areas and packing materials such as boxes and crates. Packing materials should also be inspected for physical contaminants such as wood or glass shards, nuts, bolts, machine parts, staples, and so on.

A good overall food safety plan must address four major areas:
Clean water;
Clean equipment;
Clean facilities;
Clean people.

Many packing shed operations involve the use of water. Water is often used for cleaning, cooling, and transporting fresh produce within the packing shed. Water is also used to clean equipment, facilities, and people prior to handling produce. Thus, clean and sanitary water is vital in minimizing the possible spread of pathogenic microorganisms throughout the packing shed. There are a host of options for sanitizing water including the use of chlorine, ozone, organic acid blends, ultraviolet light, and others. Systems range in complexity from strictly manual to fully automatic operation. One size does not necessarily fit all; some water sanitizers will work better in one type of operation than another. It's best to do some homework and consult with an experienced operator to determine what type and size of equipment will fit your operation.

Your eyes are a good tool for maintaining the cleanliness of facilities and equipment. Anything that comes in contact with fresh produce is a potential avenue for spreading contamination. Pay particular attention to surfaces that are hard to clean where filth may accumulate. Bacteria may "hide out" in these nooks and crannies and be protected from the effects of cleaners and sanitizers. Be on the lookout also for pinch points, corners, and other areas where produce may be bruised or cut. Wounds give pathogens an avenue for entering produce, a refuge in which to survive cleaning/sanitizing efforts, and a buffet of nutrients to feed on during storage and shipping. All food contact surfaces should be cleaned and sanitized at least daily. Damaged produce and other trash should be removed from packing lines as needed – typically several times a day. Trash containers should be emptied on a regular basis. Restrooms and break areas should be cleaned at least daily. Pay particular attention to areas where produce is stored prior to shipping, including cold rooms. Produce should be stored off the floor and at least twelve inches away from walls. It may not be practical to wash and sanitize these areas when produce is stored in them, but some regular cleaning schedule that accommodates your storage needs should be established. Be aware of ALL the surfaces in the packing shed that may become food contact surfaces and keep them clean. Food should never come in contact with uncleaned surfaces and uncleaned surfaces should never come in contact with food.

Pest control is an essential component of keeping facilities and equipment clean. There are a number of pest control resources available including contracted services. Regardless of how a pest management system is implemented, it should possess four key elements: methods to exclude pests from the packing

shed e.g. screens and other barriers; a program to clean drains, trash bins and other potential pest lures and hideouts; a program of spraying and baiting to kill invading pests; and a monitoring program that uses traps to keep an eye on pest populations. All four elements are important pieces of an effective, integrated pest control system.

Packing shed workers are often the last individuals to handle fresh produce before it ends up in the mouths of consumers. Proper worker hygiene is essential in the packing shed just as it is in the field. Clean and accessible restroom and hand washing facilities are obviously important. But even the best facilities may be compromised by untrained workers. Common sense applies here just as elsewhere in your plan. Workers who are ill or who have open wounds should not handle produce. Properly sanitized gloves should be worn when handling fresh produce. Workers should wash their hands after breaks, after meals, and especially after using the bathroom. Don't assume that everybody knows the proper techniques for using the toilet, washing hands, or wearing gloves. Training materials, including videos and signs, are available in both English and Spanish and are excellent tools for teaching and reinforcing proper hygiene.

Part of designing an effective food safety system for your operation involves thinking about what happens to your produce after it leaves the packing shed. All your hard work keeping produce safe in the field, during harvest, and in the packing shed may be undone by loading freshly packed fruits or vegetables in to a filthy truck for shipping. After all, you never know what that truck might have been hauling before it arrived at your dock. It's a good practice to insure that trucks are pre-cleaned and pre-rinsed before loading.

Both government and retailers are placing a growing emphasis on the ability to trace product back from retailer to grower and thus traceability and lot identification are increasingly seen as vital parts of a well-rounded food safety program. Bar codes are one common way to implement this. Newer technologies, such as RFID tags, are being investigated. Regardless of the technology used, prudent growers and packers should consider using some kind of coding scheme for their packed produce as part of a comprehensive food safety plan.

An integral and too often neglected part of any food safety program is proper documentation. Your operation may have the safest operation, the cleanest facilities, and the best trained and most conscientious workers ever seen. But from a legal standpoint, if you don't document your food safety activities you might just as well have skipped the whole process. Record it or regret it. Proper documentation is essential in establishing due diligence in case the safety of your produce is ever questioned. No one enjoys keeping records, but good food safety records don't have to be extensive. Records should be designed to show that you've done everything you said you were going to do in your food safety plan and that you've taken appropriate measures to correct any problems that occurred. Records can be as simple as a check sheet that lists what was done, when it was done, who did it, and, if appropriate, what the results were. It's important that records be filled in and initialed by the person who actually cleans the bathroom, or checks the wash water chlorine strength, or performs whatever task is being documented at the time when the task is performed. Typical sorts of items to document might include:
Cleaning & sanitizing procedures & schedule;
Type & strength of sanitizing solutions used;
How often sanitizing solutions are made & tested;
Sanitizer solution strength test results;
Date & time of sanitizing operations;

Description of pest control program;
Date, time, and results of pest control inspections;
Any corrective actions taken when problems occurred.

Keeping our fruits and vegetables safe helps protect us all, especially the most vulnerable among us. We cannot eliminate risk in fresh produce, but we know that a well designed and carefully implemented food safety plan as outlined above will minimize hazards to our health. Everyone in the chain from farmer to consumer has a role to play in keeping our food safe. But it's up to growers and packers to make sure that the produce entering our food supply is wholesome and uncontaminated. Food safety truly does begin on the farm.

Some useful online resources include:
Guide to Minimize Microbial Hazards for Fresh Fruits and Vegetables:
http://vm.cfsan.fda.gov/~dms/prodguid.html

Cornell University Good Agricultural Practices Publications:
http://www.gaps.cornell.edu/pubs.html
publications include:
Food Safety Begins on the Farm – a grower's guide
Food Safety Begins on the Farm – a grower's self-assessment
Food Security Begins and Stays at Home

Christmas Tree Session

How Plants Use Nutrients

Craig R. McKinley
OSU Extension Forestry Specialist

Craig McKinley is a native of Elmore City, Oklahoma and a graduate of Oklahoma State University and Texas A&M University. His professional career has included Technical Services Director for Potlatch Corporation in Warren, Arkansas, Associate Geneticist for the Texas Forest Service, Extension Specialist at North Carolina State University and Forestry Department Head at OSU.

Introduction

One of the more critical aspects of the growth and development of all plants is the availability of nutrients. These nutrients are essential for plants to complete their life cycles in a timely and effective manner. In Christmas trees, as with other commercial plant crops, the quality of the final product is highly dependent upon the amount of nutrients available and the ability of the crop to utilize those nutrients.

This paper provides some general background on the nutrients required by plants and how those nutrients are utilized in plant processes.

Definitions

To provide a proper background for the following discussion, several definitions should be presented.

Elements – Basic units of matter. In chemical terms, substances that cannot be further separated into different substances.
Nutrients – Substances that furnish nourishment for plant use. In this discussion, I will confine the term nutrients to those elements that provide plant nourishment.
Plant Food – Materials that can be used directly by plants as a source of energy or as building materials (e. g., fats, proteins, carbohydrates, etc.). Not fertilizers!
Mineral Elements – Nutrients derived from soil parent material (rock).
Essential Elements - Elements that are:
Required for normal growth and reproduction.
Cannot be replaced by another element.
Requirement must be direct. (e.g., not by relieving toxicity).

Plant Use of Elements

In a general sense, elements are utilized in plants in one or more of the following three ways.

Electrochemical – By stabilizing molecules, balancing concentrations, etc.
Structural – As structural components of various cellular systems
Catalytic – Provide for the occurrence or enhancement of chemical processes. Often involved in active sites of enzymes.

Specific Uses of Elements in Plants

A. Non – Mineral Elements

Carbon, Hydrogen and Oxygen

a. Photosynthesis
CO_2 + Water = Sugar + Oxygen
(with light & Chlorophyll)
b. Respiration
Sugar + Oxygen = CO_2 + Water
(Releases heat energy)
c. Structural

Nitrogen

Utilized mostly in structural roles such as amino acids (for building proteins) and the DNA molecule.

B. Mineral Elements

Phosphorus – Structure of DNA, energy storage.
Potassium – Acts primarily as catalyst. No significant structural roles.
Calcium – Important component of cell walls, cell division, and membrane permeability.
Magnesium – Significant part of the chlorophyll molecule, thus required for photosynthesis.
Manganese – Catalyst for chemical reactions. Involved in the structure of chloroplasts.
Boron – Sugar translocation and storage.
Iron – Utilized in chlorophyll synthesis. Enzyme activator.
Sulfur – Component of several amino acids.
Copper and Zinc – Catalysts for chemical reactions.
Molybdenum – Involved in Nitrogen fixation

Element Deficiencies

Element deficiencies and/or toxicities may be manifested in a number of plant symptoms. Some of the more common symptoms that may be observed are:

Loss of growth
Chlorosis (yellowing)
Necrosis (death of plant parts)
Deformation
Death of plant

Specific nutrient deficiency symptoms include:

Nitrogen – Chlorosis, with generally the older leaves showing this symptom first.
Phosphorus – Stunting of the older leaves first. Leaves often show a purple tinge.
Potassium – Symptoms are similar to Nitrogen deficiency, often with yellowing leaf tips.
Magnesium – Bright yellowing of leaf tips.
Iron – Yellowing on new foliage while older foliage remains green.

It is important to note that deficiency symptoms are not always definitive as elements have multiple functions, and many plant processes involve multiple elements.

It should also be noted that while sufficient elemental concentrations may occur within the soil, the acidity of the soil may influence plants' ability for nutrient uptake. Likewise, nitrogen is often not available due to its not being "fixed" into a form usable by plants. Thus, presence of an element does not necessarily indicate availability.

Summary

A number of chemical elements are critically important in the growth and development of plants. Without those elements, the normal processes required for the completion of the plant's life cycle will not occur. In a commercial crop such as Christmas trees, it is often the lack of these critical elements that result in crop losses and subsequent economic failures.

Assumptions should not be made as to appropriate planting locations and/or fertilizer applications until a soil test is performed and analyzed. Subsequent tests should also be made at regular intervals.

For those interested in further information regarding soil tests, please refer to the OSU Soil, Water and Forage Analytical Laboratory see:

http://www.soiltesting.okstate.edu/

Christmas Tree Sales Report – 2004 Season

Craig McKinley,
OSU Extension Forestry Specialist

Introduction

In 2004, a total of 90 surveys were mailed in December to Oklahoma Christmas tree growers. Immediately following the sales season, telephone and e-mail contact was attempted with those individuals who had not responded to the mail survey.

Of the total, 17 surveys were undeliverable. Nineteen growers reported being out of business, and seven indicated that no trees were sold in 2004. Twenty-five growers reported sales and other survey information. The remaining 22 growers did not respond in time for inclusion in this report, could not be located, or declined to be interviewed.

The survey asked growers to list sales by species and method (choose and cut, wholesale and/or retail). Live tree sales were listed as those sold at the farm, wholesale and/or retail, and was again, separated by species. Growers also were asked about imported tree sales and other holiday and alternative products.

Total Sales

Table 1 provides a summary of survey results from 1989 through 2004 for trees grown in Oklahoma. No survey was completed in 2003. In 2004, total reported sales were about the same as in 2002, with choose-and-cut sales up by approximately 7 percent. Both the total sales and the choose-and-cut sales increased on a grower-average basis.

Table 1. Oklahoma-grown tree sales (live trees included), 1989 - 2004.

Year	Number of Growers	Total Sales	Sales per Grower-Total (CC sales)
1989	NA	8,769	NA
1990	42	11,527	274 (197)
1991	48	11,989	250 (186)
1992	54	14,145	262 (185)
1993	55	18,002	327 230)
1994	63	20,102	319 (223)
1995	64	21,071	329 (234)
1996	59	20,795	352 (248)
1997	55	18,982	344 (224)
1998	34	13,131	386 (237)
1999	41	14,564	355 (242)
2000	44*	15,699	356 (226)
2001	28*	7590**	NA (271)
2002	35*	8591	245 (251)
2004	25*	8496	340(319)

*Does not include growers who responded, but had no sales, who did not market trees, or who did not report exact figures. **Choose-and-cut (CC) only-other years are all methods.

Sales Methods

The primary sales method used for Oklahoma-grown harvested trees was choose-and-cut (Table 2). Wholesale sales remained as a relatively minor market for Oklahoma-grown trees. Virginia pine continued to be the dominant choose-and cut species offered by Oklahoma growers, comprising over 75 percent of the choose-and-cut trees sold. Scotch pine held about 13 percent of the choose-and cut market, followed by a limited numbers of Austrian pine, Leyland Cypress and eastern white pine.

Table 2. Oklahoma-grown harvested tree sales by sales method 1989 – 2004.

Year	Choose-and-Cut	Wholesale	Retail	Total
1989	6,662	1,625	482	8,769
1990	8,111	2,641	775	11,527
1991	8,762	1,969	1,228	11,989
1992	9,852	3,294	999	14,145
1993	12,459	4,586	957	18,002
1994	13,848	5,460	796	20,104
1995	14,766	4,893	1,432	21,071
1996	14,394	4,270	2,131	20,795
1997	12,103	5,483	1,342	18,928
1998*	7,833	3,383	193	11,409
1999*	9,697	3,080	521	13,298
2000*	9,736	4,931	None **	14,667
2001*	7590	Not available	None **	Not available
2002*	7448	426	265	8139
2004*	7969	120	None**	8089

*Only cut trees. ** Does not include retail sales of imported trees at growers' farms.

Sales of Imported Trees

Approximately 45 percent of growers now sell imported trees from other states at their choose-and-cut farms. This number is up substantially from 30 percent in 2001. Imported tree sales of 2836 in 2004 equated to about 25 percent of total tree sales for the state. The number of imported trees sold was similar to that reported in 2002 (2893). True firs comprised almost 80 percent of total imported sales. Fraser fir was the most popular imported tree species, followed by Noble fir and grand fir.

Live Tree Sales

Live trees sales continued to decline as a percentage of total tree sales (Table 3). In 2004, major live trees species were Austrian pine, Scotch pine and Leyland cypress.

Sales of Other Products

Sixty-four percent of the growers reported sales of wreaths, memorial blankets and other greenery products, both from Oklahoma and imported materials. Estimated sales of these products were $30,000. Seventy-six percent of survey respondents reported sales of other holiday items such as ornaments, toys and tree stands. As sales for these items were not quantified, no dollar estimates can be provided. Tree

stands were the most common holiday accessory item sold. Fifty-two percent of growers have other non-Christmas crops such as you-pick berries, corn and pumpkins.

Table 3. Live trees sold from 1990 – 2004.

Year	Live Trees Sold	Percent of Total
1990	1,177	10.2
1991	2,030	16.9
1992	1,825	12.9
1993	2.810	15.6
1994	2,247	11.2
1995	1,251	13.2
1996	4,038	19.4
1997	3,001	15.9
1998	1,722	13.1
1999	1,266	8.7
2000	1,184	7.6
2001	541	NA
2002	456	NA
2004	407	3.5

Prices

Tree prices reported in 2004 were about the same as in 2002. Choose and cut prices ranged from $3.00 per foot to $10.00 per foot. The majority of growers who priced by the foot charged $ 5.00 to $7.00 per foot. Those who sold on a per tree basis charged $3.00 to $45.00. The average per tree price was about $28 for Oklahoma-grown material. Virginia pines tended to occupy the lower end of the price range, with Scotch and eastern white pines usually selling for higher prices. Highest prices were reported for trees imported from other regions, ranging from $34.00 to $65.00 per tree, or $5.00 to $11.00 per foot.

Discussion

Growers responding to the survey were mixed in their review of the season. Some reported sales as very good while others indicated that farm traffic was down from previous years. Thirty-six percent of the responding growers reported losses from insects, disease, drought, flooding and deer damage. Growers quantified losses as totaling $21,310. The majority of this damage was due to tip moth attack in Virginia pine plantings.

At present, some 270 acres in Oklahoma have been planted to Christmas trees. Most growers indicated that they do not intend to establish additional acreages.

Of concern to the health of the overall industry is the number of growers who have gone out of business in recent years, or who do not intend to sell trees in the future. Likewise, the pending retirements of many longtime growers may further reduce the number of individuals who are active in the Oklahoma Christmas industry.

Acknowledgements

Results from 1989-1997 were compiled by Dr. Steven Anderson, Extension Forestry Specialist, and Champe Greene, Renewable Resources Extension Specialist. Bill Ross, Extension Forestry Specialist summarized data for 1998 through 2002 with the assistance of Ms. Clark Perry of the OSU Forestry and Wildlife Extension program. The author also wishes to thank the members of the Oklahoma Christmas Tree Association and the growers who took part in this survey.

Quality Virginia Pine Seedlings and Sources

Dr. Chuck Tauer, Professor
Oklahoma State University, Forestry Department

Greg Huffman, Nursery Superintendent
Oklahoma Forestry Services, Forest Regeneration Center

Introduction

All Christmas tree growers want to produce a quality product. Christmas tree growers desire to plant seedlings which will survive, grow at acceptable rates, and develop into a desirable end product. Most of the research related to seedling quality has focused on timber reforestation needs. Fortunately much of this work is also applicable to Christmas tree production.

Most growers (using the term growers to refer to Christmas tree growers) have a mental image of what a "quality" seedling looks like. Most would agree that a fibrous root system, which is well balanced with top growth is desirable. Other characteristics such as secondary needles, a woody stem, and "good" caliper are also important. The "optimum" seedling possesses these morphological qualities, but does such a seedling automatically qualify as a high quality seedling? The answer is no! These morphological grading criteria are useful and help ensure quality seedlings. However, there are many other important factors to consider when evaluating seedling quality.

A systematic approach to developing quality seedlings is needed. Likewise once the grower receives the seedlings there are many important handling, site preparation, and planting details to carefully follow.

Seed Sources

Species selection is the first choice a grower must make. This decision in guided by grower preference, soils type, climate, pest problems, growth pattern and a variety of other factors. Most growers within Oklahoma prefer Virginia pine as a Christmas tree mainly for economic reasons and its' adaptability to a wide variety of sites. This discussion will focus on Virginia pine.
It is important to recognize that Virginia pine is not native to Oklahoma. The species occurs in the eastern US in the Appalachian and pediment region from Pennsylvania to Alabama. Virginia pine exhibits much variation in stem straightness, growth, needle length, and other traits. Since the species is not native, the first step in determining its' suitability for Oklahoma is examining its' ability to survive.

The initial seed source testing of Virginia pine in Oklahoma was done by Chuck Tauer, Oklahoma State University. He found that trees from western North Carolina and eastern Tennessee performed best in Oklahoma plantings. This study narrowed seed collection to a specific geographic region within the Virginia pine range.

Using Tauer's initial findings helped the FRC produce Virginia pine from the most suitable geographic area. Prior to the establishment of an Oklahoma tree improvement program for Virginia pine, a USFS orchard source was the seed of choice. Currently, tree selections from the National Forests in North Carolina and Tennessee, Bowater Corporation selections, and a few sources from the Texas program are included in the seed orchard that produces all the seed for the FRC program.

To further increase the quality of FRC grown seedlings intensive testing of trees produced by controlled pollination was initiated. Controlled pollination (breeding) allows tree breeders to strictly control the parentage of trees. Trees that looked superior in the forest may appear superior due to either the environment and/or the genetic makeup of the tree. Carefully designed genetic tests called progeny tests are used to evaluate the genetic superiority of trees selected.

Virginia pine progeny tests were established on OCTA members' farms in Altus (Al and Sylvia Sasse), Lawton (Carol Wilson), Antlers (Jerald Mayers), and Adair (Loren Loomis). The trees were measured and evaluated at the third and fifth year of growth. Tree survival, height, and whorls per foot were measured. Subjective quality measurements included straightness, grade, and a labor score. OCTA members were used in developing the initial scoring criteria and were instrumental in helping hone the scoring method to evaluate the labor required to "shape" the tree into a Christmas tree. Significant differences between families of trees were found for most traits at most locations. Survival showed few differences among families and the “best” indicator of tree superiority was the grade score, which showed the most consistency across the many locations.

An abnormally hard early freeze occurred on November 1, 1992 in most of Oklahoma. Trees in the most northern progeny test planting revealed that cold hardiness in Virginia pine is also a strongly inherited trait. Unfortunately, some growers have been purchasing seedlings from southerly seed sources. Generally, these trees did not survive the freeze well. Based on the progeny tests and general planting evaluations, it is recommended that growers plant seedlings from North Carolina/eastern Tennessee origins for maximum cold hardiness, adaptability, and growth.

The issue of seed sources is quite complex. Without the use of specially designed field experiments only general guidelines can be used. Dr. Murray's Catawba seed source recommendation (from the Jan. 1992 OCTA meeting) is sound based on climatic zones. Much of Oklahoma falls within the USDA Plant Hardiness Zones 6 and 7. Zone 7 covers mainly the southern portion of the state where the range of average annual minimum temperatures is 0 to 10 degrees. A small land area in extreme northwest Oklahoma is Zone 5, but the vast majority of northern sections of the state fall in Zone 6 (-10 to 0 degrees average annual minimum). Most of the Piedmont (non-mountainous) areas of N.C., S.C., Virginia, etc. fall in Zone 7. If average annual minimum temperatures were the only factor to consider then Virginia pine seed from any area of Zone 7 should be adaptable to Oklahoma from a cold hardiness perspective. Much of Oklahoma also falls within the same latitude of North and South Carolina, and Tennessee. Hardiness zone, latitude, etc. are important but only serve as a starting point for further research. Soil characteristics, wind patterns, amount, season, and kind of precipitation; etc. are also important plant growth factors.

In the case of Virginia pine the initial seed source study by OSU indicated that best growth actually occurred from seed gathered in Zone 6. These more mountainous areas of N.C. and Tennessee generally possess trees that grow in more stressful conditions both in terms of winter temperatures and poor, rocky & dry soils. The first round of progeny tests included trees from this area as well as adjacent areas in North and South Carolina (generally Catawba area seed sources), Georgia, and Tennessee.

After the first round of testing was complete, we removed families from our seed orchard that were poor performers. We call this process rouging. The process of obtaining increasingly better genetic improvement is very methodical. We started with the correct geographic sources as identified by Dr. Tauer’s research. We then used seed from superior selections found within the identified geographic

area, and finally, we then tested specific families from that geographic area in actual Christmas tree operations.

Now we are in an advanced stage of testing. About 110 second-generation selections (trees that were selected as superior in the first round of progeny testing) were made by the Oklahoma Forestry Services and by the Texas Forest Service. These selections were grafted into a breeding seed orchard, controlled pollinated, and the offspring from these crosses are being planted in a second generation round of progeny testing. Current tests are planted at Doc Cottom and Charles Grethen's farms. More tests are planned as breeding is completed. After the second generation testing is complete, a new Virginia pine seed orchard will be established by grafting the best selections. As this advanced generation orchard begins to produce seed, it will become the primary source for Virginia pine seed for the foreseeable future. Since Virginia pine is very much a "specialty" species used in rather small quantities primarily for Christmas trees, it is likely that future breeding and testing will be limited.

The most probable future scheme for making greater quality and productivity gains will be in the area of vegetative propagation either via rooted cuttings or tissue culture. As specific individuals are identified, it may be possible to mass-produce these individuals via vegetative propagation. The technology is already available, but there is a strong economic issue, which guides vegetative efforts. At this time, there has to be a strong demand (large quantity needed) and a favorable price (i.e. seedlings prices of ~$1.25+ per tree) in order for such efforts to be economically feasible.

Containerized Tree Growing

Bill Jacobs
Owasso Christmas Tree & Berry Farm, Owasso, OK

Bill Jacobs is a graduate of University of Missouri School of Forestry. Has been growing christmas trees for 24 years and has 5 acres of U-Pick blackberries. Has been growing shade and ornamental trees in containers for 2-1/2 years.

For the past 20 years we have grown a few trees in the ground for the purpose of digging to sell as B & B. The down side of this method are;

1. Top soil going down the road
2. Tree diggers never avail. when conditions right.
3. Dig too many or not enough.
4. Only dig when dormant.

We could probably spend the rest of the afternoon listing the different methods of container growing. I will summerize what we are attempting to do.

Two things that must be considered when thinking about a pot-n-pot operation;
1. Drainage set the desired pot in the ground, fill with water and after 24 hrs. if all of the water has not drained out you have a drainage problem.
2. Cost, an acre of container pot-n-pot trees, approx. 730 trees will cost you between $20,000 and $25,000.00 (15 gal. size)

Pots	$5.00
Growing media	$3.00
Average tree price	$20.00
Irrigation	$3.00
Total	$31.00

Containers: Need to determine your market; selling wholesale to other growers, to retailers, or to consumer direct. Because of our location (one of the fastest growing cities in Ok.) , and because of our other business (christmas trees and U-Pick blackberries) we chose to go direct to the consumer. We chose to grow in the 15gal. container for several reasons.
1. Weigh less than 100lbs.
2. Can grow up to a 2" trunk diameter.
3. Larger root ball.
4. Most trees do not need staking.
5. Home owner can handle without any special equipment.

Container type: Hard Plastic. We have found that you have a very definite time table when growing in plastic. When pot is grown out (full of roots) tree needs to be removed or roots will circle and grow out of bottom of pot and you can have major problems in removing.
Fabric Containers: Fabric containers are much more forgiving and you have a much longer window of growing in fabric. The roots will not circle and roots that do grow through the fabric will be small and will not be a problem when removing tree.

Potting Media: I do not know of anyone in Ok. that will commercially mix potting media. We found a company in Texas, Vital Earth, that will special mix to your specifications. A 50cubic yard load of media delivered to our farm runs approx. $1800.00. The blend we are presently using is 80% med. aged pine bark, 15% peat, 5% sandy loam. At our present planting rate a 50cub. yard load will last us a year. We are planting 4-500 l5gal. and 2-300 3 or 5 gal. containers.

Plant Material: We are buying or growing 3-or-5gal., or 3/4 to 11/4 bare root material and planting in the 15g. containers. The only exception to this is loblolly pine and leyland cypress which we are buying in plug size, planting in 3gal air pruned pots, growing for 7-8 months and bumping up to 15g containers. In the future we will probably go 100% to the larger (1 - 2") bare root material.

Irrigation: We started with Netafim from B W I Whle.. For whatever reasons we could not keep the system running. We have now switched to Rainbird controllers and Netafim hose and spray stakes. Rainbird is distributed by the Water Store in Tulsa and you can walk in the door and get your questions answered or the product replaced.

Fertilizer: We started with 18-6-12 Osmocote and lime mixed with the potting media. The first round of fall planting did real well but our spring planting did not do as well. After a year of struggling and not much growth we sent media samples to a lab in Ft Dodge Kansas and had what Dr. Whitcomb calls his 3-way test. Results were sent to Dr. Whitcomb for recommendations. We had lost all of our nitrogen, and had too much lime. We added sulphur to counter the lime changed our Osmocote to l7-5-12 added the micro pak. We now order media with no fertilizer or lime and add as we plant. Our present fertilizer mixture is 20oz 17-5-12 and 6.5oz micro pak to ea. 15g container.

Following is a list of suppliers we have or are presently using for container operation. Anyone needing specific information concerning these suppliers may give me a call at 918-272-9445.

Forest Keeling
Elsberry, Missouri
1-800-356-2401

L E Cooke Co.
Visalia, California
1-800-845-5193

J Frank Schmidt
Boring, Oregon
1-800-825-8202

Sester Farms
Gresham, Oregon
1-800-832-4487

Misty Firs Tree Farm
Estacada, Oregon
503-630-6200

B W I
Springfield, Missouri
1-417-881-3003

Total Quality Liners
Groveland, Florida
1-800-429-2171

Surface Nursery
Gresham, Oregon
1-503-663-5224

Cedar Valley Liners
Ada, Oklahoma
1-580-436-2508

Vital Earth
Gladewater, Texas
1-800-245-7645

Rennerwood
Tennessee Colony, Texas
1-888-898-7337

Water Store
Tulsa, Oklahoma
1-918-622-3222

RootMaker Products Co.
Huntsville, Alabama
1-800-824-3941

Root Control Company
Oklahoma City, Oklahoma
1-405-848-2302

Farmer's Market/Sustainable Agriculture Session

Small-Scale Production & Marketing at Crestview Farm

Susan Graff
Crestview Farms
Edmond, OK

Hello everyone, I'm Susan Graff from Crestview Farms, Edmond Oklahoma. With the help of my husband Vern and my son Christopher we grow organic produce, herbs, fruits and bedding plants. We were certified in 2003 and have grown organically since 1995 and even before that at our home. Vern does the real heavy work like the rototilling and land development and the building development. Chris helps market and sell at the Farmers' Market.

When we bought the property it was full of schrub Oak (Black Jack) trees, Sumac and Poison ivy. My husband cleared the land a little at a time to try to preserve the integrity of the soil and to prevent erosion. We wanted to build our home there and Vern started a pavilion and fire pit to entertain. We planed to later add an outdoor kitchen. But first, We wanted to start an orchard, so we planted the first apple and pear trees near to where the Barn stands now.

Vern cleared the first garden, with a backhoe, and removed some 500 to 1000 trees in that one area. Then we turned in 18 dump truck loads of horse manure mixed with the wood chips from the downed trees. We planted tomatoes, peppers, squash, cucumbers, radishes, green beans and green onions. We had to put in a well and a windmill and two 3,000-gallon tanks for watering; the watering system is gravity fed from the top of the hill to garden #1

I started selling our produce at the Edmond farmers market and did that for 2 years. I also sold the herbs, which I was growing in the back yard of our home. Next came100 peach trees and the following year we added another 100.

The garden was pretty poor the first year. The green beans would not even grow. They just shriveled, so I took a soil sample and found out that we needed amendments. The soil was much too acid. I added lime and rock phosphate and also blood meal and bone meal as well as compost and started adding grass clippings in the walkways because it was so muddy. The next year the plants seemed to look better and produce better. I now take a soil sample every year and whenever we start a new growing area. We then amend the soil accordingly before we plant anything.

We built the barn in 2000 and put in another well with a pump. Over 2000 ft. of 2" line carry water to garden #1, # 2 and 3, the grapes, blackberries the greenhouse and the orchards.

We make or own compost from grass clippings and leaves, which we get from lawn maintenance companies as well as leaves that I collect from neighborhoods as well as dairy manure. We also add the vegetable scrapes from the cleaning process of packaging for the Market and food co-op. Vern turns the compost every 5 days or so with the front end loader and also uses the rototiller for aeration. We then use the compost on the gardens, vines and flowerbeds. We also use an organic fertilizer made from chicken litter as well as fish, kelp.

I grow almost everything from seed or cuttings, with a few exceptions; I start everything in the Barn under lights and move them outside when the weather is conducive. However, I still have to move the

seedlings in and out until the weather settles, which is around April or May, and even into June. When the storms come through, I still have to move them again. This year we hope to have the greenhouse up so that I won't have to move the seedlings in and out, but I guess that will create a new se t of problems. We will address them as they happen.

We sell at the OSU OKC Farmers Market the Oklahoma Food Co-op as well as at the farm. We hope that the traffic will pick up at the farm as we go along. Although, there was quite a bit of traffic during the peach season, the harvest was cut short due to the rainy season this year.

We grow lettuce, spinach, and other green leafy vegetables such as collard greens, red mustard, turnips and turnip greens and Asian greens such as tatsoi and bok choy. Also, Swiss chard and arugula. This fall we had broccoli cauliflower and Brussels sprouts. We also grow beets, radishes, carrots, rutabaga, okra, peppers, tomatoes, eggplant, beans (green and yellow), pole beans, black eye and purple hull peas, cucumbers, summer and winter squash, potatoes, as well as onions, asparagus, leeks, shallots, and garlic which is a very good crop for me.

We also grow strawberries, blackberries, apples, grapes, Asian pears as well as Bartlett and kefir pears and Moonglow pears, Peaches and nectarines,

We have had a great success with crops such as garlic, onions, Heirloom tomatoes, turnips and their greens. Most of the green crops do well at the market such as lettuce and other salad greens, arugula , spinach and Asian greens. It seems that people can not get enough of them, especially in the spring.

We grow Heirloom and open pollinated vegetables such as Brandywine tomatoes and Cherokee purples, also yellow pear tomatoes and Roc D' Orr yellow beans as well as Maxibell green beans, also fingerling potatoes as well as blue potatoes, which are a big hit.

This year we had our first crop of apples; although small; as well as pears and a good crop of peaches before the rain started, then we lost most of them to the brown rot.

We have planted a variety of grapes and they have done very well. This was the second season to harvest and I am still learning about how to take care of them. It looked as if we were going have a great harvest this year, however, we had so much rain that they split so we lost most of our crop.

The peach trees have turned out to be a bother because of the peach tree borer. The organic pesticides just do not touch them and we have decide not to replace any of the peach trees which we have lost as we have in past years due to the high insect pressure. This year we are going to try to paint the tree trunks with a mixture of lime and latex paint. The nectarines also fall in to that category.

Most of the problem we have with the strawberries is weeds, as you all know weeding is labor intensive and one of the things I hate to do. The blackberries have done well this year for the first year to bear fruit. Next year we should have a good crop due to the rain this fall.

We rotate our crops and plant green manure and cover crops. I have planted buckwheat and oats, as will a hairy vetch, alfalfa, red clover and field peas. This year after tilling in the late summer I planted rye and oats together in the area that are not cropped. We also plant the purple Hull peas and blackeye peas as a crop and a green manure crop.

We use insecticidal soap, Neem oil, and horticultural oil only when it is necessary. Other wise we let the beneficial insects do their job. We have an abundance of Ladybugs, and have seen them overwintering in the garden shed and around the doors. We usually have Assassin bugs and green laces wings and has seen Praying Mantis laying their eggs on post. We also do a lot of hand picking. This year I'm going to try vacuuming for the squash bugs.

On irrigation and watering, we began with sprinklers attached to hoses and discovered that they were very inefficient. We switched to soaker hoses; they clogged and were unusable after one year of use. We are now using drip tape and so far it seems to be working well. We still have to work out some kinks with the system.

I recently heard someone talking about starting a second career. They said that you should start with something that is your passion. So I guess this that about sums it up.

I am going to keep doing what I am doing, and that is growing as much as I can and selling as much as I can. With the help of my son Christopher, maybe I can even make a profit this year. We have not done so yet although I am getting closer, and I can see some light at the end of the tunnel. But you all know or maybe you don't that this is a labor of love after all.

My husband owns his own company and only gets to work on weekends, and because of his company's success we have been able to fund Crestview and grow as we have. He plans on retiring to become my full time helper.

By the way that house and pavilion, which Vern started first, well, it's still is not finished due to all the other projects that are still pending, like the greenhouse and did I mention that my husband is restoring an antique tractor and hay wagon for hayride.

We became incorporated in 1998 on the advice of our attorneys to protect our personal and real property from lawsuit, which could arise from product or physical injury.

As you probably know there is always something to do. As a matter of fact I should be home right now starting seeds in flats.

Thank you for your interest in Crestview Inc. and invite any questions you might have.
Alternative Weed Control Research

Alternative Weed Control—An Update on USDA Research

Charles L. Webber III
USDA, ARS
South Central Agricultural Research Center
Lane, Oklahoma

Introduction

Alternative weed control methods represent a significant portion of the USDA, ARS weed control research at the South Central Agricultural Research Laboratory at Lane, OK (Atoka County, southeast Oklahoma). The research investigates a wide range of management practices for weed control in vegetable crops. Research includes different aspects of both component (single factors) and systems research (multiple factors) for conventional, sustainable, and organic vegetable production. Insights learned from one production system often provide insights and applications for other production systems. For example, discoveries made investigating the affects of different cereal and legume cover crop combinations in conventional production systems may have applications in sustainable and organic agriculture. Although certain herbicides used in conventional or sustainable production systems may not be suitable or allowed in certified organic vegetable production, the research methods to evaluate organic herbicides may be similar. Alternative weed control materials investigated during the 2004 growing season included corn gluten meal (CGM), vinegar (acetic acid), and pelargonic acid.

Corn Gluten Meal

Corn gluten meal (CGM) is an environmentally friendly material that has demonstrated ability to decrease seedling development and plant survival by inhibiting root and shoot development. Unfortunately, CGM can also decrease the development and plant survival of direct seeded vegetable crops. The development of a mechanized method for CGM application and the ability to apply the material in a banded pattern would increase its potential use in organic vegetable production, especially in direct seeded vegetables. The objective of the research was to develop a method to uniformly apply CGM to the soil surface in either a solid (broadcast) or banded pattern.

An applicator was assembled using various machinery components (fertilizer box, rotating agitator blades, 12-volt motor, and fan shaped gravity-fed row banding applicators). The equipment was evaluated for the application of two CGM formulations (powdered and granulated), three application rates [5, 10, and 15 lb/100 ft2 (250, 500, and 750 g/m2)], and two application configurations (solid and banded). Field evaluations were conducted during the summer of 2004 on 32-inch (81 cm) wide raised beds at Lane, OK. Differences between CGM formulations affected the flow rate within and between application configurations. The granulated formulation flowed at a faster rate, without clumping, compared to the powdered formulation, while the CGM in the banded configuration flowed faster than the solid application. The CGM powder used with the solid application configuration was inconsistent, unreliable, and thus not feasible for use with this equipment without further modifications.

These evaluations demonstrated the feasibility of using equipment, rather than manual applications, to apply CGM to raised beds for organic weed control purposes. A number of equipment alterations will increase the efficiency and potential usefulness of this equipment. If research determines equivalent

weed control efficacy between the two CGM formulations, the granulated formulation would be the preferred formulation for use in this equipment. This equipment would be useful for evaluating the benefits of banded applications of CGM for weed control efficacy and crop safety for direct seeded vegetables.

Vinegar

Vinegar is a solution containing acetic acid, an organic acid produced though the natural fermentation of plant materials containing sugars. Vinegar has been identified as a potential organic herbicide, yet more information is needed to determine influence of acetic acid concentration, application volume, and use of additives (adjuvants) on weed control. Acetic acid acts as a contact herbicide, injuring and killing plants by first destroying the cell membranes, which then causes the rapid desiccation of the plant tissues. Household vinegar typically contains 5% acetic acid. Great care must be taken when using acetic acid concentrations of 11% or greater, which can burn the skin and cause serious eye injury, including blindness.

Field research was conducted at Lane, OK to determine the effect of acetic acid concentrations, application volumes, and adjuvants on weed control efficacy. The factorial experimental design included vinegar at three acetic acid concentrations (0, 5 and 20 %), two sprayer application volumes (20 and 100 gpa), three adjuvants (none, orange oil, and canola oil), and two weedy-checks. Visual weed cover and control ratings were collected four days after treatment.

The experiment had very high weed densities with multiple species of grass and broadleaf weeds. The average weed cover ratings for the weedy check were as follows: 98% total weeds; 53% grass; 44% broadleaf; 52% large crabgrass (Digitaria sanguinalis (L.)); 25% carpetweed (Mollugo verticillata L.); and 14% cutleaf evening primrose (Oenothera laciniata Hill). Total weed control ranged from 0% control when no vinegar was used to 74% control when 20% acetic acid was applied at 100 gpa with canola oil. Vinegar was more effective in controlling broadleaf weeds than in controlling grasses. Optimum total grass and crabgrass weed control occurred with 20% acetic acid applied at 100 gpa, resulting in weed control that ranged from 44 to 63%. Broadleaf control was 84% or greater for plots receiving either 10% acetic acid applied at 100 gpa or 20% acetic acid applied at 20 or 100 gpa. Also, 5% percent acetic acid applied at 20 gpa provided good cutleaf evening primrose control (77 to 90%). When averaged across application volumes (20 and 100 gpa) and adjuvants (none, orange oil, and canola oil), weed control increased for all species as acetic acid concentrations increased from 5 to 20%. When averaged across acetic acid concentrations and adjuvants, weed control increased as application volumes increased from 20 to 100 gpa. Individual comparisons among adjuvants within acetic acid concentrations and application volumes showed little or no advantage to adding either orange oil or canola oil to vinegar spray solutions.

Pelargonic Acid

Pelargonic acid is a fatty acid that occurs naturally in many plants and animals, is present in many foods we consume, and has potential as an affective herbicide. Field research was conducted in Lane, OK to determine the effect of pelargonic acid (nonanoic acid) concentration on weed control efficacy as a burn-down herbicide.

One month prior to spraying the weed control treatments the land was cultivated to kill the existing weeds and to provide a uniform seed bed for new weed growth. The research involved 3 weed control

treatments and a weedy-check with 3 replications. The weed control treatments included applications of Scythe1 (57.0% pelargonic acid) applied at 3, 6.5, and 10% with a spray volume of 100 gpa to the seedling weeds. Weed ratings were collected on July 20 (4 DAT), July 26 (10 DAT), and August 3 (18 DAT) 2004. The experiment had a high weed density with multiple species of grass and broadleaf weeds. The weeds present at spraying included large crabgrass (Digitaria sanguinalis (L.)), goosegrass (Eleusine indica L.), carpetweed (Mollugo verticillata L.), cutleaf evening primrose (Oenothera laciniata Hill), spiny amaranth (Amaranthus spinosus), Eclipta (Eclipta prostrata L.), and yellow nutsedge (Cyperus esculentus). Weed control across species increased as herbicide concentrations increased from 0 to 10%. At all concentrations applied, pelargonic acid produced greater weed control for a longer time period for the broadleaf weeds than for the grass weeds. Visual damage to the weeds was often apparent within a few hours after application.

In this initial trial, pelargonic acid was effective in controlling both broadleaf and grass weeds as a burn-down herbicide. Additional research will investigate pelargonic acid application methods and weed control efficacy in relationship to controlling additional weed species, different weed maturities, and integrating its use into cropping systems.

Summary

Initial research in 2004 with the corn gluten meal applicator, vinegar, and pelargonic acid all demonstrated promise and potential usefulness for alternative weed control. These research studies will be repeated and expanded during the 2005 growing season. Further research on the corn gluten meal applicator will determine the effectiveness of the broadcast and banded methods, the optimum corn gluten meal application rates, and formulation differences (powdered and granulated) on weed control and crop safety of direct seeded and transplanted vegetables. Additional research with vinegar will involve further documentation of the 2004 results, expansion of adjuvant evaluations, and a closer look at the interaction between application rates, weed species, and plant size for weed control. The pelargonic acid research will be repeated in 2005 and expanded to investigate methods to integrate its use into vegetable production systems. Research in 2005 will also investigate other alternative materials that have potential use in controlling weeds in an environmentally friendly manner for organic, sustainable, and conventional vegetable production systems.

[1]The mention of a company or a produce is not intended as a recommendation.

Oklahoma Food Policy Council: Farm to School Pilot Project and Other Happenings

Chris Kirby, Urban Harvest Director
Regional Food Bank of Oklahoma

Chris Kirby received her degree in Marketing from the University of Oklahoma and has used her experience and knowledge in promoting locally grown agriculture products while also making links between the underserved communities and the local growing community. Chris is the former founder and director of the OSU-Oklahoma City Farmers Market which became the largest year round Oklahoma grown farmers market in the state. Chris is now director of Urban Harvest at the Regional Food Bank of Oklahoma with a mission of providing better access of fresh fruits and vegetables to Oklahomans that are dealing with hunger. Chris serves as Vice Chair of the Oklahoma Food Policy Council and is a strong advocate of the Oklahoma grower and producer.

The Board of Agriculture, through its Commissioner created the Oklahoma Food Policy Council and appointed the members in Fall 2001. Council membership ranges from 12 to 18 members made up of Rancher, Food Bank, Farmer, Food Editor, Processor, Vegetable Farmer, Chef, Religious, Ag Policy, Non-Profit(3), Environmental areas.

The mission of the council is to ensure that Oklahoma strives to create a healthy, safe and abundant food supply by equitably linking social, economic, and ecological issues surrounding its production, processing, marketing, distribution and consumption. The motto for the council is "Bringing Oklahoma Food to Oklahoma Tables".

In the beginning, the council had several brainstorming sessions to develop the projects and prioritize what the council would work on. It was decided by the council to look at public institutions which included the public school system, universities, hospitals and prisons. In an effort to better understand purchasing habits of those institutions, a survey was developed and sent to the public institutions across the state focusing on use, knowledge, demand and barriers of Oklahoma products.

The survey had a 68.8% response rate which we were very pleased with and the key findings were:

Nearly two-thirds are not aware of the Made in Oklahoma program
Over two-thirds would make local purchases, provided competitive price and quality and an available local source
More than half would consider local purchases if they could purchase small quantities
More than half want to at least make contact with local food sources

The council also found out that Tomatoes, Melons, Cucumbers, Potatoes, Lettuce, Strawberries – any berry, Onions, Ground Beef, Cheese, Dairy Products, and Eggs would be items that the institutions would be more likely to purchase from Oklahoma producers.

From the results of the survey it was decided that the council would tackle the Farm-to-School program with the focus of connecting local Oklahoma growers with schools in the effort to improve the health of Oklahoma children through the consumption of fresh/flavorful fruits and vegetables.

A meeting was called to bring the probable partners that could discuss the possibilities of beginning the Farm-to-School program in Oklahoma. Those partners consisted of the Oklahoma Food Policy Council, The Kerr Center, Oklahoma Dept of Agriculture, Food and Forestry, Department of Education, Department of Human Services, USDA Food and Nutrition Services, Department of Defense Fresh Produce Program (DOD), schools and school food service directors to assess the interest of the project. The meeting was an overwhelming success with a resounding agreement that the Farm-to-School program needed to happen. From that point, the partners agreed to set a goal of a pilot program to happen in Fall 2004 and the produce item that we would have enough quantity for that time of season would be watermelons. Bob Ramming, a watermelon producer from Hydro and Mike Thomas with Thomas Bros. Produce would be used as the grower and distributor for the pilot project. Each partner was a critical piece of the puzzle and without the willingness and expertise of each one, the project would have never happened.

4 school districts participated in the pilot Farm-To-School program and they were:

Broken Arrow – 23 schools
Edmond – 21 schools
Shawnee – 7 schools
Tahlequah – 6 schools

Funds for purchasing were initially supplied by the USDA Nutrition Services for the pilot project and in the future will come from the school service budget to purchase produce.

Seedless Watermelons were delivered once a week for four to five weeks beginning in late August and served as part of the school lunch program. A total of 721 cases of seedless watermelons were ordered to be delivered in 2 per case load.

Curriculum was developed by the Ag in the Classroom, a program of the Oklahoma Dept. of Agriculture, Food and Forestry and used in conjunction with the watermelon deliveries so students could learn about nutrition and about farming in fun activities.

The media came out for the press conference in both the Oklahoma City market and the Tulsa market where they did several stories both on TV and newspaper covering the deliveries made to the Edmond and Broken Arrow schools. The kids loved the watermelons!

We are hoping to expand the program to a statewide level next year with watermelons and also add additional Oklahoma produced items each year. One of the challenges in providing locally grown produce to the schools is that the schools are in session outside the normal warm season growing time. Growers that are interested in this program should look at items that can be delivered during the school year and also look at season extension techniques. Growers that participate in the farm-to-school program through the Department of Defense(DOD) have to apply with DOD for certification and meet their spec requirements for fresh fruits and vegetables. It would be a different process for products other than fruits and vegetables.

I called the food service director with the Shawnee Public Schools, which was one of our pilot program sites to see if she was able to purchase directly from Oklahoma growers and what was needed to that. Listed below are things that a producer needs to consider before selling directly to a school:

Follow DOD specs for produce
Find a school that is willing to work with a local grower…Some are more willing than others
Be able to provide for all schools in the district
Have the ability to invoice the school and wait 6 to 8 weeks before being paid
Need a guarantee on the quality of the produce
In other words, be able to provide the school the same service that their produce broker does
Follow through with your promise
Communicate

Other Happenings

It is also the goal of the Food Policy Council to help local producers to be successful in other market choices too. Listed below are other marketing opportunities for the local grower:

Farmers Markets - Direct link from the grower to the consumer; retail price for produce; needs to like working with the general retail consumer; must market your produce, yourself and your farm; helpful to grow a diverse selection of produce; very popular and growing industry
Restaurants/chefs/caterers - Better luck with locally owned businesses; menus that change seasonally; promotes local foods; higher end restaurants; establish contact by taking a basket of produce to the restaurant/chef/caterer
Community Supported Agriculture – subscription farming – up and coming concept for Oklahoma
U-Pick – the consumer comes to your farm and picks – better potential if located close to a large city. Must like the public coming to your farm all of the time during your selling season. Must consider liability issues too.
Entertainment Farming – pumpkin patches, etc.
Donate to your local food bank - Help hungry Oklahoma communities in need; Tax incentive - permitted a charitable deduction for an amount equal to the taxpayer's basis in the contributed property, not its fair-market value; protected by the Good Faith Donor Bill –HB 1052 – Oklahoma law on liability exclusion; Bill Emerson Food Donation Act – federal law; call Chris Kirby to make a donation or find an agency or pantry closest to your farm.
Plant A Row for the Hungry - Looking for PAR coordinators at each farmers market to collect excess produce at the end of the market and delivery to local agency or hold for pickup by the agency; call Chris Kirby – 405-604-7108 for a list of agencies, emergency food pantries, senior centers or on-site feeding kitchen in your area.
Use your gift and talent as a grower to help those in need Oklahoma Food Cooperative - Started 2 years ago; Markets Oklahoma products from local growers and producers over the internet; Motto – "Bring the Farmers Market to your door"; One-time membership fee for selling through the cooperative; www.oklahomafood.org
Native American Connection - Chickasaw Nation currently participates in the Senior Farmers Market Nutrition Program and the WIC Farmers Market Nutrition Program;
High rate of diabetes in Native Americans – develop proposal and present to one of the Indian Nations to grow for their tribe or reservation.
Growers Cooperative - Tremendous amount of possibilities for a producers co-op; Develop and coordinate growers from across the state to grow a diverse selection of fresh produce in quantity and quality with help in marketing and distribution; Provide a fair price to the grower
Produce Auction – There is possibility of one forming in the next year or two. Good opportunity to sell quality produce and quantity for a fair price and not have to compete with other states. Primary

customer is people supplying farmers markets, roadside stands, caterers, restaurants and small independent grocery stores.

Now more than ever the consumer is looking for locally grown products which has opened up many opportunities for the local grower. Look for the distribution method you want and grow for that market. Wishing you a great 2005 growing season!

Building a Foundation for Community Food Security in Oklahoma.

Doug Walton is the Community Food Project Coordinator at the Kerr Center for Sustainable Agriculture in Poteau, OK. Doug has worked to help organize small-scale farmers over the past 10 years in Utah, Kansas and Oklahoma, and also coordinated a USDA grant project to strengthen farmers' markets throughout Oklahoma. He was a co-founder of the Oklahoma Farmers' Market Alliance and currently serves as President of the Muskogee Farmers' Market, where he and his family sold produce and herbs for three years. Doug lives with his wife and two children on their 8 acre farm outside Muskogee, OK, where they raise vegetables, herbs and a small flock of chickens.

Think of community food security as being a goal. A goal whereby a community (a state, county, municipality, etc.) is able to meet the needs of all its members in acquiring adequate, safe, nutritious and sustainably produced foods, in ways that empower individuals and strengthen the community and its local economy.

The food security of any particular community exists on a continuum, much the way that a farm's sustainability does. The notion of community food security provides a conceptual framework by which to evaluate current conditions, as well as future decisions, and their likely effects on the food security of a community.

Early last fall, The Kerr Center received a grant from the USDA's Community Food Projects Initiative, a national competitive grant program that has been in place since 1996. Since its inception, this program has helped make possible 186 projects to increase food security in communities around the country, with this being the first one funded in OK.

Our project has 3 primary goals to accomplish over the next two and a half years:

1. Expand the capacity of the OK Food Policy Council.
2. Increase public understanding about our food system.
3. Support development of farm-to-school efforts.

Expand the capacity of the OK Food Policy Council

The Oklahoma Food Policy Council (OFPC) is a diverse group of people representing many facets of our state's food system, from farmers and ranchers to hunger-relief advocates, educators and consumers. Since it's inception in 2001, the Council has successfully focused its attention on increasing the amount of Oklahoma grown and processed foods used by public schools. While there is still much work being done in this area (see goal 3), there is also a great need to address food and ag. policies that can help bring more Oklahoma food to Oklahoma tables.

In order to provide policy makers and the general public a more complete picture of food security in Oklahoma, basic information about our current food system needs to be compiled and presented in a meaningful format. An assessment of OK's food system is currently underway and will help to answer

questions such as: Where does our food come from and how does it get to us? Who is lacking sufficient access to nutritious foods in OK? What opportunities exist or can be developed to increase the use of locally grown and processed foods in Oklahoma?

Upon completing the assessment this summer, a comprehensive report will be written to identify:
-The greatest threats to health and food security within Oklahoma.
-The extent to which Oklahoma can increase its food self-reliance, and the potential economic and social benefits of doing so.
-Policy recommendations for addressing specific problems and opportunities identified in the assessment.

Increase public understanding about our food system

To achieve this 2nd goal, the Food Policy Council will distribute the food system report to state and local policy makers, educators, and the media. A legislative seminar will also be held for presenting significant findings of the Food System Report to key committee members, legislators and department heads. A primary function of the report will be to stimulate a dialogue about current and future state policies that pertain to food, farming and nutrition.

Throughout the project, a public awareness campaign will focus on increasing Oklahoman's understanding of food security and how our food choices affect our own health and the health of our communities and local economies. We will be working with partnering organizations to coordinate coverage of food security topics and to report on project progress in partners' newsletter and through the media.

One specific educational activity involves working with OSU's Community Nutrition Education Program, whose nutritional coaches visit the homes of nearly 5000 limited-resource families throughout the state. These educators will provide information about finding fresh seasonal fruits and vegetables at farmers markets in Oklahoma.

Besides educating policy makers and the general public, another important aspect of increasing public understanding about our food system involves efforts to reach teachers and schoolchildren. Several activities will be coordinated in partnership with the OK Ag. in the Classroom (OAITC) program.

-Speakers' Bureau for OK Schools - a database of farmers, ranchers and other producers interested in visiting schools, or hosting farm tours will be compiled for use by Oklahoma school teachers.

-Teacher Workshops – Public school teachers will be given an overview of local food systems by touring CSA farms, visiting farmers' markets, school and community gardens, and eating locally grown meals. Classroom seminar sessions and hand's on training will be provided on school gardening, cooking and eating activities with kids, and farm to school initiatives.

-School Curriculum and Activities - We'll be working with OAITC's curriculum writers and teacher trainers to include more experiential learning activities that teach children how food is grown, while encouraging healthy eating habits. Our emphasis is focusing on school and classroom gardening, and activities involving the preparation and eating of nutritious foods grown and raised in OK.

Support development of farm-to-school efforts

As mentioned earlier, the Food Policy Council has initiated important action to begin connecting OK farmers with public school lunch programs. Building on these efforts, this project will allow the continuation of this work through these activities:
-Expanding Pilot Programs - This involves continuing to work together with pilot partners to include more schools, farmers and food items. This will also entail exploring other possible methods for connecting OK schools with OK farmers.

-Farm to School Workshops - Workshops will be held for bringing together school food service staff, producers, distributors, parents, teachers and others interested in learning about and establishing farm to school initiatives in OK. The first workshop is being planned for early November of this year.

-Publishing Resource Guides - Informational guides will be developed for food service directors and producers to help identify opportunities and ways to address possible obstacles to participating in farm to school transactions. Successful farm to school models in other states will also be highlighted, along with insight on transferring some of these models to OK.

Through all of the activities and interactions taking place during this project, Oklahomans of all walks (policy makers, educators, the media, schoolchildren, parents, farmers, and others) will be exposed to new ideas and a new awareness of how food, farming and nutrition affects all our lives. Combining this new public understanding with the win-win effects of making farm to school connections, we will truly be building a foundation for community food security in Oklahoma.

All Ozark Meals: Connecting People to Local Farmers, Restaurants, & Chefs

Julia Sampson
NCAT—ATTRA
Fayetteville, AR

Speaker Bio: Julia Sampson, is a Technical Specialist for NCAT, the National Center for Appropriate Technology (NCAT). NCAT is a national nonprofit organization with three focus areas: sustainable agriculture, energy, and communities. NCAT operates the ATTRA Project, which is the National Sustainable Agriculture Information Service. The Northwest AR Local Food Initiative is seeking additional funding to expand on the work of the All-Ozark Meal Project. She can be reached at julias@ncat.org

Presentation Overview
Why You Should Consider a Local Food Project
15 Great Examples from around the Country
7 Lessons from AOM
5 Tips for Farmers for Local Food Projects
Resources

Why You Should Consider a Local Food Project

Excellent for farmers' bottom line
Folks are seeking real taste
Economic development - $$ kept inside the community
1000 Families spend $5 million/yr on food
Better health and nutrition for all
Community food security

15 Great Projects and Examples from Around the Country

1- Oklahoma Food Coop- Robert Waldrop – oklahomafood.org
Statewide food cooperative
2- Southern SAWG - Keith Richards – www.ssawg.org
Forthcoming Community Food Project Handbook
3- Yale University - John Turrene
One dining hall serving organic food
4- Healthcare Without Harm – www.noharm.org
World-wide organization of physicians promoting use of antibiotic-free meat in hospitals
5 - Cancer Treatment Centers - OK, IL, PA, WA
Use of organic foods in treatments
6- University of Nebraska
Local hamburger in dining halls
7- King County, WA
Explosive growth of mini-farms selling to metro Seattle
8- New North Florida Coop– Glyen Holmes-nnfc@digitalexp.com

Coop of farmers selling sweet potatoes & greens to schools in several states
9- Sysco Corporation
Largest food distributor in US – more organic
10- Compton, California Elementary Schools -Tracie Thomas
All 24 schools will have salad bars by Spring 2005
11- The Farmers Diner–Tod Murphy– VT– farmersdiner.com
Local food from local farms
12- Institute for Community Resource Dev - Ladonna Redmond
African American community in Chicago with farmers market
13- School Fundraisers with Local Farms – NRCS, MI
Small School raised $1200 – (See Samples in Handouts)
14- Local Organic Initiative – www.sustainusa.org/localorganic
Metro Chicago spends $60-80 million/yr on organic produce; only 3% of that total comes from local farms
15-Community Food Security Coalition – www.foodsecurity.org
Umbrella organization seeking to strengthen food systems

Seven Lessons from the All-Ozark Meal Project - funded by Southern SARE

Lesson # 1 - Know Your Media Deadlines
Time Wasted: Writer - 2 hours on interviews and writing
Helper - 2 hours on fax machine; Editor – missed deadline for Coop monthly newsletter
Good News: 1 – Coop Deli had always experienced low sales volume on this date, but this Event sold out of food; 2 – Coop agreed to do another event, and perhaps, feature the local meal more often; 3 – Responses to Consumer Survey was great

Lesson #2 - Know Reporters and Their Beats
Direct your releases to a specific individual/beat
Followup with email or phone call
Know their deadlines
Good News: 1 – Press releases were passed around the newsroom
2 – Received print coverage in different newspaper sections, Lifestyles, Food, Farm & Business, Wine, etc.; 3 – Received lots of "residual" news coverage

Lesson #3 - Vary the Event Locations
Seek opportunities with collaborators
Spread the "ownership" of the campaign
Think of locale as well as price
Good News: 1 – Variety of locations = variety of prices; 2 – Variety of locations = variety of participants; 3 – Variety of locations = different market segments

Lesson #4 - Publicity Does Not Have to Be Expensive
News outlets (radio, TV, and print) are hungry for positive stories
Colorful posters and flyers
Electronic media offers world-wide distribution
Good News: 1 – Use of email lists and listservs saved valuable time; 2 – Handbills and flyers were widely distributed; 3 – PSA's, community calendars, and free TV promotions were used extensively; 4 – We sought inclusion in other organization newsletters and bulletins

Lesson #5 - Seek Potential Event "Opportunities" with Other Groups
Charities, schools, churches, microbreweries, wineries, art galleries
Good News: 1 – Already established publicity/communication channels; 2 – Higher visibility, perhaps; 3 – Broader base/participation – Different market segment

Lesson #6 - Use Volunteers and Solicit Donors
Use less staff time; Stretch a limited budget
Good News: 1 – Volunteer opportunities have definite beginnings & endings; 2 – Volunteers tend to have friends; 3 – Donors are naturally drawn to this type of "feel good" project;
4 - Donated time and dollars can help to "stretch" limited funds

Lesson #7 - Seek Broad-based Partnership & Keep Them Engaged
May have crucial resources; Can be instrumental in opening doors;
Can provide another viewpoint
Good News: 1 – Partners may have great, already-established communications channels
2 – Partners could have access to funds/fundors; 3 – Partners may have volunteer labor

5 Tips for Farmers for Local Food Projects

Tip #1 - Selling to Schools
Most Farmers: Warm Season
Most Schools: Cold Season
Success Examples:
Oklahoma – selling watermelons to schools
New North Florida Coop – selling to schools in at least 3 states
Western Massachusetts – selling to 4 schools; 1 buys $700/wk
Compton, California – selling to 23 elementary schools

Tip #2 - Selling to Restaurants
Wow Them!
Overproduce to get great looking product
Success Examples:
The Chef's Garden – Ohio - www.chefs-garden.com
Bordino's – Fayetteville – Chef Chrissy Sanderson
Farmer in Houston who designates garden beds for chefs

Tip #3 – Selling to Restaurants & Institutions
Learn Their Needs & Desires:
Look at the menu & ask the source of the products
Learn the best delivery days & times
What product would you love to have but cannot find?
Ask for a Procurement Manual
Success Examples:
Restaurants will want to use "fresh/local" for market differentiation
Hospitals will move toward healthier foods • $1-2 billion/yr
Sysco owner is a woman with an organic farm in VA

Tip #4 - Selling to Restaurants & Institutions
Think about cooperative production and marketing
Success Examples:
All-Ozark Meal – 6 farmers designated one person to handle transaction
New North Florida Coop – farmers from FL, GA & TN grown and sell to schools
Organic Valley (WI) now has dairy producers in TX

Tip #5 - Selling to Policy Makers
Get elected officials to think about local food – make it policy
Success Examples:
Chicago: Mayor Daly wants to make Chicago the greenest city in America
American Planning Association: March 2005 Conference–Track on Food Systems
Carroll County, GA: Group dedicated to rural development & preventing sprawl

Resources
Southern SAWG Community Food Systems - http://www.ssawg.org
ATTRA – "Bringing Local Food to Local People"
http://attra.ncat.org/attra-pub/PDF/farmtoschool.pdf
All Iowa Meal - http://www.pfi.iastate.edu/PFIhomenew.htm
CISA (Community Involved in Supporting Local Agriculture)
http://www.buylocalfood.com/
Community Food Security Coalition - http://www.foodsecurity.org
FoodRoutes - http://www.foodroutes.org
LocalHarvest - http://www.localharvest.org/
State Food Policy Councils - http://www.statefoodpolicy.org/

Compost Teas: An On-Farm Tool to Enhance Fertility and Pest Control

Steve Diver
National Center for Appropriate Technology
Fayetteville, Arkansas

Steve Diver is an agriculture specialist with the National Center for Appropriate Technology (NCAT). Steve provides technical support on agronomic and horticultural topics through NCAT's flagship sustainable agriculture program known as ATTRA—National Sustainable Agriculture Information Service. Prior to joining NCAT, he managed an organic blueberry farm in the Missouri Ozarks. He was an Extension Horticulturist in Oklahoma for four years.

Compost teas are attracting a lot of attention as an on-farm tool in biological farming. Compost teas have multiple benefits and uses: in addition to promoting crop growth, they also help suppress diseases.

What is a Compost Tea?
Compost teas are a water extract of a humus substrate
Three humus materials are used as a compost tea substrate: compost, vermicompost, and peat humus
Compost teas are made with or without aeration (e.g., an air pump to inject oxygen, agitation to dislodge beneficial microorganisms from the humus substrate)
Compost teas are made with or without tea additives (e.g., molasses, kelp extract, and humic acid that function as microbial food sources)
Compost teas are incubated for various lengths of time

Purpose of Compost Tea
Three components: soluble nutrients, bioactive substances, beneficial microbes
Bioaugmentation of the rhizosphere (root zone) and phyllosphere (leaf zone)
Boost crop health
Suppress plant diseases
Microbially enhanced nutrient delivery

Farmers like compost teas because they work. They help plants grow healthy and strong, supplying growth-promoting substances and plant protective substances. They supply biocontrol organisms that help crops suppress disease-causing pathogens.

Compost Quality and Pathogen Risk Reduction
Compost teas are simple to make, but they require attention to detail to ensure quality, efficacy, and biosafety. Since animal manures and food wastes are commonly used as feedstocks in compost production, there is concern at USDA that human pathogens
(E. coli, salmonella, campylobacter) may survive composting and re-grow in the compost tea brewing process.

Thus, compost quality is of the utmost importance when choosing a substrate to brew compost tea. The compost should be pathogen free and of good quality. Good quality compost is well humified, meaning that it has gone through the whole breakdown and buildup process—the microbial transformation of raw organic ingredients to humified organic matter. Compost supplies humic and fulvic acids, a diversity of beneficial soil microorganisms, and elemental nutrients.

Compost quality is determined through lab analysis. Standard laboratory parameters that indicate good quality compost include C:N ratio, moisture, organic matter, humus value, nitrates vs. ammonia, sulfates vs. sulfides, redox potential, and no detectable pathogens. Soil microbiology parameters that indicate good quality compost deal with microbial biomass and microbial diversity, actively metabolizing microbes, functional groups, bacteria, fungi, protozoa, and beneficial vs. predatory nematodes.

Certified organic farming in the United States is now uniformly regulated by the U.S.D.A. National Organic Program (NOP). The NOP is the result of the Organic Foods Production Act of 1990. The NOP Program Standards is a lengthy document that sets forth definitions, certification, labeling, accreditation, and most importantly, production and handling guidelines. Section 205.203(c)(2) of the NOP specifies how compost should be made as an allowed crop production input and sets it apart from "raw manure."
Compost must be produced through a process that combines plant and animal materials with an initial C:N ratio of between 25:1 and 40:1. Producers using an in-vessel or static aerated pile system must maintain the composting materials at a temperature between 131F and 170F for 3 days. Producers using a windrow system must maintain the composting materials at a temperature between 131F and 170F for 15 days, during which time the materials must be turned a minimum of five times.
The NOP compost regulations are derived from NRCS guidelines and the EPA Biosolids Rule Part 503. Essentially, they ensure "processes to further reduce pathogens," or PRRPs, based on time and temperature requirements to destroy human pathogens.

However, compost teas were not fully recognized in the NOP, as originally published. To upgrade the NOP standards, the National Organic Standards Board (NOSB) created the NOSB Compost Tea Task Force (CTTF). The NOSB Compost Tea Task Force published the CTTF Report in April 2004. It outlines best management practices to ensure safe and effective use of compost teas in organic agriculture. Its recommend- ations should be consulted by farmers who plan to use compost teas in fruit and vegetable production (1).

Vermicompost, also known as worm compost or vermicast, is the humus material that is the end product of vermiculture. Compost tea practitioners commonly use 100% vermicompost, a 50:50 blend of vermicompost + compost, or a 75:25 blend of vermicompost + compost, thus gaining the benefits of two different soil ecological milieus.

Peat humus, the third compost tea substrate, is a mined product from peat bogs in Alaska. It is of 100% vegetable origin, and therefore, an alternative to animal-manure based composts and vermicomposts, thereby negating concerns about pathogenic contamination. Interestingly, it has soil biology properties similar to those of compost.

Soil Biology and Compost Tea
Molecular analysis has determined that compost and peat humus possess 25,000 to 35,000 species of bacteria and 5,000 to 8,000 species of fungi. This is what drives interest in compost teas— soil biology.

More specifically, it is the microbial abundance and diversity in soils, composts, and compost teas that drives ecological functions and results in a steady supply of nutrients, builds soil structure, and generally helps control pests and suppress diseases. Microbial abundance and diversity is a universal principle of organic agriculture. It is achieved through humus farming, which provides food and shelter for soil biota.

The rhizosphere is the biologically active zone at the root-soil interface. Through mycorrhizal symbiosis, the mycorrhizosphere extends several millimeters beyond the plant root itself into the clay-humus structure of soil, exponentially expanding crop access to minerals and biotic substances. Likewise, the phyllosphere is the biologically active zone at the leaf surface. These three-dimensional biospheres are home to diverse microbial communities. Compost teas bioaugment the rhizosphere and phyllosphere.

The Soil Biology Primer is a 48-page book with color illustrations and photographs that provides an excellent introduction to soil biota and the soil food web. It has chapters on the soil food web, the food web and soil health, and soil bacteria, fungi, protozoa, nematodes, and earthworms. It is the most popular selling USDA publication in modern history. It is available through the Soil and Water Conservation Society (2), and it is also available on the Web (3).

Annie Dillard, in her book Pilgrim at Tinker Creek, wrote, "I had been my whole life a bell, and never knew it until at that moment I was lifted and struck." For many farmers, the realization that biological mechanisms underlie every aspect of crop production, and that biological farming practices (composting, cover cropping, and compost tea) can enhance these biological mechanisms as a complete alternative to NPK fertilizers and pesticides, has been a similar awakening.

Types of Compost Teas

There are two broad categories of compost teas, based on how they are made: Non-Aerated Compost Teas (NCT) and Aerated Compost Teas (ACT). Further, compost teas may be amended with compost tea additives—such as molasses, kelp extract, humic acid, and rock dust—to support the growth of beneficial microbe populations.

Non-Aerated Compost Teas. Much of the early scientific literature on compost teas was published in Europe by Heinrich Weltzein, where the NCT production method was said to result in "compost watery extracts." The compost to water volume ratio for NCT ranges from 1:3 to 1:10. The extraction periods in Weltzein's research ranged from 7 to 21 days, using well-cured animal-manure based composts as a substrate. An occasional stirring of the solution during the extraction period was the only management typically employed.

The chief advantage of NCT is that it is simple. Proponents of ACT express concern that NCT lacks oxygen and results in anaerobic byproducts detrimental to soil life. However, it is likely that NCT goes through both aerobic and anaerobic phases and results in a simple compost extract with soluble plant nutrients, some bioactive substances, and some beneficial microbes. Most NCTs are not supplemented with microbial food sources. There is substantial research that shows NCTs possess disease suppressive characteristics.

Aerated Compost Teas. The modern compost tea movement —its literature, commercial tea brewers, and practitioner experience — is largely centered on ACT production. Amigo Cantisano in California and Elaine Ingham in Oregon are two prominent advocates of ACT. ACT can be made with a commercial tea brewer or a homemade tea brewer that supplies aeration and agitation. The compost to water volume ratio ranges from 1:10 to 1:50. The extraction period is much shorter, from 12 to 24 hours. Compost tea additives are commonly used. There is a deliberate effort to extract beneficial bacteria, fungal hyphae, and protozoa during the brewing cycle, and to support their multiplication and growth with aeration and microbial food sources. Aeration and aerobic conditions are considered vitally

important. Research has shown that 6 ppm dissolved oxygen is necessary to maintain aerobic conditions; dissolved oxygen meters are commonly employed.
The chief advantage of ACT, according to its proponents, is that ACT provides superior soil microbial analysis and field performance. It has the complete components expected of good quality compost tea: soluble plant nutrients, bioactive substances, and beneficial microorganisms.

Compost Tea Application
Compost teas are commonly applied as a soil drench, through fertigation, and via foliar applications. Yucca extract, allowed in organic production, is commonly added to spray tanks as a spreader-sticker.

A common recommendation is 5 to 20 gallons of actual compost tea per acre, diluted in a sufficient volume of water normally applied per acre (e.g., 50 to 100 gallons per acre). It is important to set aside a "biological" spray rig for application of compost teas. Simply rinsing out a spray rig normally used for application of insecticides and fungicides is not compatible. Research on disease suppressive capacity of compost teas showed that a minimum of 70% leaf coverage is needed. Multiple applications of soil drenches and foliar tea applications are used during the growing season in commercial fruit and vegetable production.

Laboratory Analysis
There are three labs that can provide specialized analysis for compost teas. BBC Laboratories in Arizona (www.bbclabs.com), Soil Foodweb, Inc. in Oregon and New York (www.soilfoodweb.com), and Woods End Research Laboratory in Maine (www.woodsend.org).

Compost Tea Brewing Supplies

Alaska Giant www.alaskagiant.com	Bob's Brewers www.bobsbrewers.com	EcoVit Tea-riffic Brewers www.composttea.ca
EPM Earth Tea Brewers www.composttea.com	Keep it Simple, Inc. www.simplici-tea.com	Midwest Bio-Systems www.midwestbiosystems.com
Nature Technologies nature-technologies.com	North Country Organics www.norganics.com	T&J Enterprises www.tandjenterprises.com
Wormgold Extractors www.wormgold.com	Soil Soup www.soilsoup.com	Natural Science Organics Naturalscienceorganics.com

References and Resources

1. NOSB Compost Tea Task Force Report, 21 pages in PDF
www.ams.usda.gov/nosb/meetings/CompostTeaTaskForceFinalReport.pdf

2. Soil Biology Primer, 48-page book
www.swcs.org/en/publications/books/soil_biology_primer.cfm

3. Soil Biology Primer, NRCS web version
www.soils.usda.gov/sqi/soil_quality/soil_biology/soil_biology_primer.html

4. Notes on Compost Teas
ATTRA - National Sustainable Agriculture Information Service
www.attra.org/attra-pub/compost-tea-notes.html

Building a Foundation for Community Food Security in Oklahoma

Doug Walton, Community Food Project Coordinator
Kerr Center for Sustainable Agriculture
Poteau, OK

Doug Walton is the Community Food Project Coordinator at the Kerr Center for Sustainable Agriculture in Poteau, OK. Doug has worked to help organize small-scale farmers over the past 10 years in Utah, Kansas and Oklahoma, and also coordinated a USDA grant project to strengthen farmers' markets throughout Oklahoma. He was a co-founder of the Oklahoma Farmers' Market Alliance and currently serves as President of the Muskogee Farmers' Market, where he and his family sold produce and herbs for three years. Doug lives with his wife and two children on their 8 acre farm outside Muskogee, OK, where they raise vegetables, herbs and a small flock of chickens.

Think of community food security as being a goal. A goal whereby a community (a state, county, municipality, etc.) is able to meet the needs of all its members in acquiring adequate, safe, nutritious and sustainably produced foods, in ways that empower individuals and strengthen the community and its local economy.

The food security of any particular community exists on a continuum, much the way that a farm's sustainability does. The notion of community food security provides a conceptual framework by which to evaluate current conditions, as well as future decisions, and their likely effects on the food security of a community.

Early last fall, The Kerr Center received a grant from the USDA's Community Food Projects Initiative, a national competitive grant program that has been in place since 1996. Since its inception, this program has helped make possible 186 projects to increase food security in communities around the country, with this being the first one funded in OK.

Our project has 3 primary goals to accomplish over the next two and a half years:
1. Expand the capacity of the OK Food Policy Council.
2. Increase public understanding about our food system.
3. Support development of farm-to-school efforts.

Expand the capacity of the OK Food Policy Council

The Oklahoma Food Policy Council (OFPC) is a diverse group of people representing many facets of our state's food system, from farmers and ranchers to hunger-relief advocates, educators and consumers. Since it's inception in 2001, the Council has successfully focused its attention on increasing the amount of Oklahoma grown and processed foods used by public schools. While there is still much work being done in this area (see goal 3), there is also a great need to address food and ag. policies that can help bring more Oklahoma food to Oklahoma tables.

In order to provide policy makers and the general public a more complete picture of food security in Oklahoma, basic information about our current food system needs to be compiled and presented in a meaningful format. An assessment of OK's food system is currently underway and will help to answer questions such as: Where does our food come from and how does it get to us? Who is lacking sufficient

access to nutritious foods in OK? What opportunities exist or can be developed to increase the use of locally grown and processed foods in Oklahoma?

Upon completing the assessment this summer, a comprehensive report will be written to identify:
-The greatest threats to health and food security within Oklahoma.
-The extent to which Oklahoma can increase its food self-reliance, and the potential economic and social benefits of doing so.
-Policy recommendations for addressing specific problems and opportunities identified in the assessment.

Increase public understanding about our food system

To achieve this 2nd goal, the Food Policy Council will distribute the food system report to state and local policy makers, educators, and the media. A legislative seminar will also be held for presenting significant findings of the Food System Report to key committee members, legislators and department heads. A primary function of the report will be to stimulate a dialogue about current and future state policies that pertain to food, farming and nutrition.

Throughout the project, a public awareness campaign will focus on increasing Oklahoman's understanding of food security and how our food choices affect our own health and the health of our communities and local economies. We will be working with partnering organizations to coordinate coverage of food security topics and to report on project progress in partners' newsletter and through the media.

One specific educational activity involves working with OSU's Community Nutrition Education Program, whose nutritional coaches visit the homes of nearly 5000 limited-resource families throughout the state. These educators will provide information about finding fresh seasonal fruits and vegetables at farmers markets in Oklahoma.

Besides educating policy makers and the general public, another important aspect of increasing public understanding about our food system involves efforts to reach teachers and schoolchildren. Several activities will be coordinated in partnership with the OK Ag. in the Classroom (OAITC) program.

-Speakers' Bureau for OK Schools - a database of farmers, ranchers and other producers interested in visiting schools, or hosting farm tours will be compiled for use by Oklahoma school teachers.

-Teacher Workshops – Public school teachers will be given an overview of local food systems by touring CSA farms, visiting farmers' markets, school and community gardens, and eating locally grown meals. Classroom seminar sessions and hand's on training will be provided on school gardening, cooking and eating activities with kids, and farm to school initiatives.

-School Curriculum and Activities - We'll be working with OAITC's curriculum writers and teacher trainers to include more experiential learning activities that teach children how food is grown, while encouraging healthy eating habits. Our emphasis is focusing on school and classroom gardening, and activities involving the preparation and eating of nutritious foods grown and raised in OK.

Support development of farm-to-school efforts

As mentioned earlier, the Food Policy Council has initiated important action to begin connecting OK farmers with public school lunch programs. Building on these efforts, this project will allow the continuation of this work through these activities:
-Expanding Pilot Programs - This involves continuing to work together with pilot partners to include more schools, farmers and food items. This will also entail exploring other possible methods for connecting OK schools with OK farmers.

-Farm to School Workshops - Workshops will be held for bringing together school food service staff, producers, distributors, parents, teachers and others interested in learning about and establishing farm to school initiatives in OK. The first workshop is being planned for early November of this year.

-Publishing Resource Guides - Informational guides will be developed for food service directors and producers to help identify opportunities and ways to address possible obstacles to participating in farm to school transactions. Successful farm to school models in other states will also be highlighted, along with insight on transferring some of these models to OK.

Through all of the activities and interactions taking place during this project, Oklahomans of all walks (policy makers, educators, the media, schoolchildren, parents, farmers, and others) will be exposed to new ideas and a new awareness of how food, farming and nutrition affects all our lives. Combining this new public understanding with the win-win effects of making farm to school connections, we will truly be building a foundation for community food security in Oklahoma.

Fruit Session

How Chill Unit Accumulation Affects Timing of Bud Break of Tree Fruit and Small Fruit

Sue Gray, Extension Horticulturist
Tulsa County O.S.U. Cooperative Extension

Biography:
Sue Gray has served Tulsa County growers for the past twenty years. Her areas of expertise include commercial production of pecans, fruit, vegetables, and urban watershed planning. She has also worked for the Maryland Cooperative Extension service as a horticulturist and for the O.S.U. department of Horticulture as a research technician in pecan and vegetable research.

Fruit and nut plants survive in temperate regions by becoming dormant in the fall, then entering a state of rest in winter. Shorter day length and cooler temperatures trigger this condition. It is a very gradual process in which plants slow down and stop growing. They then drop their leaves, entering a deeper and deeper state of rest.

Rest and dormancy are two distinct conditions. Dormancy can be brought about by environmental stresses, such as excess heat, drought, insect damage, or very low fertility.
However, cool, short days usually bring about dormancy. Rest, on the other hand, is a physiologically controlled condition within the plant. We can bring a plant out of environmentally induced dormancy. We cannot "wake up" a plant that is truly "at rest".
Prolonged, cumulative exposure to cool temperatures puts a plant in a state of deep rest.
In this condition it can withstand very cold temperatures. Even a mid-winter warm spell will not cause the plants to break dormancy due to this resting condition. This is Nature's way of insuring that plants will not begin to grow again during a false spring in mid-winter.

Various species of fruit differ in the duration of their rest requirements. Sub-tropical fruits may slow down during cold spells, only to resume growth when it gets warm again. Temperate zone fruits, on the other hand, have longer rest requirements. The length of this rest period has been studied for decades. The chart below, developed in the 1930's, shows the various rest requirements of fruits and nuts known at that time. The duration of rest is determined by what are known as chill units. A chill unit is generally recognized as an hour of exposure to cold temperatures between 37 ½ to 50 degrees F., with 43 being the average.

For example, a variety of apple that has a chilling requirement of 1800, needs 1800 hours of cold weather averaging 43 degrees before it can come out of dormancy in the spring.

Many mathematical models have been developed over the years to calculate the chilling hours required by fruit species and cultivars within those species. In 1980, Harry Swartz, of the University of Maryland, calculated accumulated chilling hours based on ten years of national weather data. He then plotted this on a U.S. map to illustrate where various chill units are accumulated in the U.S. This was published in the July 1982 issue of Fruit Varieties Journal as well as the Time-Life "Winter Gardening" edition of their gardening encyclopedia. Such a map is useful in showing growers which trees to plant in their areas.

Our geographic location in the northern hemisphere dictates which cultivars of various fruits that we can successfully grow.

For example, ‘Tropic Snow’ peach requires only 200 hours of chilling. We can grow it in San Antonio, Texas, assured that it will break dormancy after only 200 hours of temperatures averaging 43 degrees F. However, if ‘Tropic Snow’ were planted in Fayetteville, it may start to break bud during a late December warm spell, subsequently suffering freeze damage when winter temperatures return.

On the other hand, if we were to plant ‘Redhaven’ peaches in South Texas, they may grow just fine. They may enter dormancy when days become short. However, the tree may never properly “wake up”. Why? Because ‘Redhaven’ requires 950 hours of chilling time. Trees with unsatisfied rest requirements may leaf out later than usual, have problems with sporadic blooming sequence, and have misshapen fruit.

When temperatures exceed 59 degrees F., the process can be reversed. We can lose chill units during mid-winter warm spells. Oklahoma and Arkansas are infamous for fluctuating winter temperatures. Fortunately, in spite of these fluctuations, we generally accumulate plenty of chill units for our trees to normally break dormancy.

Some growers have been inquiring about growing red raspberries in greenhouses. An understanding of chill unit requirements is important with this crop as well. However, it must be artificially induced. In Belgium, a leader in greenhouse raspberry production, plants are grown outdoors until days get short and they drop their leaves. They are then put in coolers and kept at 43 degrees F. on a constant basis until their chilling requirements are met. Then, they are forced into production in greenhouses. If the raspberries had been placed immediately into greenhouses, without chilling, their rest requirement would not have been met, and fruit production would be severely reduced.

During the mild winter of 1999 chill unit data was gathered at three sites in Oklahoma. It was just barely enough for some peach cultivars and not enough for others, ranging from 711 to 825 hours of chilling over the three locations. This causes us to ask if global warming/climate change may cause us to grow lower chill peaches in the future. More data should be gathered on a routine basis to track chill units and see if this is true. Dr. J.D. Carlson, of the O.S.U. Department of Biosystems and Ag Engineering, is willing to arrange for such data to be available to growers via Mesonet if there is enough interest.

Understanding the need for chilling requirements of various species and cultivars of fruits and nuts should save us from attempting to grow crops not adapted to our climate.
It can also provide us with a tool for understanding how weather impacts bloom and subsequent fruiting of plants.

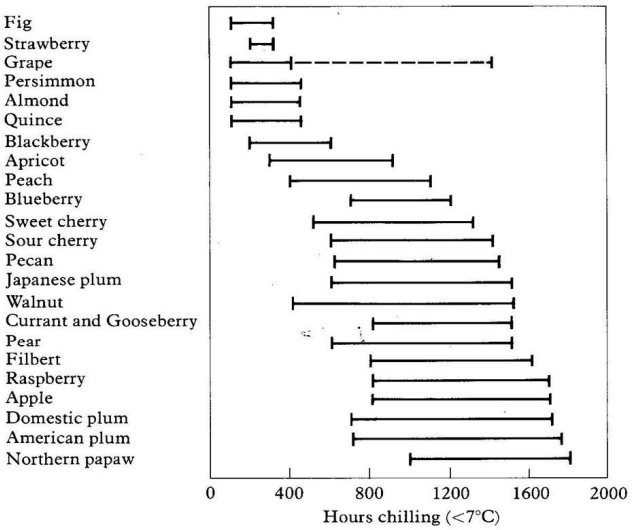
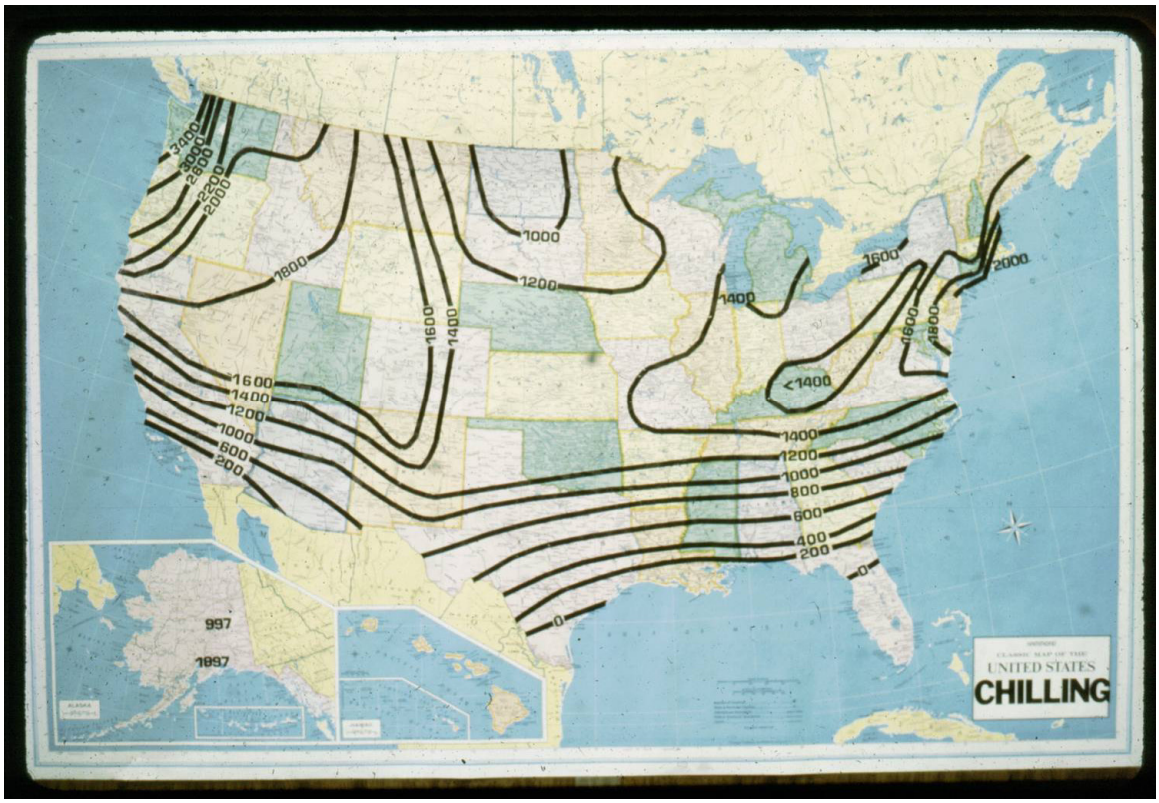


Figure 15-3 Approximate chilling requirements to break winter rest for fruit and nut species. The ranges shown for each species indicate the differences between low- and high-chilling cultivars within the species. Grape will grow with very little chilling but will begin growth much faster after long chilling. [Partially based on data of Chandler, Kimball, Philp, Tufts, and Weldon, 1937]



Viticulture in the Old North State

Andy Allen
Mid-America Viticulture and Enology Center
Southwest Missouri State University
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Trends and Statistics

Grapes and wine have been a part of the NC scene since the time of the first colonists. The industry has traditionally been based on the production of muscadine grapes and wines, except in the mountains where other, cold-hardy native grape varieties were utilized. In more recent history, grape production underwent a sharp 20-year decline in the 80s and 90s as bearing acreage fell from a high of 2400 acres in 1978 to 470 acres in 1998.

In the late 90's the trend reversed itself as a newer industry, based on varieties of Vitis vinifera, began to emerge and dominate the scene. Vinifera was not new to NC, having been grown at a few vineyards in the mountains and Upper Piedmont since the mid-1970s. Muscadines also began to enjoy a renaissance during this period. Currently, there are an estimated 1300 acres of vineyard in NC. Of this, slightly less than one-third is planted with muscadines. The rest is in bunch grapes, approximately 92% of which are planted with Vitis vinifera varieties.

There are estimated to be over 250 vineyards in NC. The average-sized vineyard in NC is approximately 4½ acres. Bunchgrapes are being grown throughout the Piedmont and much of the mountain regions. The main area of production currently is in the upper Yadkin Valley region, an area just east of the mountains that runs from the NC-VA border to just south of Interstate 40. This region recently applied for and received the state's first official appellation, the Yadkin Valley American Viticultural Area.

In bunch grape acreage, according to the last official survey in 2001, Chardonnay is the number-one variety, followed by Cabernet Sauvignon. Other top varieties, in order of acreage, are Merlot, Cabernet franc, Viognier, Syrah, Riesling, Sauvignon blanc, and Pinot noir. There is much interest in lesser-known and -grown varieties, and growers have begun putting in smaller plantings of varieties such as Mourvedre, Sangiovese, Petit Verdot, and Nebbiolo. There is little interest at this point in time in hybrids and hybrid plantings make up slightly less than 8% of the bunch grape acreage. Most of this acreage is in the standard varieties Chambourcin and Seyval blanc. Native varieties other than muscadines have not attracted much interest, and currently only a few acres of Niagara have been planted for sweet, dessert wines. Interest in viticulture is beginning to grow in the higher elevations of the Appalachian Mountains, where winter low temperatures are too often lethal to vinifera varieties. Grape production here will have to be based on the more cold-hardy hybrid and native American varieties.

Issues and Challenges

The newness of the bunch winegrape industry is also the source of most of its challenges. With no long history, and therefore no depth of localized knowledge or experience, many growers have rushed to establish vineyards without adequately understanding what they were doing. A common mistake has been to look towards other viticultural areas of the world, particularly the West Coast or France, and

assume that whatever worked there would also work in NC. This is most commonly seen in the choice of varieties. Pinot noir, Pinot grigio, Zinfandel, Sauvignon blanc, and Riesling do not perform well in NC, but continue to be planted nevertheless.

Another problem is in the area of vine vigor and trellis systems. Most of the acreage is established on various versions of VSP trellis, with a small percentage of the acreage on Lyre. While VSP works well with low vigor varieties or sites with poor soil, in NC this system does not adequately allow the vine to express its vigor. This problem is being compounded by the use of spacings that are too close for the vigor of the vines. This leads to multiple hedgings and leaf pullings in order to manage the canopy.

One of the biggest recurring challenges facing the industry is the bacterial disease Pierce's disease(PD). Pierce's disease, which is normally a problem mainly along the coastal plain and lower Piedmont, was for a couple of years showing up in cooler areas where growers thought they were safe from it. This was due to warm winters over a few years that allowed the January 30° mean minimum isotherm to move westward into the foothills of the mountains. In surveying vineyards for PD it was found at elevations of up to 1400-1500 feet. Several vineyards, mainly in the Piedmont region, suffered economically serious vine losses during those years. While most growers have replanted and are starting to regain lost production, PD still remains a potential threat if warm winters are experienced.

Opportunities

Despite the challenges the industry has faced so far, it has gotten off to a good start. The majority of vineyards have produced 2 or 3 crops of good quality fruit and the resulting wines are attracting a lot of positive press. Acreage is continuing to expand, as are the number of wineries in the state. At this writing the official number of wineries has just increased to 41 and there are more in the planning stages. Grape prices have continued to slowly increase on average over the last few years.

The legislative environment has been very positive for the industry as well. In 2001, the NC senate passed bill 823, which opened many doors of opportunity for the industry. It established the winegrower's permit, whereby any vineyard of at least 5 acres may have its grapes made into wine at a commercial winery and then bring it back to sell under the vineyard's own label at its premises. It also made it legal for wineries to sell wine by the glass at special events and allowed the establishment of up to 3 off-site tasting and sales rooms in areas where sales of alcohol are not prohibited by local statute.

How are Recent UA Variety Releases Performing for Growers? The Good and the Not So Good Reports

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New variety releases are made every year or two from the University of Arkansas Fruit Breeding Program. At the time of release, the major characteristics and performance in research plantings are reported. However, subsequent information about the variety's performance in the "real world" may not be published or reported at grower meetings. Provided in this paper are a few comments on some of the more recent UA releases and how they are performing.

Blackberries
Kiowa. This thorny, very large-fruited variety was released in 1996 and continues to be a favorite for pick-your-own and local sales, and some have reported success with it in shipping. In fact, someone mentioned to me recently of a 10-acre planting near Watsonville, Calif. being used for shipping. It has also proven to have some tolerance to double blossom/rosette, though not resistant like the thornless varieties. It was the strongest seller of the thorny Arkansas varieties in 2004 so this reflects continued use in the marketplace. It remains a good choice among the thorny options.

Chickasaw. Released in 1999 as a very productive, large-fruited variety, Chickasaw has been the most common Arkansas variety to show virus symptoms. This concern has been rather widespread in the U.S. It is not fully determined what virus or viruses are involved, but symptoms are yellow leaves, reduced productivity, and reduced vigor with cane dieback. This variety has also been shown to be susceptible to double blossom/rosette. All problems aside, it is still a very impressive berry in size and yield in Arkansas trials.

Apache. Fruit size continues to be impressive for this 1999-released variety and it is still the largest of the Arkansas thornless options. The occurrence of white drupes on fruit is an increasing concern for those that produce for the shipping market. The cause appears to be made worse by rainfall during harvest, and sunburn following rain may be a major culprit. It remains an excellent berry and plant to consider although shipping concerns are substantial. It was the largest seller of Arkansas varieties in 2004.

Ouachita. The first commercial plantings of this new variety were established in 2004, thus no commercial results are available yet as to performance. Research trials in Arkansas indicate continued good field and postharvest performance.

Prime-Jan® and Prime-Jim®. No commercial plantings of these new and unique primocane-fruiting blackberry varieties have fruited yet, though a good supply of plants is now on the market. They looked the best ever in Arkansas this year (PC fruit that is) as there was a moderate summer experienced. More

will be learned about these as they are tried. Remember these are targeted for home gardens and very limited commercial evaluation and do not have fruit quality suitable for shipping.

Navaho and Arapaho. Though no longer new (Navaho released in 1989, Arapaho 1993), these varieties continue to make an impact. Navaho has proven to be the winter hardiest of the two and it is unsurpassed in commercial fruit quality and firmness. Arapaho has performed well in very warm climates in Texas and southern Georgia, better than in many Arkansas trials over the years. They remain among the leaders in sales of the Arkansas blackberry releases.

Grapes
Neptune. This table grape continues to look better in evaluations the longer after release it is tested. It continues to be crack free in summer rains near harvest, have very consistently shaped large clusters, and good fruit quality. Yields in more recent trials are better than reported at the time of release. The only negative seen with Neptune was a substantial infection with downy mildew in 2004, encouraged by the numerous rains in mid-summer. The only commercial evaluations are from Idaho, where it shows promise.

Jupiter. Downy mildew infection was heavy on Jupiter in the 2004 summer, indicating that control of this disease is critical to maintain good foliage for the entire season. It continues to free of fruit cracking also. As with Neptune, commercial reports from Idaho are positive for this variety.

Blueberries
Ozarkblue. This blueberry continues to be planted as a late-season highbush variety ripening after Brigitta and before Elliott. The largest plantings are in South America, with smaller plantings in other areas of the world including Oregon in the U.S.

Peaches and Nectarines
The first trees of fruiting age should be fruiting now or in 2004. It is hoped that commercial success with the new releases will be positive.

Low Acid Peach Releases from the University of Arkansas

John R. Clark and James N. Moore

John R. Clark is a professor of horticulture at the University of Arkansas and currently directs the fruit breeding program. James N. Moore is distinguished professor emeritus and directed the program from 1964-1997.

Two new peaches released in the fall of 2004 have been named ‘White Rock' and ‘White County'. A few details follow:

‘White Rock'
Type - White, non-melting flesh, cling.
Fruit Maturity Date – June 25 first mature on average at Clarksville, Ark.
Fruit Size – Medium, 140 g but responds greatly to early thinning.
Skin Color - Red blush over 70% of skin with cream-like ground color; very attractive.
Flavor, Sweetness - Low-acid, light white peach flavor; sweet with average 12% soluble solids.
Fruit Firmness – Very firm, non-melting flesh that remains firm when fully mature to over mature.

Bloom Date - March 27 average full bloom at Clarksville.
Bacterial Spot Resistance – Moderate resistance, occasionally seen on leaves but no economic damage on fruits.
Comments - 'White Rock' is a very productive, mid-early season, low-acid flavor white flesh peach for the fresh market. Shipping evaluations have not been made but should be suitable for transport. 'White Rock' is named for White Rock Mountain in Franklin County, Arkansas.

'White County'
Type - White, melting flesh, freestone.
Fruit Maturity Date – July 14 first mature on average at Clarksville.
Fruit Size – Large, 250 g average.
Skin Color - Red blush over 80% of skin with cream-like ground color; very attractive.
Flavor, Sweetness - Low-acid, distinct exceptional white peach flavor; sweet with average 14% soluble solids.
Fruit Firmness – Very firm, but softens to melting flesh when fully mature.
Bloom Date - March 26 average full bloom at Clarksville.
Bacterial Spot Resistance – Moderate resistance, occasionally seen on leaves but no economic damage on fruits.
Comments - 'White County' is a very productive, mid-season, exceptional low-acid flavor white flesh peach for the fresh market. Shipping evaluations have not been made but should be suitable for transport. 'White County' is named for the famous horticulturally rich county in east-central Arkansas.

These new peaches offer additional options for Arkansas and Oklahoma growers to consider for planting. Trees can be attained from:

Cumberland Valley Nurseries, Inc.
PO Box 471
McMinnville, TN 37111-0471
800-492-0022

Performance of Various Vinifera, Hybrid and American Wine Grape Varieties in Oklahoma

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Introduction
Variety selection is one of the most important aspects of vineyard establishment. Varieties vary in their yield potential, fruit quality and adaptability under Oklahoma conditions. Localized comparative test results of variety performance are important as Oklahoma growers make vineyard establishment decisions.

Grapes can be grown on their own roots, i.e. rooted cuttings, or grafted onto rootstocks. Various rootstocks can offer benefits such as pest resistance, tolerance of certain soil characteristics and tolerance of salts and salinity. In areas where winter freeze injury is prevalent, rootstocks impart additional risk to the vineyard since vines frozen back below the graft union must be replaced or re-grafted.

Rootstocks commonly used are either selections from hardy native species or plants resulting from crosses of various native species. Vines resulting from crosses would be expected to exhibit traits from one or both of the parents of the cross. Budbreak date is important as some varieties tend to initiate growth earlier in the spring which predisposes them to injury from late spring freezes.

Methods
Replicated Variety Trial:

This trial consisting of 13 varieties on 1103 Paulsen rootstock was established in May, 2001. Vines were planted in rows 12' apart with vines 8' apart within row. The vines were trained to a high cordon trellis. Plots were organized in a randomized complete block design with 5 replications and two vines per plot. In May, 2002 two additional vines grown on their own roots were added to each plot to allow comparison of grafted vs. own rooted vines. Data collection began in 2003 including bud break according to Eichorn-Lorenz rating scale, vigor, fruit yield and quality. Fruit was harvested when sugar content reached 20 or 22 degrees brix for white or red varieties, respectively according to a pre-harvest sample of 100 berries.

Juice quality after harvest, soluble solids, pH and acid, was determined at the Oklahoma Food and Agricultural Products Research and Technology Center from a random sample of berries within each variety.
Observational Variety Trial: Plantings of various new varieties/lines of interest continue to be made.
Results: Results are summarized in the following tables.

Table 1. Effect of Cultivar on Average (3d and 4th Leaf) Fruit Yield and Quality from Grafted (1103P) Grape Vines, Perkins, OK 2003-2004

Variety	Harvest Date	Wt/acre (lbs) 453 plt/a	Avg Berry Wt (g)	Avg Cluster wt (g)	Avg. pH	Titratable Acidity (% Tartaric Acid)	oBrix Avg S.S.
Ruby Cabernet2	2-Sep	17,248	18.4	176.8	4.12	0.47	22.66
Cabernet Franc2	29-Aug	15,931	16.2	159.6	4.29	0.39	23.03
Shiraz2	28-Aug	15,900	16.6	190.6	4.14	0.56	21.63
Sangiovese2	1-Sep	14,693	23.0	239.3	3.84	0.51	20.58
Viognier1	10-Aug	13,229	14.8	193.9	3.88	0.58	18.29
Merlot2	30-Aug	12,815	15.3	176.4	4.21	0.41	23.74
Cabernet Sauvignon2	31-Aug	10,063	13.1	113.1	3.95	0.52	22.16
Petit Verdot2	26-Aug	9,984	12.5	108.9	4.00	0.58	22.96
Chardonnay1	13-Aug	9,033	15.2	176.8	3.88	0.64	20.89
Malbec2	29-Aug	7,029	21.7	97.8	4.16	0.54	21.22
Pinot Gris2	12-Aug	6,850	12.9	101.1	4.15	0.53	21.80
Cynthiana3	19-Aug	2,991	9.2	52.0	3.68	1.20	22.36

Variety Type - 1-Vinifera, white; 2-Vinifera,red; 3-American, red; Planted 2001; High cordon trellis; vine spacing 8x12

Table 2. Effect of Cultivar on Fruit Yield and Quality from Own Rooted Grape Vines (3rd leaf), Perkins, OK 2004

Variety	Harvest Date	Wt/acre (lbs) 453 plt/a	Avg Berry Wt (g)	Avg Cluster wt (g)	Avg. pH	Titratable Acidity (% Tartaric Acid)	oBrix Avg S.S.
Chambourcin5	20-Aug	16,852	25.1	212.8	3.81	0.55	21.52
Merlot2	7-Sep	12,458	14.5	132.4	4.33	0.29	25.08
Malbec2	2-Sep	7,361	20.0	86.2	4.15	0.48	22.05
Viognier1	11-Aug	6,795	15.0	164.8	3.78	0.52	16.81
Cabernet Sauvignon2	5-Sep	6,489	14.6	97.1	4.03	0.38	22.95
Ruby Cabernet2	8-Sep	6,441	14.8	99.3	4.11	0.32	23.70
Sangiovese2	7-Sep	5,625	23.6	140.4			
Cabernet Franc2	30-Aug	5,014	16.5	148.4	4.23	0.32	23.60
Pinot Gris2	11-Aug	4,632	14.3	86.2	3.80	0.49	18.76
Chardonnay1	13-Aug	3,751	15.4	167.0	3.79	0.64	20.45
Shiraz2	31-Aug	2,850	17.9	128.9	4.14	0.40	21.18
Cynthiana3	20-Aug	2,752	9.7	49.6	3.61	1.07	21.08
Petit Verdot2	1-Sep	849	11.9	58.4	4.21	0.37	23.50

Variety Type - 1-Vinifera, white; 2-Vinifera,red; 3-American, red; 5- Hybrid, red;
Own rooted planted 2002; High cordon trellis; vine spacing 8x12

Table 3. Average (3rd and 4th leaf) Yield and Quality of Selected Varieties/lines, Observational Grape Variety Trial, Perkins, OK 2003/2004

Variety	Harvest	Wt/acre	Avg	Avg	Avg.	Titratable	oBrix

	Date	(lbs) 453 plt/a	Berry Wt (g)	Cluster wt (g)	pH	Acidity (% Tartaric Acid)	Avg S.S.
Chambourcin5	19-Aug	6639	22.3	162.9	3.83	0.65	22.51
Chardonel6	31-Jul	4892	19.1	227.5	3.59	0.80	22.41
*Frontenac5	24-Jul	6863	10.2	109.3	3.49	1.05	22.15
H1 - #2493	26-Aug	6172	45.6	95.2	4.06	0.52	18.58
H2 - #2113	29-Aug	5908	33.6	138.3	3.91	0.59	20.73
H3 – Cimarron3	26-Aug	4362	16.7	69.2	3.87	0.76	19.13
H4 - #12-3754	25-Aug	15629	25.7	180.9	3.94	0.64	22.60
H5 - #1253	29-Aug	5286	36.2	199.7	3.95	0.55	19.93
H6 - #17-3473	29-Aug	5522	37.8	144.5	4.10	0.58	18.65
*Rubiyat3	26-Aug	5385	19.9	115.3	4.29	0.49	21.10
Sauvignon Blanc1	9-Aug	6170	15.5	123.1	3.82	0.59	19.65
Vignoles6	28-Jul	4564	13.9	109.5	3.71	0.81	21.73
*White Reisling1	22-Aug	3780	14.0	91.2	3.62	0.63	19.75
Zinfandel2	20-Aug	5701	26.1	222.4	3.66	0.68	16.87

Variety Type - 1-Vinifera, white; 2-Vinifera,red; 3-American, red; 4-American, white; 5- Hybrid, red; 6-Hybrid,white
Planted in 2001, * planted in 2002; vine spacing 8x12; High cordon trellis; Own rooted plants,

Table 4. Effect of Variety on Average Budbreak Date - Replicated Wine Grape Variety Trial – Perkins, OK, 2003-2004

Variety	Average Budbreak	Budbreak for 2003	Budbreak for 2004
Chardonnay1	29-Mar	1-Apr	27-Mar
Sangiovese2	3-Apr	7-Apr	30-Mar
Viognier1	3-Apr	7-Apr	30-Mar
Cabernet Franc2	4-Apr	7-Apr	2-Apr
Merlot2	4-Apr	9-Apr	31-Mar
Shiraz2	5-Apr	4-Apr	6-Apr
Malbec2	7-Apr	9-Apr	5-Apr
Pinot Gris2	7-Apr	7-Apr	8-Apr
Petit Verdot2	8-Apr	11-Apr	5-Apr
Cynthiana3	9-Apr	14-Apr	5-Apr
Ruby Cabernet2	10-Apr	13-Apr	7-Apr
Cabernet sauvignon2	12-Apr	12-Apr	12-Apr

Variety Type - 1-Vinifera, white; 2-Vinifera,red; 3-American, red; 4-American, white; 5- Hybrid, red; 6-Hybrid,white

Table 5. Effect of Variety on Average Budbreak Date – Observational Grape Planting Perkins, OK 2003-2004

Variety	Average Budbreak	Budbreak for 2003	Budbreak for 2004
Chardonel6	2-Apr	4-Apr	31-Mar
H2 - #2113	3-Apr	7-Apr	30-Mar
H3 – Cimarron3	3-Apr	7-Apr	31-Mar
H6 - #17-3473	3-Apr	7-Apr	31-Mar
H4 - #12-3754	4-Apr	4-Apr	5-Apr
H5 - #1253	5-Apr	7-Apr	4-Apr
Sunbelt3	5-Apr	7-Apr	4-Apr
Neptune	6-Apr	12-Apr	31-Mar
White Reisling1	6-Apr	9-Apr	3-Apr
Sauvignon Blanc1	7-Apr	12-Apr	3-Apr
Frontenac5	8-Apr	11-Apr	5-Apr
Chambourcin5	8-Apr	12-Apr	5-Apr
H1 - #2493	8-Apr	13-Apr	4-Apr
Zinfandel2	8-Apr	13-Apr	4-Apr
Vignoles6	11-Apr	14-Apr	8-Apr
Montepulciano2	12-Apr	12-Apr	12-Apr
Rubiyat3	16-Apr	16-Apr	17-Apr

Variety Type - 1-Vinifera, white; 2-Vinifera,red; 3-American, red; 4-American, white; 5- Hybrid, red; 6-Hybrid,white

Sampling and Control of Thrips on Blackberry

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The eastern flower thrips (EFT), Frankliniella tritici (Fitch) is a yellow-orange insect about 1/16 inches long with feathered wings. Thrips feed by scraping the surface of flowers, leaves and fruits causing blossom drop and fruit deformities. High numbers of flower thrips are not tolerated in sensitive crops like strawberries or floral crops and are an insect contaminant of harvested blackberry and raspberry fruit. Growers have reported small, seedy white drupes in harvested berries only during the first fruit picking of 'Apache' and 'Arapaho' blackberries. This is suspected of being caused by plant genetics possibly in conjunction with feeding by thrips or stink bugs. Although there is no evidence that EFT transmit any virus diseases to blackberry, other thrips species are known to vector tomato spotted wilt virus.

Pest management of thrips requires pest species identification, estimating population density through the fruiting period and deciding if and when to apply control tactics. So far, the EFT is the main species in blackberry in Arkansas. Field monitoring of thrips from bloom to near harvest involves either weekly jarring thrips from flowers or fruit clusters onto a white or blue plate or checking for thrips on blue sticky card traps. Chen et al. (2004) observed that more western flower thrips, Frankliniella occidentalis (Pergande) were attracted to blue sticky card traps than to yellow or white sticky card traps. These yellow thrips are also easier to count on blue traps than on white or yellow traps. The blue sticky card traps are expected to be useful for monitoring for EFT in caneberries.

There are two conventional chemicals registered for use against thrips on caneberries: malathion and pyrethrin. These compounds provide only fair control of thrips. The present recommended insecticides for caneberries are listed in either MP144 Insecticide Recommendations for Arkansas – 2005 (paper copy) or at: http://www.uaex.edu/Other_Areas/publications/HTML/MP-144.asp or look at the Crop Profile for AR blackberry at: http://pestdata.ncsu.edu/cropprofiles/docs/ARblackberry.html. The current study objectives were to gather efficacy data against thrips on blackberry for new insecticide formulations and evaluate a monitoring method that determines the thrips population density on blackberry.

Methods:
The following thrips studies were conducted in Judsonia, AR. In 2004, the insecticide treatment plot consisted of 10 blackberry crowns spaced 18" apart in rows 14' apart in a randomized complete block design with four replicates. The treatments were: Indoxacarb (Avaunt), Novaluron, Spinosad (SpinTor), Thiacloprid (Calypso), Thiamethoxam (Actara) and an untreated check. On 20 May and 1 June, treatments were applied to the foliage at a rate of 100 gal/acre to achieve runoff using a Solo hand pump sprayer. Prior to each spray and at four days after treatment (4 DAT) on 24 May and 5 June, twenty fruit clusters each with four or five berries and one trifoliate leaf were collected randomly from within each plot on 20 and 24 May, and 1 and 5 June. These samples were placed in labeled plastic bags and refrigerated until EFT could be counted. Each sample was soaked twice for 10 min. in 70% ethanol in a 1000 ml Erlenmeyer flask, agitated, solution poured into a Buckner funnel and suction filtration was used to draw the ethanol through a porous filter paper (qualitative 417) leaving the EFT on the filter paper. Immediately, a microscope was used to count the number of EFT nymphs and adults per sample on the filter paper. Data are presented as the mean number of EFT nymphs and adults per 20 fruit

clusters and analyzed using ANOVA and means were separated using Waller-Duncan K-ratio t-test ($P \leq 0.05$).

In 2003, we placed 15 blue sticky card traps at the top of the canopy on trellis posts in the perimeter of four sides of a blackberry planting and recorded thrips per trap about every 7 days. In 2004, we compared placement effects on blue sticky card trap captures of thrips in two blocks of blackberries where three traps in the edge and center each at 1' (just below the leafy canopy) and 3' height (middle of fruiting canopy). Thrips per trap were recorded weekly in April and biweekly in May until we ran out of blue traps. To this date, we have not located a supplier of blue sticky card traps.

Results

On 20 May, total numbers of EFT nymphs and adults per sample were similar across all treatments. By 4 and 11 DAT, all treatments had significantly reduced the number of EFT per sample by > 2.5-fold compared to the untreated check. At 4 DAT after the second application on 1 June, Calypso reduced the number to < 1.3 EFT per sample that was significantly less than that for Novaluron, Avaunt and the check but similar to Actara and Spinosad. Actara, Spinosad, Novaluron, Avaunt all had thrips counts that were significantly less than the untreated check. Via the IR-4 Program, one or more of these formulations may become registered against thrips on caneberries.

Significant counts of EFT were first captured on blue sticky traps by 2 May in 2003 (Fig. 1) compared to an earlier capture on 15 April in 2004 (Fig. 2). Thrips peaked on 21 May 2003 at about 400 thrips per trap and 1.5 thrips per cluster compared to a peak on 24 May 2004 of only 150 thrips per trap. Our observations indicated that the highest thrips count ranged from 1.5 to 3.3 thrips per cluster on 20 May 2004. By the next week, counts dropped to 0.8 thrips per cluster in the untreated plots (Table 1). In 2004, blue sticky card traps caught significantly more thrips in the edge than center on 24 May, and on the 12 and 24 May traps at 3 ft height caught more thrips than did traps at 1 ft height (Fig. 2). We suggest that the best method for monitoring EFT population density is to place at least three blue sticky card traps on a perimeter post of a blackberry planting at a 3' height near the plant canopy and count thrips weekly. Once you detect more than 100 thrips per trap the thrips on fruit may be approaching 1 thrips per cluster. At this point, it is suggested that a grower assess the number of thrips per cluster by randomly collecting 20 fruit clusters per planting, jar thrips from each cluster on to a blue plate or agitate all 20 clusters in 70% alcohol (see methods above) and count thrips. An insecticide application may be necessary when the fruit count approaches 1 thrips per cluster.

References Cited:

Chen, T. Y., C. C. Chang, G. Fitzgerald and T. J. Henneberry. 2004. Trap evaluations for thrips (Thysanoptera: Thripidae) (Diptera: Syrphidae). Environ. Entomol. 33: 1416-1420.

Table 1. Insecticide effects on the total number of eastern flower thrips nymphs and adults per 20 fruit clusters in a blackberry planting in Judsonia, AR (2004)

Treatment/ formulation	Rate amt/acre	20 May (spray) 0 DAT 4	24 May DAT 11 or	1 June (spray) 0 DAT	5 June 4 DAT
Calypso 480SC	4 oz	65.8 a	2.5 bc	6.3 b	1.3 d
Spinosad 25C	6 oz	53.5 a	5.3 bc	5.5 b	2.5 b-d
Actara 25WG	4 oz	22.3 a	3.0 bc	4.3 b	2.0 cd
Avaunt 30WG	4 oz	45.5 a	3.8 bc	4.5 b	4.5 b
Novaluron 10EC	14 oz	36.0 a	6.3 b	4.0 b	4.3 bc
Untreated check	--	30.0 a	17.3 a	16.8 a	14.8 a

Means for each date followed by the same letter are not significantly different (P > 0.05, Waller-Duncan K-ratio t-test)

Figure 1. Number of eastern flower thrips caught on 15 blue sticky card traps placed on perimeter trellis posts on all four sides of a blackberry planting in Judsonia, AR (2003)

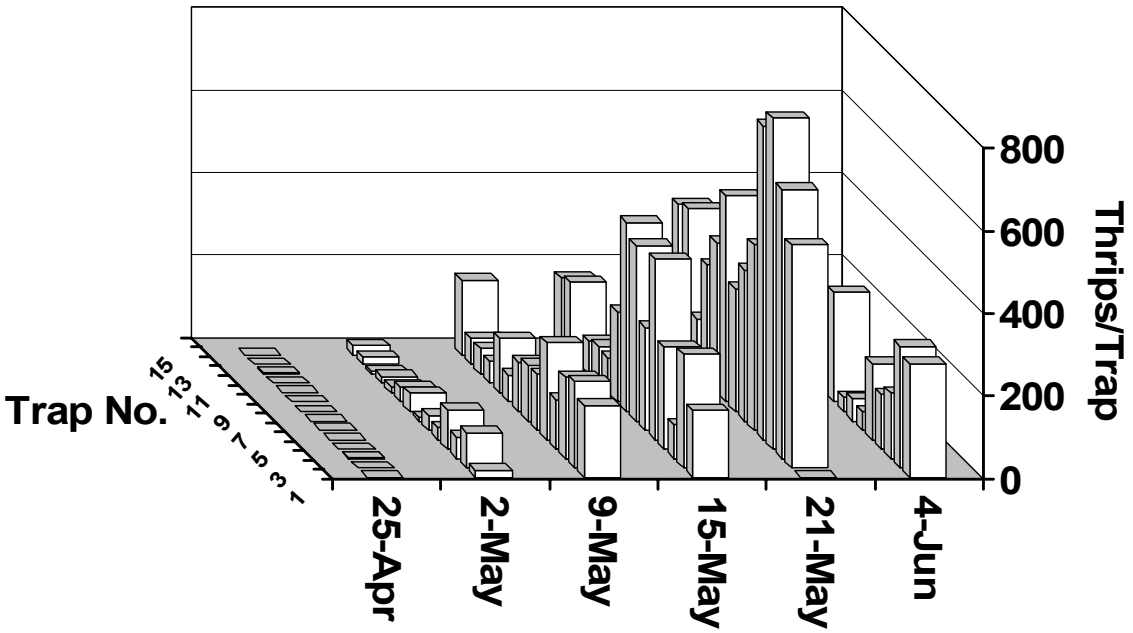
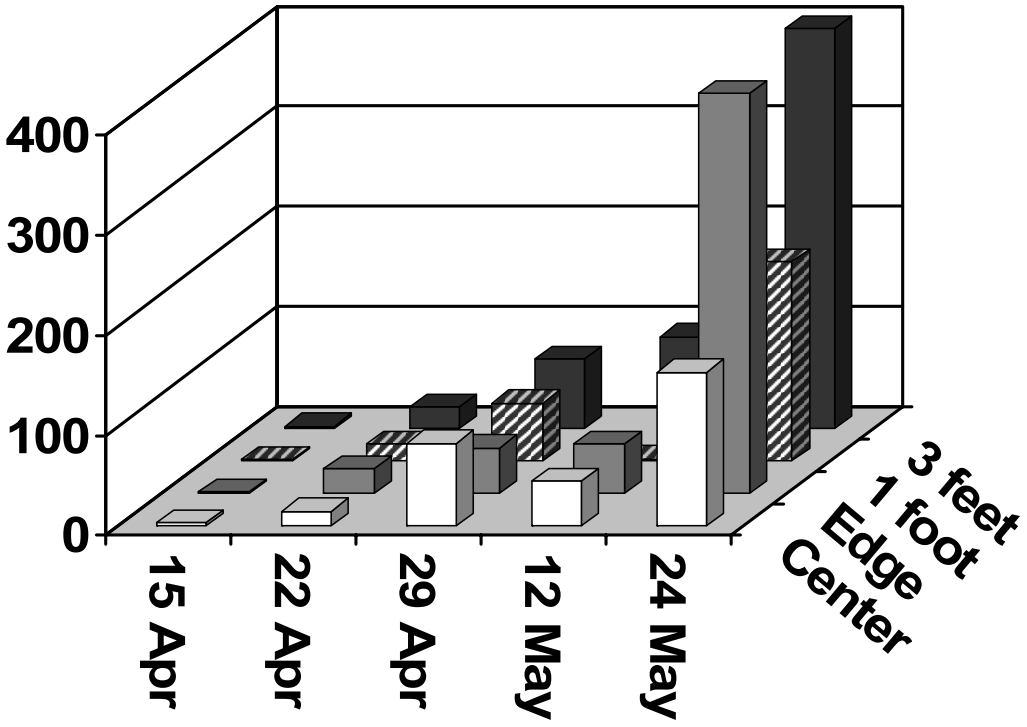


Figure 2. Number of eastern flower thrips caught on blue sticky card traps placed in the edge or center of a blackberry planting at either 1’ or 3’ height in the canopy in Judsonia, AR (2004)



Growing and Vinting Cynthiana/Norton Grapes

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Cynthiana, also called Norton, grapes Vitis aestivalis have unusual features that make it difficult to grow and turn into premium wine. Growing and making wine from this grape in the same manner as V. vinifera grapes will seldom result in a premium wine (Main and Morris 2002). In this presentation, the focus will be on the differences between Cynthiana and other (V. vinifera and interspecific hybrid) grapes.

At first glance, Cynthiana would not seem a likely candidate for wine production. It is high in titratable acidity (up to 15 g/L), malate (up to 6 g/L), and potassium (up to 6 g/L) and has a high pH (> 3.5). It has poor color in warm years, aggressive seed tannin, small clusters, small berry size, and low juice yield. Despite these features, and with proper management, an excellent wine can be made from Cynthiana grapes.

Key differences between Cynthiana and other wine grapes. Cynthiana grapes have three-times as much malic acid and two-times as much potassium as most other wine grapes. Cynthiana grapes can have up to 20% non sugar solids as compared to 5% in other grapes (Table 1). Note that the soluble solid readings are on hot-pressed juice. It is imperative that a Cynthiana must sample be heated before analysis. An increase in titratable acidity of up to 40% is seen with heating. Heating to extract skin components for testing is not necessary with other grapes but is necessary to get a true picture of Cynthiana juice parameters. Heat the must sample to 165°F, press through cheesecloth, and allow to cool to 70°F before analysis.

Table 1. Composition of soluble solids in hot-pressed Cynthiana juice at different sampling times.

Refractometer soluble solids (%)		Fermentable sugars (%)		Non sugar soluble solids (%)		Expected alcohol (% v/v)
18.8	=	80	+	20	produces	8.3
22.6	=	85	+	15	produces	10.6
24.3	=	90	+	10	produces	12.0

Viticulture. The primary focus of Cynthiana viticulture is to pick the fruit at 24% soluble solids, maintain a green canopy, and do everything possible to reduce malate and potassium in the fruit. Cynthiana grapes grown on a drip-irrigated, high wire, bilateral curtain at 6 x 9 spacing should produce the following results: 23 to 25 % soluble solids, pH 3.4 to 3.7, titratable acidity 12 g/L, 120 to 140 clusters per vine, 50 to 60 g clusters, berries weighing about 1 g, 4.5 to 5.5 tons/acre, and dormant prunings of 2.2 lbs/vine. Only factors that limit the success of growing this grape are being pointed out due to time constraints.

It is helpful to establish a HACCP-like, viticultural and enological plan for Cynthiana (Zoecklein 2004). The differences in this grape are significant both viticulturally and enologically. It is easy to make mistakes that are detrimental to the finished wine. Components of a HACCP-like plan are available on the internet (Zoecklein and Wolf 2004).

Site selection is critical, because you need well-drained soils. Cynthiana does not tolerate wet soils. A week of soggy soil will turn the leaves yellow and stunt growth. When establishing a vineyard, do not let water stand around the roots or trunks. Use growth tubes only if you have sandy soils as they can retard growth in a wet year.

The vines do not grow well on a VSP training system, as the spurs do not produce abundant fruit when oriented upward. The recommended training system is a bilateral cordon (BC) or Geneva Double Curtain (GDC). Row spacing on BC should be 6 to 8 ft. x 9 to 10 ft. and on GDC, 6 to 8 ft. x 12 ft. Vines should have two trunks on a GDC system when in-row spacing is greater than 7 feet.

Vine nutrition is not well understood for Cynthiana. The roots are very efficient in removing potassium from the soil, and therefore, potassium fertilizer should not be used unless potassium deficiency is seen in the vine. The addition of potassium fertilizer increases juice pH and potassium in Cynthiana (Morris et al. 1987). Severe magnesium deficiency is often seen in Cynthiana. It is advisable to apply a pre-bloom magnesium foliar spray (6 to 8 lbs magnesium sulfate/100 gallons water) plus two or more additional sprays during the season. It is extremely important to maintain a green canopy throughout the season. Fertigation is an excellent way to apply nitrogen and micronutrients.

Balance pruning is difficult in Cynthiana. Unripened periderm results in low dormant pruning weights. In general, recommended pruning is to 2 to 5 bud-canes with one-bud renewal spurs and 80 to 100 buds retained. The vines can be mechanically pruned with hand follow-up. Shoots should be positioned in a downward orientation two times per year after shoot entanglement to facilitate pruning and harvest. Shoot positioning will also help reduce fruit pH. Allow shoots at the top of the cordon pointing directly up to remain in that orientation. These shoots break easily, have few clusters, and protect against sunscald.

Cynthiana is very disease tolerant, but it can be affected by powdery mildew, downy mildew, phomopsis, anthracnose, zonate leaf spot, fruit rots, crown gall, Eutypa, Pierce's disease, berry moth, leafhopper nymphs, stink bugs, Japanese beetles, grape root borer and birds. The underlined diseases and pests tend to be the most problematic. It is essential to control berry moth because this will lead to fruit rots and prevent hanging the fruit for the 50 days from first color until harvest. Leafhopper nymphs strike the University of Arkansas AAREC vineyards at mid-veraison and can turn a vine canopy yellow in a few days. The vines do not recover from this, and it becomes almost impossible to get the fruit to 24% soluble solids.

Cynthiana is extremely sensitive to 2,4-D. It is sulfur sensitive and may be sensitive to other commonly used fungicides. Use extreme caution when spraying, and apply as few sprays as possible.

Leaf removal is recommended 20-30 days after berry set. This helps reduce fruit potassium and malic acid in addition to reducing disease pressure (Main and Morris 2004). Remove leaves in an 8 to 12 inch zone below the cordon on either side of a canopy with north south orientation. Remove 40 to 60% of the leaves in this zone.

Making Wine. The primary focus of Cynthiana wine production is to keep pH below 3.6 and improve wine structure. Cynthiana wine can be made in every style. It is best suited to a Burgundian style – light, fresh, fruity. Many factors affect wine style, but Cynthiana has three major production challenges. These are high pH, inadequate structural/textural balance, and extremely high malic acid content. Structural balance may be viewed as:

Perceived Sweetness ↔ acidity + bitterness and astringency (tannin)

Sweetness is comprised of alcohol, glycerol, polysaccharides, and sugar. The high malic acid content of Cynthiana is fixed, so to become structurally balanced, it is necessary to increase the sweetness factor or reduce and/or soften the tannin component. It is not desirable to add sugar to a wine because of the possibility of fermentation in the bottle. The polysaccharide component of sweetness can be increased with selected yeast and malolactic bacteria and through a sur lie process. The tannin component can be reduced by a variety of cap management techniques.

Malic acid levels are up to three times higher in Cynthiana than in other grapes, this poses a problem for winemaking. Malic acid is best reduced by vineyard practices as elaborated earlier. Malic acid is converted to lactic acid by malolactic bacteria, and pH can increase 0.5 pH units. This pH increase is up to three times higher than in other wines, and the malolactic bacteria are almost impossible to stop in Cynthiana. It is extremely important to monitor pH during fermentation and to keep the pH below 3.6 during both the alcoholic and malolactic fermentation. A commercial malolactic strain that produces polysaccharides and low volatile acidity is recommended for Cynthiana. Native malolactic bacteria can produce acetic acid from the 1 g/L citric acid found in Cynthiana. Yeast strains that consume malic acid such as Lalvin 71B have not found favor due to flavors produced. Yeast strains that produce polysaccharides and improve structure should be used with Cynthiana. The Lalvin yeast strains ICV-D254, BM45, and BRL97 all work well for Cynthiana wines by contributing to mouthfeel and flavor.

Macerating enzymes are advertised to improve color, body, and structure. In a maceration enzyme study at our facility, five different macerating enzymes were tested on Cynthiana (Main and Morris 2003). There was no increase in color or color stability. Maximum color extraction occurred on day three of fermentation and thereafter color was lost. In another experiment, tannin addition helped to stabilize color. It is important to add copigmentation cofactors such as grape skin tannin or oak powder at crush to encourage early pigment polymerization. Cynthiana has many diglucoside pigments, and color stability can become a problem. In the warm climate of Arkansas and Oklahoma where color can be lacking, it is important to retain as much color as possible. Short skin contact time will not only help retain color in Cynthiana it will also promote softer tannins and contribute to structural balance.

Structural balance can be obtained by several procedures that modify tannin extraction. Cold soak is a procedure where the fruit is held at 35 to 55°F for 3 to 10 days to extract phenolic compounds in the absence of ethanol. It promotes fruit character, soft tannins, color stability, mouthfeel, and polymerization of phenolic compounds. Délestage is a process that removes seeds and aerates the wine. It has found favor in Cynthiana wine made in Virginia. A detailed description of the process can be found at http:www.icv.fr/kiosqueuk/Procedur/delestage.htm. The procedure is done in lieu of pumping over and reduces seeds by up to 40% thus reducing astringent and bitter seed tannin.

Another procedure that promotes structural balance is light lees return. Light lees are white wine precipitates that form post fermentation. When added to the wine during malolactic fermentation the

yeast cells break down releasing polysaccharides and mannoproteins that add to complexity and mouthfeel through a sur lie effect. Stirring of the lees is important in 1000 gallon and larger tanks to prevent release of sulfur compounds. Frequency of stirring affects the sensory balance, and tasting should be done frequently.

Tartaric acid is used to keep the pH below 3.6. The lower the pH of the grapes on entering the winery, the less tartaric acid required. This is an expensive treatment and may cost up to $0.60/gallon. However, it is a necessary procedure as off flavors can form, and color will be lost if the wine is fermented at high pH. Even though you may add up to 2% tartaric acid, it will all fall out of solution as potassium bitartrate upon cold stabilization. This can be seen in the wine shown in Table 2 where the initial juice had 11.8 g/L + 19 g/L added = 30.8 g/L (3.08%) total tartaric acid, yet the finished wine only had 2.1 g/L (0.21%) tartaric acid. Even at a titratable acidity of almost 1%, this wine had good structural balance and gave the perception of a wine of much lower acidity. Ion exchange can also be used for pH reduction in Cynthiana wine (Walker 2002, 2003).

In a cool year like 2004, the color of Cynthiana will be so intense that it can turn teeth blue. It is therefore necessary to use a neutral, low acid, good body wine as a blending agent to reduce the color. The blended wine should be tested for stability in a series of blending trials before large scale additions are made.

Table 2. Must and wine composition of a 2004 Cynthiana wine.

	Soluble Solids (%)	Fermentable Sugars (%)	pH	Titratable Acidity tartaric (g/L)	Citric acid (g/L)	Tartaric acid (g/L)	Malic acid (g/L)	Lactic acid (g/L)
Must	24.7	21.6	3.78	12.6	1.2	11.8	5.3	-
Wine	-	-	3.56	9.8	0.2	2.1	0.3	2.7

A total of 19 g/L tartaric acid was added to adjust pH. Yeast used was Lalvin BRL97. Wine alcohol and Glycerol were 12.2% and 9 g/L.

The use of French oak is preferred over American oak to help add complexity and smoothness to the wine. Cynthiana wine is not known for long aging potential. Sulfur dioxide should be generally avoided until bottling to allow for polymerization and precipitation of phenolics. Much of the rest of the winemaking process is the same as for other grapes.

Obviously, many of the techniques presented cannot be used at the same time. The techniques mentioned, produce good Cynthiana wine. It is up to the winemaker to understand and refine these techniques to produce a premium wine.

References and useful web sites.
Many of the references cited in this paper are available at the University of Arkansas, Grape and Wine Program Web site: http://www.uark.edu/depts/ifse/major8.html.

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Organic Fruit Research for Arkansas and Oklahoma: Beginning anew

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C.R. Rom grew up on a fruit farm in Northwest Arkansas. He attained a BS of Agriculture studying Horticulture and Business from the University of AR and earned his MS and PHD degrees from The Ohio State University. He was a horticulturist at the Washington State University prior to becoming a professor at the University of Arkansas in 1989. He has broad responsibilities for horticulture education, and research on fruit crop physiology and management, and organic and ecologically-based production systems.

As a product of my youth in the 1960's, and through personal and family experiences, I became interested in environmental issues. My career as a horticulturist was spawned in the "green revolution" with idealistic notions of "feeding the world" and "saving planet earth." After completing my academic training, my first professional responsibilities were as a young horticultural scientist in Washington state where I worked with the large tree fruit industry. My research goals were to support the industry through research to produce high quality fruit as efficiently as possible with the least inputs, and the most economic profitability. When I moved to Arkansas in 1989, I continued that work. However, my interests started to change. Because pests were such a significant threat in this region compared to the Pacific Northwest, much of my work was coordinated with Dr. Donn Johnson who is regarded as a pioneer for IPM technologies in fruits in the Southeast. Further, as the markets and production systems changed from high tonnage of relatively low quality fruit for processing to production of high quality fresh market fruit for direct markets, a new focus emerged on producing fruit to capture markets through direct marketing and serving the customer. Part of the national and international trend in fruit consumption is the use of certified organic produced fruit, or fruit produced in ecologically based production systems. That provides an opportunity for growers in our region although we are currently hindered by a lack of reliable, appropriate, science-based information to produce organic fruit.

Several factors came together to encourage me to shift research emphasis toward organic production systems. As mentioned, I saw an opportunity for our industry to be a part of the emerging trend - or be left behind. I was encouraged and supported by several agencies, including Gerber Products (Fort Smith, AR), and the Colorado Organic Crop Management Association who had contacted me to assist them with organic management research. This lead to small grants for organic fruit production from the Organic Farm Research Foundation (OFRF) , the Washington Tree Fruit Research Commission (WTFRC) , and Gerber Products. With that seed money, we found some success in small projects. Further, I noted that several new students, both undergraduate and graduate students, have been attracted to our research program because of this new focus. The most significant developments were encouragement and grants from Gerber Products that allowed us to hire a program technician specifically for organic horticulture research and education.

In the fall of 2003, we hired Ms Heather Friedrich (MS, Horticulture) who had both training and research experience in organic fruit production at Iowa State University. As a result of her being on our

staff, we have been able to organize a working group of colleagues at the University of Arkansas all interested in working as a team on organic fruit production, and to write grants to support our efforts. That team includes Dr. Donn Johnson, Entomology, Dr. Jennie Popp, Agricultural Economics and Agribusiness, and Dr. Barbara Bellows, NCAT-ATTRA. Further, at the UA we have organized an informal working group or consortium, the UA-EcoAg group who communicate to share information and have scheduled a series of seminars. The new organic work is much more of a team-effort than most efforts in which I have been previously involved.

In the last 15 months, our group has actively sought extramural funding to support our research. Although not successful in every case, we have been encouraged by seed-money support from various federal agencies including divisions of the USDA through competitive grants. Most notably, we recently received two "planning grants" titled the "Southern Organic Fruit Initiative" to develop a region-wide, multidisciplinary, multiagency research and outreach program to support and stimulate organic apple, peach, blueberry and blackberry production in the region. The Southern Region Sustainable Agriculture Research and Education (SARE) program of the USDA has supported us in these efforts. Further, we have received funding from SARE, the OFRF, the WTFRC, and Gerber Products to study organic apple production systems through physiologically based research.

Currently we have several large grants pending which have passed through a preproposal consideration process. One grant proposes to assist the UA Cooperative Extension Service (CES) develop programs and materials to support organic agriculture by providing professional development programs to the CES staff across the state. A second project to SARE in-review is to study the interaction of ground cover management and nutrition management in southern orchards.
The biggest current roadblock to the program is a lack of a certified research farm. Discussions with UA Division of Agriculture administration indicate they are favorable to the idea of developing an organic research unit, but funding to develop and operate such a facility will have to be completely from extramural sources through grants and gifts. We are currently pursuing those avenues as resources are needed to hire specialized skill management for an organic research and demonstration unit, and specialized equipment that will be needed to operate the farm. We are hopeful we can find the resources to develop this research facility as it is believed this will give our research, education and outreach group the unifying focus and resource needed to attract additional resources to develop our program.

It is our goal to create information to support sustainable, environmentally responsible, ecologically-based, and organic production systems to provide opportunities for growers, and high quality wholesome products for consumers while preserving and enhancing our local natural resources. There is a unique opportunity in this state that is known as the "natural state" to capitalize on that reputation with organic produce. However, the research scientists, educators, and information outreach specialists cannot do this alone. For this program to grow and be successful, it will need significant input and contributions from stakeholders. We hope that growers, marketers, consultants, etc., will challenge us to do work to resolve issues to their businesses through our research. We hope stakeholders will feed us good questions and prioritized needs as well as their ideas about potential solutions we may study. We hope stakeholders will ask for the information we generate and participate in our outreach efforts. Further, we hope that stakeholders will become personally active and committed to the development of this program both through their political powers as well as through their gifts and contributions to support the effort. This is a team effort, and everyone involved has responsibilities to see that the team is successful for the benefit of our industries, our consumers, our economies, and our environment and resources.

Update on Apple Cultivars for Arkansas and Oklahoma

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Introduction

The highlands of Northwest and Western Arkansas and Northeast and Eastern Oklahoma have a long history of apple production. However, production in the region has significantly changed during the last century, and especially in the past three decades. For most of the last half of the century, the bulk of apples produced in the region was produced for processing. Thus, the range of cultivars produced was limited and quality was a minimal concern for growers, but yields (tonnage) were primary concerns. Now, very few if any fruits are grown for processing.

The current opportunity for apple growers in the region is direct and local markets. These markets are high-value niche markets that require growers to focus on new production issues. To be successful, growers must produce a range of cultivars with ripening dates from mid to late August, until November. They must have fruits that are attractive and have strong aesthetic appeal to consumers. They must have internal quality of crispness and flavor. Whereas in industrial apple production, uniform ripening for simultaneous ripening was a virtue, for direct markets, cultivars that have extended ripening periods are better. Lastly, the cultivars must be locally adapted to avoid spring frosts, tolerate high light and hot summer temperatures, and must have manageable pest resistance.

The University of Arkansas has had an apple cultivar evaluation program for more than 100 years. Currently, the program, located at the Main Agricultural Experiment and Extension Center farm in Fayetteville, has approximately 40 cultivars in evaluation. The goal is to identify those cultivars that are adaptable and have characteristics to capture the high value markets, especially direct markets, that is the opportunity for regional producers.

Considerations in Selecting Apple Cultivars

A number of environmental factors and pressures limit apple production in the region. Those factors are spring frosts, summer heat, and disease and insect pressure. However, there are a number of characteristics that favor apple production and upon which growers should capitalize when selecting cultivars, specifically extended mild autumn season, vacation traffic, and developing economies of the NW Arkansas and NE Oklahoma region.

Adapted cultivars should have relatively late bloom - bloom in "mid-bloom" season. This is characterized by the bloom date of 'Golden Delicious'. Cultivars that bloom before 'Golden' will be susceptible to seasonal frosts in some years while those blooming during or after that time will only infrequently suffer frost loss. Winter hardiness is not a concern for apples in this region, but tolerance of hot summer temperatures is. Disease susceptibility can limit cultivar use or cause significant increases in management costs. The most frequent and damaging apple diseases experienced in this area are cedar-apple rust, fireblight, powdery mildew, and the summer or harvest rots of white rot, black rot and bitter rot. Apple scab occasionally occurs but because of the warm spring temperatures is not the threat it is in other apple producing regions. Thus, selecting scab-resistant cultivars does not have a significant management impact and in fact may cost more. For example, some cultivars with significant scab resistance, such as 'Liberty', have minimal or no resistance to cedar apple rust so still requires significant spray protection in the spring. Further, these cultivars may require use of antibiotics to prevent fireblight. 'Liberty', although a reasonable quality cultivar with good scab resistance, ripens in mid-August when the market is weak (it is not apple season yet), and is very sensitive to the summer rots which occur under high temperatures. So, nothing is gained by using those scab-resistant cultivars.

Time of harvest is a significant trait to consider. Because of the early bloom we have in this region (late March through early April), harvest is early. Customers do not think about apples until the approach of autumn and the apple market season does not really start until Labor Day. Cultivars that ripen in July and August have only very limited markets and should be selected to be "fill" fruits around other crops such as peaches, blackberries or tomatoes. Also, during the heat of August, summer rots are more prolific and aggressive and difficult to control. However, when September and October come with cooler temperatures, these rots will subside and may not even occur.

Lastly, be sure cultivars are locally adapted. For example, one of the "hottest" cultivars on the market in the US which is doing well in high-value direct markets is 'Honeycrisp'. This apple comes from a breeding program in Minnesota. It was selected for its cold hardiness and high fruit quality. In Minnesota it ripens in September. However, in our region, in our tests, this cultivar blooms about 5-7 days before 'Golden' and is frost-sensitive, it ripens about mid-July, it is very heat-sensitive and will suffer heat and solar damage on the tree, and it is very sensitive to both fireblight and the summer rots. Regardless of how good this apple is in other regions, it is not adapted to this region and we have had significant difficulty cropping the trees.

Apple Cultivars to Consider

For direct markets, a grower should offer three to 10 cultivars at any one time of the season to entice consumers to purchase products. In that product mix, growers should have some cultivars that are considered "traditional", some "heritage" cultivars, and some "new" cultivars. In the following table are some cultivars that have reliably preformed well in our tests and may be considered for grower trials.

The University of Arkansas had an apple breeding program from 1967 - 1997 and currently approximately 120 advanced selections are in test. In the near future, additional cultivars will be released that will be useful in the region's markets.

For additional cultivar information, growers are referred to the following two websites.
UA Cooperative Extension Service: http://www.arhomeandgarden.org/fruits/tree_fruit/apples.asp
The NE-183 National Cooperative, Multidisciplinary Apple Cultivar Evaluation Program
http://www.ne183.org/

Table 1. Apple cultivars which may be considered for production in the Arkansas and Oklahoma growing region. Note: This is not meant to be an exclusive list as new cultivars are being added continuously. Growers should conduct their own cultivar trials to determine what works best in their situation, fit their management, and captures their market.

Cultivar	Notes
Traditional Cultivars	
'Lodi'	A mid-summer, yellow cooking apple. 'Yellow Transparent' is very similar and can also be grown. Limited market, but can "start" the season or compliment other summer crops.
Jonathan	Blooms a bit early but tends to be somewhat frost hardy. Select red strains. Susceptible to fireblight and powdery mildew. Ripens late August through early September. Long-time favorite of the region.
'Golden Delicious'	A must for the market. Susceptible to fireblight, rust and powdery mildew. In hot autumns will get harvest rots. Will russet in humid springs and russet sensitive to some fungicides applied during and after the bloom period. In warm seasons may not yellow but stay greenish. Harvest early through mid September. Biennial bearing can be a problem; trees require adequate pruning and fruit thinning to prevent the problem.
'Idared'	A prolific cropping cultivar. It is tart and good for cooking, somewhat soft for a dessert apple. Sensitive to fireblight and very sensitive to summer rots in warm seasons. Easy tree to grow. Ripens mid-September.
'Delicious'	Select a high-coloring strain but resist the temptation to harvest early. Ripens early to mid-September. May sunburn. Relatively resistant to fireblight and rust but does get scab, quince rust and powdery mildew. Color and flavor variable and depends upon September conditions. Consumers will request.
'Winesap'	Ripens mid to late September. Susceptible to scab, rust, and powdery mildew. Do not use spur-type forms as trees are stunted and produce small fruit.
'Granny Smith'	May bloom early but typically has prolonged bloom. Susceptible to all diseases. Ripens in late September to early October. A tart apple that

	appeals to a niche market.
'Rome Beauty'	Very late bloom and may require special pollenizers. Susceptible to fireblight, cedar apple rust and powdery mildew. Ripens early to mid October. Annually a very productive tree. Select spur-type, high coloring sports.
Heritage Cultivars	
'Summer Champion'	An Arkansas native. Blooms a bit early and ripens in mid-July. Used primarily for cooking. Only moderate susceptibility to rust.
'King David'	An Arkansas native. Thought to be a cross of 'Jonathan' and either 'Arkansas Black' or 'Winesap'; has attributes of all. Mid to late bloom season. Low susceptibility to most diseases - almost tolerant. Moderate fruit size, hard, acid. Ripens mid-September.
'Arkansas Black'	An Arkansas native more popular now than a century ago. Blooms mid to late season. Ripens in mid to late October. Only limited disease susceptibility. Very hard, and acid and may be better to eat after storage for a month.
'Mammoth Blacktwig'	An Arkansas native. Trees bloom late and avoid frost. Fruit are large. Limited disease susceptibility. Harvest season is mid-October.
Relatively New Cultivars	
'Gala'	Blooms early but has a protracted bloom period. Tends to over-crop and must be thinned and pruned well to allow fruit to size. Susceptible to all diseases, especially fireblight. Excellent quality and very tolerant of summer heat. Ripens in mid to late August. This is regarded as the first "autumn-apple".
'Jonagold'	Blooms early to mid season. Susceptible to all diseases, especially fireblight and will get summer rots in hot seasons. Ripens early to mid September. May sunburn in hot temperatures and high light. Large fruit with excellent quality. Fruit color is variable and depends upon temperature during harvest. Fruit color will range from greenish-yellow to dark-pink and red. Select high colored sports.
'Fuji'	Blooms early to mid season. Very susceptible to fireblight. Ripens late September through mid October. Select red sports. Early ripening sports have not been tested but late ripening sports fit the region's markets better.
'Suncrisp'	Bloom mid season. A yellow apple with a orange- pink blush. Tend to be better colored than 'Golden' although do not taste like a 'Golden'. Very prone to russet and like 'Golden' will biennial bearing.

'Cripps Pink' (aka Pink Lady)	Late blooming and very later ripening apple - late October to early November. Susceptible to all diseases but produces a moderate size, high quality, attractive apple. Tolerates summer and fall heat.
'Sundowner'	Late blooming and very late maturing - ripens early to mid November. Susceptible to all diseases.
'Goldrush'	Blooms mid season and harvested in mid to late October. Very resistant to scab and powdery mildew but some susceptibilty to fireblight and rust. In hot autumns may get harvest rots. Very russet prone - more so than 'Golden'. Often a mottled-green over yellow color and not very attractive. But, crisp and very unique flavor but not a 'Golden' flavor.
'Enterprise'	Good resistance to scab, rust, and blight but may develop powdery mildew. Ripens in early to mid October. Fruit are medium to large and tart but with a pleasing taste.
Other cultivars worth a look in limited test. Zestar, Empire, Sansa, Ultragold, Cameo, and Fortune.	

Impact of Japanese Beetle on Apple Cultivars: Differences in Feeding and Damage

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Japanese beetle was introduced into the US early in the 20th century and is a pest to agriculture and ornamental horticulture in all states east of the Mississippi river except Florida. It was first reported in northwest Arkansas in 2000 and by 2003 it had become a significant economic pest of fruit crops in Washington and Benton counties.

The adult beetles are voracious feeders of foliage skeltonizing leaves. They have a preference for members of the Rosaceae and Vitaceae families. Japanese beetle has a complete life cycle. The larvae and adults are the most horticulturally problematic. Eggs are laid in turf near adult feeding sites. Larvae emerge from the eggs and remain in the soil for 8-10 months. While in the larval stage, they may feed on turf and plant roots. Larvae enter a 7-14 day pupal stage and emerge after ground moistening rains in June through July.

During the 2003 and 2004 growing seasons, a relatively large infestation occurred at the University of Arkansas Agricultural Experiment and Extension Center main farm in Fayetteville. The infestations have provided a unique opportunity for us to evaluate apple cultivars for differences which may occur in feeding preference by the beetle. In both seasons, during mid to late July, multiple observers rated all apple cultivars and breeding selections for feeding damage. Damage was subjectively rated two ways. First, a rating scale of 0 to 5 was used; 0 equaled no feeding, 3 = moderate, horticulturally significant damage, and 5 = very severe damage and defoliation. Trees were also rated for estimated canopy loss due to the pest as a percentage of the total canopy damaged by feeding. A total of 262 apple genotyopes and 13 crabapple genotypes were rated. Following are some of those results.

Table 1. Japanese beetle damage rating to selected commercial apple cultivars.

Cultivar	2003 Damage Rating (0-5)	2004 Damage Rating (0-5)	Average Damage Rating 2003-2004	2003 Canopy Damage (%)	2004 Canopy Damage (%)	Average Canpy Damage 2003-2004
Liberty	3.4	2.9	3.2	45	33	39
Delicious	2.3	2.5	2.4	21	22	22
Gala	2.2	2.2	2.2	19	17	18
Fuji	1.4	2.0	1.7	7	11	9

Table 2. Japanese beetle damage rating of selected apple cultivars, Fayetteville, AR, 2004.

Cultivar	Damage Rating (0 -5)
X6392, XH 982	4.0
X3191, C3263	3.5
Sundowner, William Crump	3.3
NY 674, Zestar!	3.0
Earligold	2.8
Surprise	2.6
Fuji Nagfu #6, Pink Pearl, Cameo, Delblush	2.5
Enterprise, Hidden Rose, Mother, Ozark Gold	2.3
Autumn Gold, Blushing Gold, Court Pendu Plat, Delshel, GE1347, NJ121, Orleans Reinette, Cripps Pink, PX4013, Pristine, Senshu, Smoothie Golden Delicious, Stark Ultra Gold	2.0
Crimson Gala, Gold Rush, Law Spur Rom	1.8
Arkansas Black, Arlet, Ben Davis, Calville Blanc D'Hiver, Delroyal, Galaxy Gala, GE1348, Granny Smith, Jonagored, Jonica, Melrose, Monidel, NJ139, PX6329, Delicious, Red Winesap, Ruby Jon, Thome Empire, Scarlet Gala, Stellar, Suncrisp	1.5

Cortland, Ultrared	1.3
Delkistar, NJ 134, NY75413 (Royalty), PX6629	1.0
Tsugaru	0.5

Table 3. Japanese beetle damage of crabapples in Fayetteville, AR, 2003-2004.

Crabapple cultivar	Damage Rating (0-5)	Canopy Damage (%)		
		2003	2004	Average
Pririe Fire	4.4		67.0	–
Spring Snow	4.3		65.0	--
Red Silver	4.2		66.0	--
Liset	3.8	65.0	51.3	58.3
Brandywine	3.6	26.7	51.1	38.9
Guinivere	35	57.5	48.3	52.9
Mary Potter	3.2	2.5	43.6	23.1
Selkirk	3.2	55.0	41.5	48.3
Dolgo	3.2	65.0	38.3	51.7
Ormiston Roy	3.1	3.5	37.5	20.5
Thunderchild	3.0	37.5	34.2	35.9
Candied Apple	2.9	2.5	33.8	18.2
Golden Rain	2.2	1.0	17.2	9.1

Table 4. Japanese beetle damage rating of 'Gala' apple after treatment with Surround kaolin clay and conventional insecticide controls, Fayetteville, AR, 2004.

Treatment	Damage Rating (0-5)	Canopy Damage (%)
Conventional control	2.6	25
Surround Kaolin Clay	2.1	13

Control treatment consisted of applications of Imidan (23-Apr, 3-May, 8-July) and Guthion (21-June).
Surround was applied in a battery of three sprays applied at daily intervals three times during the season (beginning 16-May, 20-Jun, and 10-July).
Japanese beetle emergence and infestation occurred from approximately 4-June until 7-August.

The Southern Organic Fruit Initiative

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Historically, fruit production has been a significant, traditional component of the agriculture market-basket of this region. Although this has changed because of various reasons, tremendous opportunities exist for organic produce to satisfy expanding local and high-value niche markets.

A group of faculty at the University of Arkansas have started a multidisciplinary, multi-state cooperative project to understand the obstacles and opportunities for organic fruit production which can be addressed through research, education and outreach. This project has received preliminary funding from two USDA agencies to initiate the coordinated effort. As a result of this project and the expected research and outreach to follow, it is anticipated that organic fruit production in the region will expand as barriers to production and marketing are minimized. It is expected there will be an increase in farm families producing organic fruit crops, a closer linkage between farmers and communities and a shift to more environmentally appropriate production practices. Further, reliable, environmentally benign production information and technology developed through this project will also be available and useful to conventional growers. Thus, the implications of this project are far reaching.

Several obstacles hinder organic fruit production in this region. There is a lack of environmentally appropriate, scale-neutral technology to support and enhance organic fruit production in the region. Therefore, fruit crop establishment is a high-risk operation, requiring high capital investment for a long-term production system and growers are unlikely to start a venture without substantial confidence in locally appropriate research and demonstrated technologies. Most universities in the Southern region have available limited information on organic management in vegetable production, but there is little information on organic fruit production. Because the environment of the southern region is significantly different from in other regions such as the cooler northeast region or more arid western region, there are unique biological and environmental hazards to southern fruit production. These region-specific hazards require organic research that is conducted in these conditions, in the South; thus, much of the available information developed in other regions is not directly applicable to southern fruit producers. In a survey of organic fruit growers, the need for science-based and proven methods for production was expressed. Producers indicated that there are significantly more challenges in producing organic fruit in the humid,

warm south and east versus the arid west of the US. Further, it was stated that adequate research and extension information for organic fruit production was a limiting challenge to growers.

In order for southern organic fruit production to be sustained and to expand, it is necessary to identify barriers to marketing and production and then develop research and outreach programs to address those barriers. It is proposed to create a region-wide, multi-institution and multi-disciplinary Southern Region Organic Fruit Work Group (SROFWG) of scientists, extension specialists, and grower/industry representatives. The SROFWG will identify key needs through stakeholder input and generate collaborative grants to develop research and outreach programs to overcome the barriers to organic fruit production in the region. The outcomes of the proposed project include 1) Identification of both state-specific and region-wide market opportunities and production barriers, 2) Formation of the SROFWG, and 3) Development of grants, and cooperative research and outreach programs to address key questions. As a result of this proposed project, the SROFWG will develop plans and begin coordinated research through the submission of grants to agencies and programs such as SARE, USDA-CSREES and NRI, OFRF, etc.

Objectives
1) Develop a Southern Region Organic Fruit Research Working Group to:
A. Assess the state of organic fruit production in the South;
B. Develop focus groups in each state that identify interest, obstacles and management issues in organic production and organic information needs;
C. Develop innovative partnerships of research, extension, industry, tree fruit growers and local farmers' markets;
D. Develop an organic fruit research initiative to investigate and develop new organic management techniques.
2) Develop full research proposals based upon research priorities determined in Objective 1 and submit to appropriate agencies and foundations, in order to develop an Organic Crop Management Plan to support and develop organic fruit production systems in the Southern Region.

Process
Each land grant University and USDA scientists within the states of the 13 states of the Southern Region were contacted for their interest in developing and participating in the SROFWG and scientists representing six states (AR, GA, NC, SC, TN, KY) are currently active. Representation will also be sought from grower organizations and industries in each state. All relevant disciplines to fruit production (e.g. horticulture, entomology, pathology, soil science, economics, statistics, etc.) will be sought to participate in the project.
A baseline assessment of the state of organic fruit production in the South will be determined for production acreage, number of farmers, and crops produced by using USDA-ERS data, local certification agencies and Extension queries. Additionally, needs for organic production and marketing information will also be determined through the focus groups.

In-State Focus Groups. In-state focus groups of a 7-15 people (approximately 5 producers, 1-2 industry representatives, 1-2 consumer representatives, 3 consultants, extension specialists and/or researchers), will be organized in at least 5 states. A standardized focus group methodology and standardized questions were developed and distributed to each state-coordinator. Focus groups will seek to determine perceived organic production and marketing barriers and needs across production, marketing, consulting/extension, and research perspectives, as these perceptions can differ with new technologies. Focus Groups will discuss challenges to organic fruit production, with an emphasis on apple, peach,

blackberry and blueberry production. Stakeholders' input on organic production, including pest, soil, and horticultural management, and marketing issues will be discussed and prioritized. Through these meetings, information needs including resource and research needs on organic fruit production will be revealed. Each group will be asked to identify five key issues to be addressed to improve production and marketing of organic southern fruit. Finally, one or two growers per state will be identified at the focus groups to attend the Southern Region Organic Fruit Working Group meeting scheduled for late October. A southern organic fruit listserv will also be established to provide an avenue for further discussion and information dissemination after the conclusion of focus-group meetings.

Formation and Meeting of the SROFWG

Following the focus groups, there will be a 1 day regional Organic Fruit Working Group meeting to discuss a research initiative on organic fruit management to be developed and set forth in multi-year grant proposals. Participants representing all disciplines working with fruit crops in all Southern Region states will be invited to participate in the meeting. Members of the SROFWG will meet to 1) present on-going research and Extension projects related to organic fruit production and marketing, and 2) to discuss issues identified from each in-state focus group. The SROFWG will prioritize systems-based organic research and extension goals for the next three years in the Southern Region. Topics of discussion will include potential organic management strategies, nutrient management and crop load management methods, pest management, ground covers, soil fertility, physiology, economics, and marketing. Key research projects will be determined in order to develop an "Organic Fruit Crop Management Plan for the Southern Region" based on discussions from the local and regional meetings and at least 3 funding agencies will be identified to submit proposals (e.g. SARE, USDA-CSREES, OFRF, etc.). A regional coordinator will be identified for each project to be developed. Proposals will be outlined, writing tasks will be assigned to collaborators in each state, and timelines developed for project planning and submission, working toward the completion of regional grant proposal(s) for submission in 2005. These activities are planned pursuant to creating an Organic Fruit Crop Management Plan for the Southern Region to be developed in 2007-2010 in order to support and develop organic fruit production systems in the region.

By using stake-holder focus groups to prioritize research and education needs, and through coordinated research and education efforts, it is hoped that the organic fruit industries of this region will develop, be sustained and thrive. As a result, new opportunities to high value markets will be developed and growers will be given tools to produce fruit with ecologically principled, science-based information appropriate to the region and for the scale of their operations. This project requires input and support from producers, marketing and processing organizations, and allied industries in order to be successful.

Biology and Control of the Raspberry Crown Borer in Arkansas Blackberries

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The raspberry crown borer (RCB), Pennisetia marginata (Harris), is an important economic pest of blackberries in the United States and Canada. The RCB larvae burrow into and feed in the crowns of blackberry plants. In late spring, larvae burrow into base of canes and feed on the cambium and pith reducing nutrient flow to the canes that may kill the canes and form a shepherds crook at the top of canes. Overall, this pest causes loss in plant vigor, reduction in yields and ultimately plant death (Schaefers 1974). In the past the organophosphate Guthion was applied as a soil drench to control the RCB larval stage of this insect pest. In 1996 the EPA cancelled use of all formulations against RCB larvae except Guthion which may be lost in summer of 2005.

The duration of the RCB lifecycle has not been studied in Arkansas, or any other southern state. In Northern states and Canada the lifecycle is two years with the larvae spending 22 months in the crowns of the plants (Raine 1962). This is debatable in Arkansas were there is a much warmer climate.

There is an implicit need to develop and implement new control tactics and determine the biology of the RCB in Arkansas.

Materials and Methods
An insecticide timing and efficacy trial was conducted in a blackberry planting at Round Mountain Orchard in Conway, Arkansas. Each treatment plot had 5 blackberry crowns in a randomized complete block design with five replicates. The materials applied on 23 October 2003 and 6 May 2004 are listed in Table 1. The soil (400 gal/acre) around each crown was drenched via a watering can with a treatment solution or a greater wax worm cadaver was inserted at one inch depth in soil next to each crown. Blackberry crowns were dug up on 24 June 2004, split open and counts made of the number of larvae per plot.

To determine the duration of the RCB lifecycle, 10 plants were dissected every two weeks beginning in April and ending in October when a 0 count for all life stages was obtained. Each RCB larva obtained was identified as RCB, weighed and measured for head capsule width and body length. Each RCB pupa was weighed, reared to adult, and sexed. Weekly from 16 September on, the blackberry plants were searched for RCB adults from 10 am to 12 noon.

Results
On 23 October, the soil drench treatments of blackberry crowns with Brigade, Lorsban or Guthion produced significantly better control of RCB larvae (9-fold reduction) than did the S. feltiae nematode solution and the untreated check. Novaluron and the S. feltiae-infested cadaver provided intermediate control of the larvae (Table 1). In contrast, none of the treatments applied on 6 May caused a significant reduction in the number of RCB larvae per crown (Table 1).

In Arkansas the RCB appears to complete its lifecycle in one year. Only RCB larvae were found in crowns from May through Sept. 3. Pupae were found between September 3 to 18. Adults began emerging from about Sept. 16 to 30. No larvae were found in the canes after Sept. 3.

Discussion

The raspberry crown borer is a difficult pest to control. In May the larvae migrate from the cambium, which is just below the bark, to the pith, deep within the crown of the roots. The larvae are protected from insecticides and nematodes (S. feltiae) after they migrate into the crown. The best time to target this pest is immediately after egg hatch in mid-October to early April when the larvae are located just underneath the bark. Brigade and Lorsban 4E provide slightly better control than did the only labeled insecticide for this pest, Guthion (Table 1). Unfortunately, the nematode solution and infected cadavers did not offer adequate control. Other alternative control tactics will be developed to reduce the reliance on insecticides against RCB. Another nematode, Heterorhabditis bacteriophora, that actively searches for its prey will be evaluated against RCB larvae in spring 2005.

The lifecycle of the raspberry crown borer was determined to be one year in Arkansas. Larvae pupate in September; adults emerge and lay eggs in late September through mid October. Most of the eggs hatched by late October and larvae bored into the cambium of lower canes to over winter.

Table 1. Effect of treatments applied to 'Arapaho' blackberry plots on the numbers of RCB larvae in October 2003 and May 2004 in Conway, Arkansas.

Treatments	**Rate**	**No. of larvae per 5-plant plot**	
Formulations	**Amt form/acre**	**23 Oct 04**	**6 May 04**
Untreated Check		**27.8 a**	**19.6 a**
S.feltiae *	**60,000 IJ/crown***	**19.2 ab**	**16.2 a**
S.feltiae *	**Infested cadaver**	**15.0 b**	**NT***
Novaluron 10EC	**12 oz**	**11.4 bc**	**17.8 a**
Guthion Solupak	**1 lb**	**3.0 cd**	**11.8 a**
Lorsban 4 E	**32 oz**	**1.4 cd**	**16.8 a**
Brigade WSB	**1lb**	**0.2 d**	**13.2 a**

*** IJ, infective juveniles; NT, no treatment; *S. feltiae,* Nematode species**

References

Raine, J. 1962. Life history and behavior of the raspberry crown borer Bembecia marginata (Harr.) (Lepidoptera: Aegeriidae). Can. Entomol. 94: 1216-1222.

Schaefers, G.A. 1974. Control in relation to period of egg hatch. J. Econ. Entomol. 67: 451-452.

Implications of New Food Bioterrorism Regulations for Fruit Packing Sheds

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In 2002, the U.S. Congress passed legislation formally known as the "Public Health Security and Bioterrorism Preparedness and Response Act." The overall intent of this act was to improve the ability of the United States to prevent, prepare for, and respond to bioterrorism and other public health emergencies. The act contains a number of provisions designed to help insure the safety of the nation's food, feed, water, and drug supply. The provisions that are most relevant to packing shed operations are intended to help control possible incidents of food contamination and are enforced by the U.S. Food and Drug Administration (FDA).

There are four main provisions of the Act that deal with food:
Detention, which gives authorities the ability to isolate contaminated food or feed from the public;
Facility Registration, which identifies and records locations where food or feed is manufactured, packed, or stored;
Record Keeping, which creates a system for tracing contaminated food or feed;
Prior notice, which creates a system for better evaluating and inspecting imported food or feed.
More information on the first three provisions is presented below. The prior notice regulations affect importers of food or feed only. The on-line resources presented at the end of this article provide more information on prior notice regulations for those importing fruits or vegetables.

The regulations pertaining to detention authorize the FDA to detain a food for which there is credible evidence or information indicating such article presents a threat of serious adverse health consequences or death to humans or animals. The FDA does not require external authorization or a court order to detain food or feed. The maximum period of detention is 30 days and there are legal mechanisms defined to appeal the detention order. A final decision to release or destroy the detained food or feed should be made before the detention period expires.

Detention is a new power granted to the FDA by the law that may affect packing shed operators. However, it does not place any new specific requirements on packing shed operations. The other two provisions – registration and record keeping – do have specific requirements that apply to all facilities that process, pack, or hold food used for human or animal consumption in the U.S. Moreover, these requirements apply both to domestic and foreign facilities. Most packing sheds will need to meet these registration and record keeping requirements but some will not. There are a number of facilities that are specifically classed as exempt in the regulations and therefore are not required to register. One of these facilities is a "farm." Farms are defined as facilities in one general location devoted to growing and harvesting crops. Washing, trimming outer leaves, and cooling are considered part of harvesting. On-farm packing sheds doing only these things to crops grown on-farm are exempt from the requirements of this act. Note that the FDA considers some typical packing shed activities to be "packing or holding," including sorting, grading, waxing, treating for pests, wrapping, or boxing harvested food for the sole purpose of transporting this food off the farm. Packing sheds engaged in these activities are not exempt.

Some questions and answers are given below to help interpret these regulations as they apply to packing shed activities.

Question: I harvest peaches into totes, then sort and pack them into boxes in my packing shed. Do I need to register?
Answer: Yes. Sorting (grading) and repacking previously harvested fruit is considered altering or manipulating the food and thus is considered packing.

Question: I harvest blackberries into plastic clamshells and then box them in my shed for shipping. Do I need to register?
Answer: No, assuming the blackberries are not removed from the clamshell and repacked in the shed after harvest. Simply placing raw produce into containers (such as clamshells, baskets, mesh bags, or plastic bags) during picking without altering or manipulating the fruit is considered part of harvest and not packing.

Question: My packing shed is not located on my farm property. Do I need to register?
Answer: Yes. Only on-farm facilities are exempt.

Question: I have several farm properties and transport my produce to a single packing shed located on one of my farm properties. Do I need to register?
Answer: No. If the shed is otherwise exempt (i.e. not engaged in packing or holding produce) and all farm properties are located in the same area then there is no requirement to register.

Question: I pack my neighbors' fruit in addition to my own in my packing shed. Do I need to register?
Answer: Yes. Only on-farm facilities dealing with produce from a single owner are exempt.

Question: I use chlorinated wash water to sanitize my produce. Do I need to register?
Answer: No. Assuming that chlorination is done to "normal" sanitizing levels, up to ~ 200 ppm. Properly sanitized wash water is considered a desirable part of normal washing and cooling operations and thus a part of harvest.

Question: I hold produce for some time in my packing shed before I ship it. Do I need to register?
Answer: No. If the shed is otherwise exempt then temporary storage of produce for purposes of assembling shipments is considered part of harvest.

For existing facilities, the registration deadline was December 12, 2003. All new facilities that are required to register are supposed to do so prior to starting business. The regulations do contain provisions for possible civil and criminal penalties for failure to comply with the law's requirements. Fortunately, registration is fairly simple and painless. The owner, operator, or any other designated agent may register a facility and the FDA does not charge for registration.

There are two ways to register:
On-line at: http://www.access.fda.gov;
Or by paper form.
Forms may be downloaded from the above website, they may be requested by calling 1-800-216-7331, or they may be obtained by writing to:

U.S. Food and Drug Administration
HFS-681
5600 Fishers Lane
Rockville, MD 20857

The following information will be needed to complete the registration process:
Facility name, address, phone number, and emergency contact phone number.
Parent company name, address, and phone number (if applicable).
Name, address, and phone number of owner or operator.
Any trade names used by the facility.
Applicable food product categories and facility activities.

Registration information needs to be updated only if any of the relevant information changes. Once the registration process is complete, the FDA will issue an official registration number for each facility registered. This number should be kept on file for future reference. Note that facility registrations are tied to a given owner and therefore if a facility changes hands then the old owners must cancel their registration and the new owners must re-register the facility. Registrations must also be cancelled if a facility goes out of business. There is a 30 day grace period for modifying or canceling facility registration information.

Aside from registration, the other main requirement placed upon packing shed operators who are not exempt from the act's provisions is the keeping of certain specific records. Any packing shed operation required to register must also keep records to identify the most recent source of the produce handled in the shed (if it did not come from the owner's farm) and the immediate recipient of the produce from the shed. These records must include transporters or shippers. In the most common scenario where a farmer is dealing only with produce grown on his or her own farm, he or she would be required to keep records on what shipper took possession of the food when it left the packing shed and the entity to which that shipper was supposed to deliver the food. Records must be kept for the expected lifetime of the food in commerce, which of course may vary considerably. The records that are required to be kept include:
Name of the shipping and/or receiving firm;
Firm's address, telephone number, fax number, and e-mail address – if available;
Type of fruits or vegetables shipped – including brand name and/or specific variety if applicable;
Date(s) the produce was received and/or shipped;
Quantity and type of packaging e.g. boxes, bins, etc.;
Lot number, code number, or other identifier – if the information exists.

In summary, some packing sheds will be exempt from the new food bioterrorism regulations because they meet the definition of a farm given above and some will not be exempt because they fit the definition of a processor or packer. Those facilities that are not exempt will need to be registered with the FDA and their operators must keep the shipping and customer records specified by the regulations. It is up to each packing shed operator to determine if they are exempt or not and to take the appropriate actions. It is worth restating that these regulations grew out of an increased awareness of potential vulnerabilities in our food supply. They were meant to give the FDA the information they need to combat these threats without imposing undue burdens. We all have a stake in ensuring their success.

For More Information:
FDA Compliance Guide, "What you need to know about registration of food facilities":
http://www.cfsan.fda.gov/~acrobat/fsbtreg.pdf
FDA website containing information on the Bioterrorism Act of 2002:
http://www.fda.gov/oc/bioterrorism/bioact.html

Peach Varieties for Arkansas and Oklahoma

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The following is a list of peach varieties that have been produced and sold at Peach Pickin' Paradise in Clarksville, Arkansas. The descriptions provided for each variety are solely our personal opinions.

REDHAVEN: Most popular peach-- flesh holds its color making it excellent choice for freezing. Very good all purpose peach having a long season. Tends to stick to pit during the first part of the season. Some difficulty with trees.

EARLY LORING: Good early freestone-- yellow flesh.

NECTAR: Popular white-fleshed freestone--freezes well.

BEL AIR: Pretty, tasty, frost hardy, all purpose, very popular.

GLOHAVEN: Large, pretty, very popular, mid-season "haven".

LORING: Second only to Redhaven in popularity. Large, slightly oval, smooth yellow flesh. Susceptible to frost.

GOLD CLING: Baby Gold and Mountain Gold-- Absolutely the best for canning-- no other peach compares. (The number of people who can peaches is shrinking.) Great for pies, preserves, and snacking. Bright gold color and firm flesh.

SHINN: Old variety white cling has unique taste, but falls too easily from tree.

SUMMER PEARL: White flesh with slightly pink tinge in juice. Good tasting, good freezing. Holds up better than Belle of Georgia.

RUSTON RED: Very good tasting freestone. Trees have been difficult to establish.

CRESTHAVEN: Excellent, very popular, a special favorite for freezing.

BLAKE: Excellent choice. Has yellow/red flesh with a tart/sweet flavor…Juice is red.

INDIAN RED: Old time favorite for pickled peaches. Also good for pies, preserves and eating. Flesh is red and white. When cooked, the product is beet red.

GARNET BEAUTY: A good early season freestone.

SURECROP: Not bad for an early peach. No name recognition and not any surer that other varieties.

DIXIRED: Once popular early peach but outclassed by the slightly later Redhaven.

RANGER: Good peach -- similar to Red Elberta.

RED GLOBE: Attractive, firm, good size and flavor.

HARMONY: Smooth, round, nicely colored, good tasting, but a short season.

MADISON: Medium sized, soft fleshed, mild flavored. Not much demand.

BELLE OF GEORGIA: Called Georgiabelle by the old timers. White fleshed, melt-in-your mouth peach with a flavor and texture all its own. Very much in demand. Bruises very easily and is quick to drop from the tree.

ELBERTA: Being the first good freestone to reach this part of the country, the Elberta made a name for itself that lives on. It is in demand by people who never saw one--Grandma just said to get that kind. This orchard has had two plantings of this variety of which one turned out to be the large, oval, beautifully colored, tasty Elberta of great renown. The other was a smaller, less colored, and less flavorful Elberta that could not compete with newer varieties. Why the difference? This remains a mystery. At best, the Elberta does have a bitter taste around the seed which is not found in most other varieties.

JEFFERSON: Similar to Elberta--ripens a little later.

SWEETHAVEN: A tasteless disappointment-- does not live up to the standard of the other "havens."

WHITE STAR: Firmer than most white peaches with an unbeatable taste. Very good freezing and fresh eating. A favorite of many. Not a pretty peach, however, due to a deep seam and deeper cracking on the outside.

WHITE HALE: A jumbo sized peach, good taste if ripe. It's extremely large size causes it to be picked before its time by U-pickers.

DERBY: Mildly flavored early peach. Light demand.

REDCAP: Highly colored early peach. Tastes better while it is firm. Low demand.

VALLEY FIRE: Attractive peach, but early season taste.

ANGELUS: Newer variety--nice size, attractive, and good tasting. Susceptible to frost.

Strawberry Plasticulture for a Local Market

Cathie Greene, U-Pick strawberry grower
700 Beaty, Pocola, OK 74902
www.wildthingsfarm.com

Wild Things Farm is a 90-acre family operated business located in Pocola, OK. Strawberries, fresh produce, a corn maze, and other activities are offered seasonally. Our goal is to create a fun, safe, and educational environment where individuals and families can experience a real working farm.

Strawberries are rotated between two fields and preparation begins as soon as the ground can be worked in the spring. Two thousand Camerosa plants and two thousand sweet Charlie plants are planted in addition to four acres of the Chandler variety.

Currently methyl bromide is used when the beds are formed and plastic laid. This year mustard will be planted as a biofumigant. Our goal is to become chemical free.

The strawberries are tipped in late August or early September and left to root in the misting area for three or four weeks. They are then transplanted between September 25 and October 10. Wheat is planted between the raised beds in the middles. Care must be taken to protect plants from deer damage.

Flowering generally begins in March. Flower buds must be protected from freezing weather. Once the plants reach a 10% bloom stage we begin to use overhead irrigation for frost protection. It usually takes a month for the strawberries to mature.

Marketing the berries is critical. Chandler berries do not keep well once picked. Newspaper advertising has worked well since a variety of people read the paper. Television and radio are more costly and, depending on the stations chosen, the customer cross-section may be limited. Festivals may attract new customers, especially when there are multifaceted attractions simultaneously (pony rides, crafts, contest, food). We try to keep our farm logo on all written materials. We also wear matching shirts so employees can be easily identified. Customers can find us at our web site.

Media days can work, and it is helpful to have something extraordinary to attract the media. Two years ago we took the media up in a hot air balloon to look at the corn maze and the publicity well outweighed the $250 balloon fee.

Attractions for kids are important. When kids have fun, they get their parents and friends excited about visiting which makes for returning customers. Animals, wagon rides, hay and sand excite kids. Keep things simple and basic.

Have adequate signage. People are comfortable when they know where to park, what the hours are, and how much things cost. Make sure signs are clear and positive. Let your customers know you appreciate them and want them to return.

Finally, word of mouth is the best and most economical marketing. Provide a good product and customers will appreciate it and return.

Monitoring and Control of Brown Stinkbugs

Barbara Lewis, Jackie McKern and Dr. Donn T. Johnson, University of Arkansas, Department of Entomology, Fayetteville, AR 72701

Stink bugs have attained pest status in fruit and other crops in the southern United States as broad-spectrum organophosphate insecticide use has lessened. Stink bugs inject toxin into fruit destroying cells that inhibits fruit development at the feeding wound causing scarring or "catfacing". Several generations occur in Arkansas. Stink bug populations build in non-fruit and fruit crops throughout the growing season. Soybeans are probably the last crop harvested in the south and it experiences pressure from large stink bug populations. This leads to high numbers of stink bugs wintering in ground debris in woodlots and fencerows adjacent to crop plantings.

Several stink bug species are captured in and near fruit plantings. Stink bugs are strong fliers with shield-backed shape. They range in size from 3/8" to 1", have sucking and piercing mouthparts and lay barrel-shaped eggs in clumps. There are five wingless nymph stages between egg and adult. The brown stink bug, Euschistus servus servus is the most common stink bug pest in fruit plantings. The green stink bug, Acrosternum hilare, appears in significant numbers in July (Fig. 3). Other stink bugs captured in low numbers in yellow pyramid traps in fruit plantings included: dusky stink bug, Euschistus tristigmus, red-shouldered stink bug, Thyanta accerra, and rice stink bugs, Oebalus pugnax.

Presently, the stink bug pest management program in peaches recommends periodic ground cover mowing to prevent flowering of weed hosts in and around peach orchards that lessen catfacing (Killian and Meyer 1984). Sprays of Lannate and Endosulfan (2 applications per year) are registered for stink bugs on peach, but no insecticide is labeled for stink bugs in blackberry. Given availability of a registered insecticide, it is recommended to spray insecticide only where and when catfacing damage exceeds 1% of fruit. Weekly, a grower should assess the stink bug population and randomly select at least 5 trees in both the planting perimeter and interior and inspect 20 fruit per tree for catfacing. Previously, limb jarring stink bugs from blackberries or fruit trees was used to make spray timing decisions. Unfortunately, jarring fruit plants is unacceptable by growers because it dislodges healthy fruit and is too time consuming. This paper describes improvements in stink bug monitoring methods and the effectiveness of new insecticides replacing organophosphates.

Methods

The attractiveness of safety yellow painted pyramid traps to stink bugs was enhanced by weekly replacement of a bait dispenser. Each dispenser was charged with the synthetic brown stink bug aggregation pheromone, methyl 2, 4-decadienoate (Aldrich et al. 1995, Cottrell et al. 2000). Stink bugs land on the yellow trap and walk up into an inverted screen funnel and into a screened capture arena. In 2000, four baited yellow pyramid traps were check weekly for stink bug counts in three Arkansas demonstration IPM peach sites (Clarksville, Conway and Nashville) and one abandoned site with two traps in (Wynne) were sampled from 1 June to harvest. From 1 April 2001 to harvest, four traps were sampled again in the three IPM sites. In 2004 in Conway, AR, we collected stink bug trap counts from four traps from 22 April to 14 October. Damage assessment was done by inspection of 30 fruit on each of 10 plants.

Five insecticides were evaluated against brown stink bug in Conway, AR. Treatment plots each had 5 blackberry plants, 18" apart in rows 13' apart in a randomized complete block design with four replicates. Each treatment plot had three fiberglass screen cages each enveloping a fruit cluster with ten brown stink bugs. On 7 July 2004, the following treatments were applied by a Solo hand pump sprayer at a rate of 100 gal/acre to foliage of these plants and caged stink bugs: Indoxacarb (Avaunt), Novaluron, Spinosad (SpinTor), Thiacloprid (Calypso), Thiamethoxam (Actara) and an untreated check. At two and six days after treatment (2 DAT and 6 DAT) on 9 July and 13 July, each cage was examined and percent mortality was tabulated. The numbers of dead stink bugs on the ground in each treatment plot were also counted. Data are presented as the mean number of dead stink bugs per treatment, analyzed using ANOVA and means were separated using Waller-Duncan K-ratio t-test (P = 0.05).

Results

In 2001, pyramid traps caught the first stink bugs in mid April in Arkansas. Fruit near the edge of each planting were damaged first. The most stink bug damage occurred in the diverse truck crop planting at Conway, Arkansas. The Clarksville and Nashville peach orchards were monocultures that had less than 45 stink bugs per four traps per season in 2000 (Fig. 1) and 2001 (Fig. 2). The truck crop farm in Conway had peaches adjacent to plantings of apples, muscadine, blackberry, tomato and egg plant resulting in more than 140 stink bugs per four traps per season (Figs. 1 to 3). By 23 June 2004, stink bugs exceeded 100 per four traps and peaked at 189 per four traps on 1 July (Fig. 3). We have used this information to derive a tentative spray action threshold for peaches: spray insecticide only if there is > 1% new stink bug catfacing or > 25 stink bugs per baited yellow trap. We are still developing a action threshold for blackberry.

Actara, Spinosad and Calypso were effective at 2 and 6 DAT, Avaunt was effective at 6 DAT (Table 1). None of these compounds are currently labeled for use in blackberry.

Future

The east Asian stink bug poses a possible future threat. This imported stink bug has been found feeding on fruit and soybeans in New Jersey and Pennsylvania. It is also called the Brown Marmorated stink bug or the yellow/brown stink bug. Learn more on the Internet at: http://www.rce.rutgers.edu/stinkbug/default.asp.

References

Cottrell T. E., C. E. Yonce and B. E. Wood. 2000. Seasonal occurrence and vertical distribution of Euschistus servus (Say) and Euschistus tristigmus (Say) (Hemiptera: Pentatomidae) in pecan orchards. J. Entomol. Sci. 35: 421-431.

Killian, J.C. and Meyer, J.R. 1984. Effect of orchard weed management on catfacing damage to peaches in North Carolina. J. Econ. Entomol. 77:596-1600.

Table 1. Insecticide effects against brown stink bugs (BSB) in Conway, AR (2004)

		% BSB Mortality		No. Dead BSB on ground	
Treatment/ Formulation	Rate amt/acre	9 July 2 DAT	13 July 6 DAT	9 July 2 DAT	13 July 6 DAT
Actara 25WG	4 oz	96.7 a	100.0 a	29.5 ab	9.8 a
Spinosad 25C	6 oz	84.2 ab	95.0 a	22.8 b-d	3.0 bc
Calypso 480SC	4 oz	72.5 a-c	92.5 a	24.8 bc	8.8 a
Avaunt 30WG	4 oz	68.3 bc	92.5 a	32.3 a	10.5 a
Novaluron 10EC	14 oz	20.8 de	55.0 c	10.3 f	2.0 bc
Untreated check	--	19.2 e	50.0 c	0.8 g	0.3 c

Means for each date followed by the same letter are not significantly different (P > 0.05, Waller-Duncan K-ratio t-test)

Figure 1. Total stink bugs (SB) in four yellow pyramid trap at five peach sites (2000)

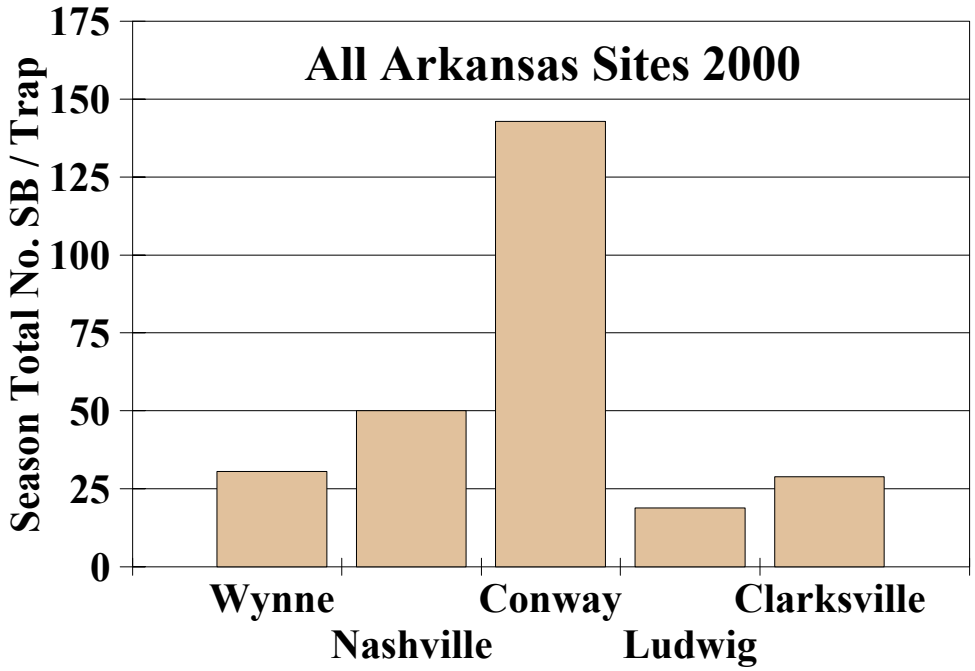


Figure 2. Total stink bugs (SB) in four yellow pyramid traps at three peach sites (2001)

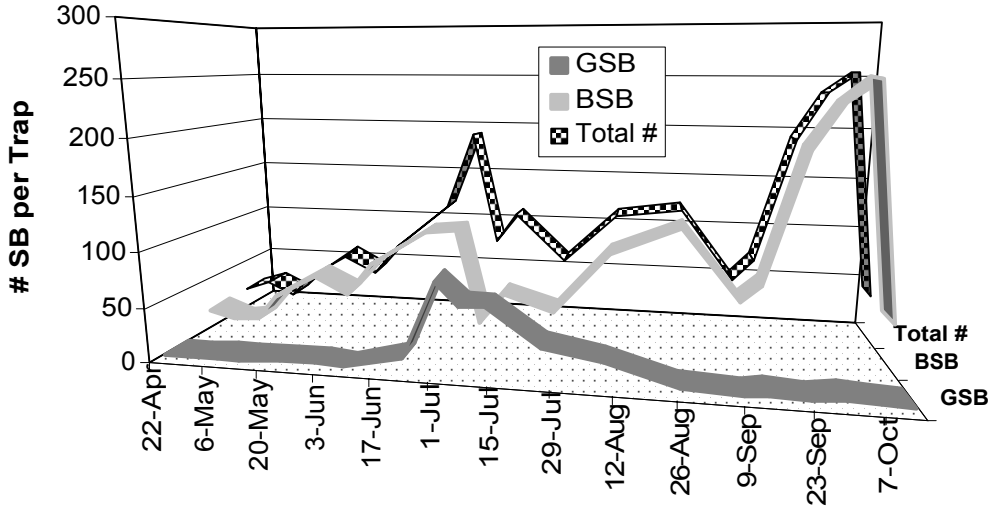
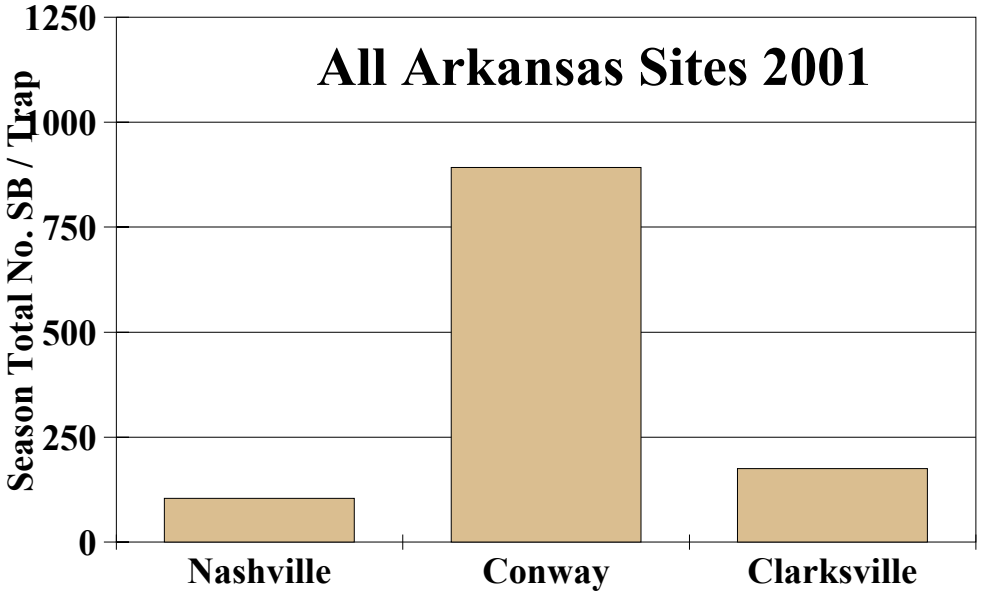


Figure 3. Counts of brown (BSB) and green (GSB) stink bugs and totals captured in four yellow pyramid traps in Conway, AR (2004)



Low Acid Peach Releases from the University of Arkansas

John R. Clark and James N. Moore

John R. Clark is a professor of horticulture at the University of Arkansas and currently directs the fruit breeding program. James N. Moore is distinguished professor emeritus and directed the program from 1964-1997.

Two new peaches released in the fall of 2004 have been named 'White Rock' and 'White County'. A few details follow:

'White Rock'
Type - White, non-melting flesh, cling.
Fruit Maturity Date – June 25 first mature on average at Clarksville, Ark.
Fruit Size – Medium, 140 g but responds greatly to early thinning.
Skin Color - Red blush over 70% of skin with cream-like ground color; very attractive.
Flavor, Sweetness - Low-acid, light white peach flavor; sweet with average 12% soluble solids.
Fruit Firmness – Very firm, non-melting flesh that remains firm when fully mature to over mature.
Bloom Date - March 27 average full bloom at Clarksville.
Bacterial Spot Resistance – Moderate resistance, occasionally seen on leaves but no economic damage on fruits.
Comments - 'White Rock' is a very productive, mid-early season, low-acid flavor white flesh peach for the fresh market. Shipping evaluations have not been made but should be suitable for transport. 'White Rock' is named for White Rock Mountain in Franklin County, Arkansas.

'White County'
Type - White, melting flesh, freestone.
Fruit Maturity Date – July 14 first mature on average at Clarksville.
Fruit Size – Large, 250 g average.
Skin Color - Red blush over 80% of skin with cream-like ground color; very attractive.
Flavor, Sweetness - Low-acid, distinct exceptional white peach flavor; sweet with average 14% soluble solids.
Fruit Firmness – Very firm, but softens to melting flesh when fully mature.
Bloom Date - March 26 average full bloom at Clarksville.
Bacterial Spot Resistance – Moderate resistance, occasionally seen on leaves but no economic damage on fruits.
Comments - 'White County' is a very productive, mid-season, exceptional low-acid flavor white flesh peach for the fresh market. Shipping evaluations have not been made but should be suitable for transport. 'White County' is named for the famous horticulturally rich county in east-central Arkansas.

These new peaches offer additional options for Arkansas and Oklahoma growers to consider for planting. Trees can be attained from:

Cumberland Valley Nurseries, Inc.
PO Box 471
McMinnville, TN 37111-0471
800-492-0022

Strategies for Fruit Thinning

Curt R. Rom, Associate Professor
Jason McAfee, Program Technician

Department of Horticulture
University of Arkansas
Fayetteville, AR 72701
PH: 501-575-2603 FAX 501-575-8619
URL: http://www.uark.edu/ArkHort

C.R. Rom grew up on a fruit farm in Northwest Arkansas. He attained a BS of Agriculture studying Horticulture and Business from the University of AR. He attained the MS and PHD degrees from The Ohio State University. He was a horticulturist at the Washington State University prior to becoming a professor at the University of Arkansas in 1989. He has broad responsibilities for horticulture education, and research on fruit crop physiology and management, and organic and ecologically-based production systems.

Fruit thinning is one of the most important management practices to ensure orchards produce profitably. Annual, well-timed fruit thinning ensures an optimum crop load of fruit is produced which can achieve maximum size and quality. Fruit thinning reduces the natural tendency for biennial bearing and encourages annual bearing. Just as pruning, proper pest management, fertilization and irrigation are necessary management operations, fruit thinning must be practiced annually and prudently.

Fruit trees produce many more flowers than are needed to produce a valuable crop. We have counted 14,000 to 25,000 flowers on a semi-dwarf apple tree. Research in many places over the past five decades indicates that it is important to optimize and not maximize crop load. Only 200-400 fruits are needed per tree to achieve their biological carrying capacity for large fruit.

The timing of fruit thinning is a critical consideration. The greatest effect on fruit size and return bloom is realized with early thinning - beginning at least during bloom. Thus, fruit thinning and crop load management can be practiced at several different times of the season.

The first period of crop load management is during the dormant season. An important aspect of annual crop load management and fruit thinning is to practice annual dormant pruning. This eliminates a portion of the crop prior to bloom and stimulates vegetative renewal growth. Thus, a grower can maintain a balance between vegetative growth needed to sustain the growing fruit crop and to encourage the developing flowers for the following year's crop. Further, the pruning removes some flower buds and thus leaves more of the stored reserves needed for new growth to be distributed to fewer flowers and giving each flower a greater "chance" to achieve its potential. Skipping pruning has remarkably deleterious effects on the tree. It will result in a tree that will over-crop, produce many small, poor colored and flavored fruit, and send the tree into a biennial bearing pattern. So, the first step in proper crop load management and fruit thinning is proper dormant or prebloom pruning.

The second important period of fruit thinning is the bloom period. As a rule, the first flowers on a tree to open, whether apples or peaches, will produce the largest fruit and flowers that bloom later will produce smaller fruit. So, if possible, employ thinning practices which can preserve the early blossoms

and eliminates the later blossoms. It is very important, however, to realize that in this region, bloom thinning is very risky if there is any chance of a flower killing frost occurring during the bloom period. Many growers feel the risk is too high and skip the bloom period of thinning.

The next period of thinning is the immediate post-bloom period; from petal fall for the following 15-20 days. Growth regulators can be applied when fruits are 11-17mm diameter. With these treatments, the smaller fruits will abscise and the larger fruits are retained.

The last period for thinning is the period of 20-30 days after bloom. Typically, this is done by hand-thinning; physically pulling, cutting or knocking off fruits which are small, misshapen, have insect damage, etc. Fruits need to be finally spaced with 6-8 inches between fruits in all directions and when possible, fruit clusters should be thinned to singles.

There is little benefit to fruit size, quality or return bloom from thinning after 30-40 days after bloom and in most cases it is not a wise economic decision; it is likely not worth the trouble or cost.

Bloom thinning is typically done with caustic chemicals. The thinners are applied after the first flowers have been pollinated and fertilized, and work by desiccating the remaining flower pistils rendering them unable to be pollinated and fertilized. Again, these treatments have a risk associated with them if a frost occurs late during the bloom period and kills the first flowers about the same time the thinning treatment has killed the later flowers. Studying micro-meteorological patterns for your orchard are an imperative part of the decision to use bloom thinners. Although an effective treatment, many of these chemicals, however, cause fruit russet problems lowering surface aesthetic quality of the fruit and reducing their value. Recently, new work has demonstrated that 2 gals of fish oil (e.g. Crockers' Fish Oil) in 100 gallons of water applied with a 2% concentration of premixed lime-sulfur (calcium polysulfide) applied just past full bloom and again 3-5 days later is a very effective bloom thinner and does not cause significant fruit blemish or russet problems. Although not fully tested in this region, it is worth limited test if frosts are not predicted.

For post-bloom thinning, three practices have been used with some success. The auxin NAA (FruitThin) applied at 5-15ppm at 11-17mm receptacle diameter or 7-15 days after petal fall has given good results. The temperatures must be above 60F and effects are best when day time temperatures are between 70 and 80 F with clear, sunny skies, and night time temps are in the 50's F. Cool temperatures or cloudy weather will limit treatment effectiveness. Likewise, temperatures too high or droughty conditions may cause over thinning. In some cases, the treatment will only kill seeds but fruit will not abscise resulting in "pygmy" fruit. Another growth regulator ACCEL (6BA+ BA4+7) can be applied between 5 and 20 days after bloom. Earlier applications tend to be more effective. The treatment is very weather dependent as well and does not work similarly on all cultivars. Lastly, the insecticide carbaryl (Sevin XLR) can be applied at 1pt/100 gallons water per acre at 15-21 days after bloom. Although this has been shown to be a very effective thinner, it has caused problems with IPM programs by disrupting the balance between predatory entomophagous insects and insect pests of the tree. Often, for example, we have had severe mite outbreaks after treatment with carbaryl that early in the season and the negative effects on fruit size, quality and return bloom completely reversed the positive effects to be gained by proper thinning. Post-bloom applications of fish oil and lime sulfur at 5-10 days after bloom has resulted in reasonable thinning in reports from the Appalachian and New England region. However, more than 3 or 4 applications total in a four to 6 week period have resulted in some fruit damage, some foliar phytotoxicity, and some small fruit size.

Many factors affect thinning efficacy. As mentioned, timing is very critical. Weather has a large impact. But, other factors such as crop load, tree health and physiological status, nutritional status, etc., effect thinning success. Further, the concentration of the treatments, the amount of water, and even the type of sprayer and quality of spraying may affect thinning results. In our lab we are studying several alternatives for fruit thinning. During the bloom period we are studying several possible treatments including osmotic agents, pH agents, detergents, and essential oils. The purpose of all is to kill floral pistils without damaging fruit. During the post bloom period we are studying chemicals that may either cause seed abortion and fruit drop, of chemicals that lower photosynthesis of spur leaves for 3-7 days. The lower photosynthetic rate results in intense carbohydrate stress and competition among fruits. The small, weak fruitlets abscise and the larger fruit are retained. If photosynthesis recovers and new leaves form, then the remaining fruit have no competition.

There is no single "silver bullet" that works perfectly, all the time, in all conditions, in all years, and on all cultivars. It is best to take a multi-prong approach to thinning. First, be sure your trees are well managed and healthy. Start the thinning program with good annual pruning. If possible, use a bloom thinning agent if frosts are not predicted for the season. Follow-up with some post-bloom treatments. Clean up and make final adjustments in crop load by hand thinning. Then, be sure to pick fruit in a timely fashion, remove all fruit from the trees at harvest, and keep trees healthy into the fall. Never rely wholly on a new thinning treatment. Because of the variance with cultivars, chemicals and equipment, a grower should try treatments on a limited number of trees until you have developed your own experience base.

Herb Session

Growing Dye Plants for Fibre Arts Dyeing

Sharon Owen, Master Gardener & Owner
MoonShadow Herb Farm
Muskogee, Oklahoma

Gloria Gallaso, Fibre Artist
Tres Hermanas Wool Works
Ponca City, Oklahoma

No form of herb growing is so woven into the fabric of American history as the planting of herbs for the dye pot…and so here, the dyer's garden is born.

Choosing Which Plants to Grow

Become familiar with dye plants
-available wild, native plants
-herb/ornamental plants already in garden
-adding color-specific dye plants
-other interesting textile plants - ?
-Consider your use & the potential yield
-10 ft row of dyer's coreopsis dyes several times more yarn to a much darker color than a 10 ft row of zinnias.
-Don'at grow common/native plants that are plentiful/avail in your area: ragweed, bindweed, dock, goldenrod, broom sedge (*Adropogon virginicus*) – related to Little bluestem.
There are many available common plant species, including shrubs and trees that are excellent dye sources!

Planting a Dyer's Garden

Good reds or blues
-Madder
-Indigo
-Japanese indigo
-woad

Other interesting colors
-Hollyhock
-Hibiscus
-Purple loosestrife
-Grow plants that look pretty; fragrant, edible and produce dye.

Best dye plants per sq ft garden space:
-dyer's coreopsis
-Garland chrysanthemum (*Chrysanthemum coronarium*)
-Indigo
-Marigold
-weld

Nice plants but space-eaters (for amount of dye yeield):
-Black-eyed Susan
-Purple loosestrife
-Hollyhock
-St. John's Wort
-Sunflower

Production Garden – photo and handouts
-23 ft W x 26 ft L
-8 beds: 4 ft W x 8 ft L
-plant material = 7 lbs. Wool yarn
-good projector for spinning guild or herb society

Dye Plant Profiles:

Woad:
Dyer's woad
(*Isatis tinctoria*) Genus Isatis = 30 different types of herbs
(mustard family) Europe – Asia – near East
Biennial
sun, avg-rich soil, water-lover
(fertile soil = better pigment)
Noxious weed in some states!
18 in. rosette 1st year
2-3 ft flower stalks 2nd year
Start from seed early spring and/or early fall (or both)
Plant garden row allowing 1 plant/sq ft
seeds stay viable for years
Dig and discard plants in fall – may leave one plant to flower
Harvest leaves 1st year – mid-summer/mid-fall best when used fresh. Too early/too late = poor pigment. Seeds may also be harvested.
Yield: 24 plants = 4 oz wool
Colors: Leaves = lovely blue shades; Seeds = pinkish, mauves, tans, rusts
Trivia: To US by colonists; replaced by Indigo by 1900s. Traditionally processed into balls.
Fiber Examples – photos.

Indigo:
Start from seed, soak seeds/seedpods overnight
Don't disturb roots – transplants temperamental
Young plants are stunted by cool/cold temps.
Height: 3-6 ft
Spacing: 1 plant per sq. ft.
Compound leaves – 3 inch
Harvest: cut stems as plant flowers – max pigment concentration/yield. Strip leaves from stems (late summer/fall). Begin at base of plant ⅓-½ of leaves. Harvest at 2 week intervals. Use immediately for best color results.
Leaves contain 10% to 50% blue pigment.

Yield: 2-4 plants = 4oz. Wool
2 dozen plants (*I. suffruticosa*) = 2 lbs wool.
Trivia: Most successful dye plant known. Brought to Europe from East Indies late 1400s.
By 0700s imported to Great Britain from South Caroline (*I. Suffruticosa*). Replaced Woad as primary blue dye in Europe. Urine was favorite liquid for dye vats – reducing agent – alkaline.

Japanese Indigo: Dyer's Knotweed
(*Polygonum tinctorium*)
Japan, SE Asia – temperate zones
100s of species…
Only *P. tinctorium* gives blue dye
Annual (all zones) – easier to grow than *Indigofera*
Sun (some shade) – rich, moist soil – mulch
The better you treat it, the more it will give!
Easy to grow – no pests or disease
If you can grow peppers, you can grow this!
Grow from seed 0 (difficult to find)
stem cuttings
Harvest: remove leaves anytime from mid-summer – frost
Remove ⅓ leaves per picking, pick every 2-3 weeks.
More you pick, the more you get (side shoots)
Use fresh.
Japanese Indigo
Dyer's knotweed – fiber examples
Colors: Various shades of blue. Various shades of gold, khaki and brown.
Can also use leaves to give above colors!
Yield: Leaves of 2-4 plants = 4 oz wool
Pointers: Collect seeds when seed head turns tan – dry and rub out seeds and store. Lose viability, so use within same year. Flowers late in season. Root stem cuttings and grow inside.

Madder (*Rubia tinctorium*)
Herbaceious perennial
Sow seeds; plants; layer or stem cut
Raised beds; fertile alkaline soil
Lime encourages more dye pigment
Allow 18-24" between plants
5 ft x 8 ft bed = 12 plants
Harvest roots 2-3 years spring or fall while dormant – was, cut and store dry. Harvest tops late fall or winter once they have died.
Yield: 12 plants provided approximately 6 lbs fresh roots. Will shrink to 2-3 lbs dried.
8 oz fresh/dried roots will dye 1 lb. fibers.
Colors: (tops) coral-pink and salmon shades, (roots) wide color range – coral, dark orange, brick reds, clear red, Turkey red.
Trivia: Ancient dye plant (Indus civilization circa 3,000 BCE) Turkey red developed in India. Used for British Red Coats.

Madder Root – Fiber examples

Weld
Dyer's Mignonette – Dyer's Rocket
(*Reseda luteola*)
Europe, Mediterran region
flat rosette 6-10 inch
Flower stalks 2-4 ft.
Sun – well drained, alkaline soil
sow seeds in spring ½ in deep
resents transplanting – long tap root
2 plants per square feet.
Harvest: Pluck leaves (1st year) from rosettes; cut whole flower stalks. Use fresh or dry.
Yield: Rosettes of 12 plants or flowering tops of 6 plants = 4 oz. Wool
Colors: various dark yellows, greenish yellows, and golds. Produces purity of yellows better than any other herbaceous plant. Light fast.
Trivia: Fibers dyed with weld can be top-dyed with indigo/woad = Lincoln green & Saxon green.
Romans used weld to dye tunics of the vestal virgins.
Weld fiber examples.

Dyer's Chamomile
Golden Marguerite (*Anthemis tinctoria*)
perennial
sun – avg/poor soil – water in hot weather
36 in tall
sow seeds – or transplants
divide mature plants
Allow 24 in between plants
Harvest: Gather leaves anytime – use fresh or dry
Pick flower heads as they fade – harvest stalks to ground
Colors: Flower heads = various yellows
Leaves = olive and unusual shades green
Yield: Leaves & flowers of 12 plants = 4 oz wool
Trivia: Traditional dye used for Turkish carpets.

Sunflowers
(*Helianthus annuus*)
Height 4-6 ft
Direct sow seed – flower 60-90 days
Full-sun, well-drained, average soil
Spacing 1 plant 3-4 sq. ft.
Prevent hybridization by planting varieties ¼ mile apart!
Not remarkable dye plants…But!
Cheerful and easy to grow
Make useful screen or backdrop for large dye garden
Attracts bees, butterflies, goldfinches and other birds

Common Sunflowers
Harvest: Pick whole sunflower heads in full bloom

Use fresh
Prolonged simmering & soaking to produce strong color.
Yield: Flowers from 12 plants dye 4 oz. Wool
Colors: Various shades of green and yellows, greenish-gold, and beige
Common Sunflower – fiber examples

Hopi Dye Seed Crops
Hopi – special seed crops
sunflower (*Helianthus annuus*)
bean (*Phaseolus vulgaris*)
maize/dye corn (*Zea mays*)
selected & used for centuries
Near extinction
Unique & significant dye plants
preserved for the future

Hope Black Dye Sunflower
(*Helianthus annuus*)
Strain developed by Hopi Indians – AZ
Endangered species
Traditional dye for basketry & textiles
Harvest: Use sunflower seeds (hulls) ONLY
Bag flower heads after petals wilt – collect – dry
Simmer 30-60 minutes & strain dyebath
Color: Range of dark blues, blacks, and purples

Ancient Seeds for Modern Needs
Mailing address & Store location:
526 N 4th Ave
Tucson, AZ 85705
520.622.5561
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www.nativeseeds.org Members receive 10% discount
Limit 6 seed packets/customer

Flowers for Dyeing
Black-eyed Susan (Rudbeckia)
Coreopsis (tickseed)
Dahlia
Dyer's coreopsis
French Marigold
Garland chrysanthemum (*Chrysanthemum coronarium*)
Golden Marguerite (Dyer's chamomile)
Hardy hibiscus
Hollyhocks
Purple loosestrife
Zinnias

Herbs for the Dye Pot
Basil, purple
Catnip
Fennel, bronze
Hops
Marjoram
Mullein, common
Parsley
Pearly Everlasting
Peppergrass
Queen-Anne's-lace
Rue
Safflower
St. John's Wort
Tansy
Wild Oregano (Pot marjoram)
yarrow
Yellow bedstraw (Lady's bedstraw)

Common Plants for Dye (Wild Dye)
Milkweed
Mullein
Sumac berries
Ragweed
Goldenrod
Blackberry
Chokeberry
Pokeberry
Elderberry
Dock
Sorrel roots
Alder
Black walnut
Osage Orange (Bois d' Arc)
Wheatstraw
Sassafras
Broom sedge (*Andropogon virginicus*) Interesting Textile Plants

Cleaning Agents:
Urine (alkaline) – wool!!!
Dry, loose clay (Fuller's Earth), dirt, oatmeal flakes, wood ashes

Plants Containing natural alkalis & saponins:
Soapwort (Bouncing Bet), Yucca roots, Soapberry tree (fruits)

Tools:
Fuller's Teasel (1-2 for teasel tool) (*Dipsacus sativus*), various reed, cane & bamboo, Spindle Tree (*Euonymus europaea*).

Fragrant Textile Plants (Insecticides & Repellents included):
Camphor Basil, Eucalyptus, Indian Tobacco, Lavender, Patchouli, Pennyroyal, Pyrethrum, Rosemary, Southernwood (Artemisia abrotanum), Tansy, Veviter, Wormwood (Artemisia abenthimum).

Market Niche?
Spinning & Weaving Guilds are receptive to buying GOOD QUALITY locally grown dye plants; US dollar is down – imports are costly; Grower should supply fiber samples dyed with their plant product; Consistent product quality is the key.

Carol Leigh's
Hillcreek Fiber Studio
7001 Hillcreek Road
Columbia, MO 65203
573.874.2233
1.800.874.9328
Carol Leigh Brack-Kaiser & Dennis Kaiser
www.hillcreekfiberstudio.com See Workshop Schedule.

(Computer scanned dyestuff/plant price list) Slide information

Yarn Barn
930 Massachusetts
Lawrence, KS 66044
785.842.4333
info@yarnbarn-KS.com

Guilds:

Tulsa Handspinners
Diana Hartzmann
1203 South I 10 East Ave.
Tulsa, OK 74128

Green Country Fiber Guild
Cathie Laurent
RR 1 Box 305
Dewey, OK 74029

Fiber Friends
Peggy McCord
RR 2 Box 79
Miami, OK 74354

Mt View Weavery
Edmond, OK

Weave A Real Peace (WARP)
Oklahoma City, OK

Norman Fiber League
Shirley Cannon
809 Iowa St
Norman, OK 73072
BobMackeymackey@worldnet.net
Log Cabin Spinners
Wanda Nobbe
5621 Mountain View Road
Edmond, OK 73034

Kansas Alliance of Weavers & Spinners

Columbia (MO) Weavers & Spinners Guild

References:

Wild Color – author Jenny Dean – ISBN 0-8230-5727-5
A Weaver's Garden – author Rita Buchanan – ISBN 1-883010-07-1
Women's Work – The First 20,000 Years: Women, Cloth & Society in Early Times – author Elizabeth Wayland Barber – ISBN 0-393-31348-4

Photographing Flora

Deborah Redden
Ozark Folk Center
Heritage Herb Gardens

Have you ever seen a flower that just took your breath away? You run and get your camera, take a picture and when you get the picture developed it is not at all what you saw? The how and why of this has to do with light. Light hits an object and this image is sent to our eyes. Our mind then deciphers the images and we see a flower.

Using a camera is a matter of bending light into images also. To make the camera see what you do can be a simple matter of adjusting your distance from your subject. There are rules to follow to increase your chances of obtaining the picture you want and there are a few tricks to level the playing field.

One of the first things you should become accustomed to is viewing your intended subject on a tic tac toe board. This is what is called the rule of thirds. The idea behind this is that you place your subject on the intersection of the lines instead of in the center of the frame. Very few things in life are centered, so our eyes are more comfortable viewing pictures that are a bit off.

Another way to enhance your photo is to back light. If you hold a leaf up to the sun you can see the beautiful veining out lined in the light. This same technique can add a luster and glow to your flower picture. How ever you can not shoot directly into the sun. The glare would over expose your picture and the results are a wash of white. If you move a bit off the center the light will still shine through the petals. This is one of the exposures where you may have to lie down, twist sideways, or walk about your subject till the glare is gone. Do be careful walking with your eye glued to the camera. Your sense of direction and depth will be affected and you may take a tumble.

Many professional photographers carry a reflection disk in their bag of tricks. This is about 1 foot in diameter, (it folds in on its self to store in your camera bag) silver on one side and a golden tone on the other. It is used to reflect light on to a subject. The silver side can bring a subject out of the dark and highlight the focal point of interest leaving the background muted. The gold tone side can reflect a harsh light in warmer tones. For around your garden and house I have found that aluminum foil on a paper plate holder will work as a fairly good reflector. Heavy duty colored Christmas foil wrapping paper can also give you some interesting tonal differences. Be sure to get the foil as smooth as possible.

Out in the field or in your garden, the wind can make picture taking next to impossible. Some times you can block the breeze with your body or with a well placed umbrella. Carrying a clear piece of plastic that is large enough to cover you and the flower will cut the wind and give you a softer light to work with. Sometimes you can find large white trash bags that you and the flower can climb into. And sometimes you will just have to wait for the weather to change or find a friend to stand around holding a large piece of cardboard.

A black background can be very dramatic when taking pictures of flowers. It especially brings out leaf patterns and variegates. With something like the scented geraniums where the leaf shape is as interesting as the flower, a dark background will bring this to the fore. Poster board works well if you are in a place where you can tape it up. Because it is flimsy it will not stand on its own and will flop about in a light

breeze. Another problem with poster board is that water will stain it and ruin a good shot. There is a version of the poster board that has a hard foam back and a semi water restraint front. It runs about $3.00 a sheet. You can of course use a number of homemade backgrounds. Table cloths, spray painted cardboard, and any number of dark materials tacked to a simple frame. Let your imagination run wild and try many things. You may surprise your- self with a most interesting photo.

If you are taking a photo to show a particularly large blossom or spectacular grouping remember that with out a reference point your whole point is lost. Sometimes you can just place a ruler next to your subject. This will give the viewer something to compare with and have a better idea of size of your subject. Many people will have a child stand in the frame. Some times you can put a nice wicker lawn chair next to your subject and add a bit of the' Victorian' to your photo. And if you just want a record of the size or shape lie down and put your foot in the frame.

Try to keep in mind when you are photographing Flora (The name of the Roman goddess of flowers) that each has a texture, hue, and form that are unique. What is it about this particular flower or group of flowers that has you excited enough to want to save the image? To share a moment of beauty? Bragging rights? Your own personal pleasure? Hopefully these tips will help you to photograph what you see.

Deborah Redden has been gardening and teaching classes in the Heritage Herb Gardens since 1997. One of her earliest memories is following her father and mother to their gardens to pick tomatoes and flower bouquets. She comes from Rochester New York which is known for its lovely parks, gardens and of course cameras. Her first camera was a Kodak Brownie and her love of picture takings remains a life long passion. With the help of the Committee of 100 Deborah was able to take a photographic apprenticeship. Taking pictures of the many plants in the Heritage Herb Gardens, Ozark Folk Center Events, crafts, and visitors keeps her busy at the park. At home she photographs the beautiful Ozarks and any one or thing that will hold still long enough for the shutter to click.

Production of Herbal Essential Oils and Hydrosols for Commercial Purposes from Growing to Distilling

Udder Farm's Cream of the Crop
Max & Carol Grier
17201 E. 50th Street
Yale, OK 74085
918-285-5000

Max and Carol Grier are the owners and operators of Udder Farm in Yale Oklahoma, where they raise herbs for essential oil extraction. Max and Carol are enjoying working on their third year in developing this project. In the spring of 2003 they planted 1,200 Melissa plants, loved and nurtured, for a successful year. In the spring of 2004 they divided the plants and now have over 4000 plants in raised beds on their 120 acre farm. Fall 2004 the plants became the focus for Udder Farm's for the production of essential oil and hydrosol.

Max has knowledge on the distilling process, and Carol has a talent for growing herbs with the help of the Oklahoma environment. Together they have secured markets for their unadulterated essential oils and hydrosol.

Max and Carol Grier, and well known on an International basis and hold a patent on their process, and formula's for natural soaps, used for industrial and commercial needs. "Udder Farm's Cream of the Crop"

There product and Farm was selected as a finalist for 2004 Innovator of the Year award in Oklahoma, and picked as one of six "Most Promising New Business" awards in Oklahoma, May 2004. Carol was named as a finalist, "50 Making a Difference" for Oklahoma, in the selection for Oklahoma Woman of the Year 2004.

Making Mediterranean Herbs Feel at Home in Captivity

Tina Marie Wilcox
Heritage Herb Garden
Ozark Folk Center
Mountain View, AR

The goal of this class is to share information about the successful organic cultivation of Mediterranean herb plants in containers. The first thing to realize is that when a plant is growing in a container, it depends upon the gardener for its every need. Container plants are much like human infants. To grow beautiful potted plants it is best to understand the individual needs of the particular plant you plan to grow and do your best to provide for those needs.

In favor of Latin
The plant will be from a particular family and genus and will be a specific species of the genus. This botanical classification helps us to identify the plant, where it is from, and helps us to know something about its growth characteristics. Though Latin names may seem difficult and awkward to use at first, the more we use the botanical nomenclature of plants, the more fluent we become and the more fun we can have!

Basics to Consider
Most Mediterranean herbs are happiest in full sun when planted in the ground. Full sun means a minimum of six hours of sun per day. Container grown plants dry out too quickly in full sun during the summer. Generally speaking, container plants should be located in partial shade. Monitor the health and vitality of your plants for placement decisions.

Water—a matter of life or death
What are its water requirements during different seasons of the year? Mediterranean plants are quite thirsty during the growing seasons, especially during times of high heat, but do not need as much water as tropical plants or fast growing annuals.

While on the subject of watering it is good to understand the importance of proper watering. Only bog plants want to be soggy all of the time. During the hot summer months, most potted plants will need watering at least once a day. Water thoroughly. Thoroughly means soak the root ball. Plants in deep shade or that live in the air conditioning do not need as much water. Plants that suddenly stop using water in the summer are in trouble. Some plants may start needing water twice a day. If you don't want to water twice a day and want happy plants, transplant those twice-thirsty plants into larger containers.

Morning is the best time to water, especially in winter. Late afternoon watering is the next best time in summer. Avoid wetting the leaves in the heat of the day and before sundown. Water droplets magnify light rays and cause leaf burn. Water left on foliage after dark can help the spread of fungal disease.

During the winter, the plants are not using very much water for respiration and transpiration. Lower temperatures and shorter day lengths decrease the need for water. Excessive water stays around the roots, suffocating the plant. Lack of oxygen and soggy growing medium encourages the growth of fungal diseases. Plants must be monitored carefully. Heat from central air-conditioning systems or

wood heat takes moisture out of the air. Plants may need more frequent watering in these conditions. The secret is in the observation of the plants.

Plants will tell you what they need. For example, watching rosemary leaves for signals is an enlightening experience. Healthy rosemary leaves are dark green on top and whitish underneath. The leaf margins curl under. When the plant is thirsty, the green tops take on a gray tone and the epidermis looks a little wrinkled. If dry conditions prevail the new growth on stem tips wilt and some leaves get crispy. If too many leaves get crispy, the plant will die. Plants that are kept too wet develop black tips on the leaves. This black will spread throughout the leaf if the condition is not corrected. Tip the plant out of its pot. There will be wet brown roots. Cut these away and add fresh growing medium before returning the root ball to the pot. Stop over watering. This should do the trick.

Watch the soil surface. If the surface is dry, the containers should be lifted to test the weight of the root ball. Very light pots probably need water. This method of checking pots for water decreases the disease spread by fingers digging into soil surfaces, passing bacteria from pot to pot. Experience and observation will teach you.

Growing Medium for Nutrition and Root Support

What kind of soil does your plant need--light and well-drained, sandy and alkaline, peat moss and acid? Mediterranean plants like light, well-drained growing medium that is neutral to slightly alkaline. Peat moss is acidic. It holds moisture for a long time. When it dries out, peat moss is difficult to rehydrate. Compost combined with a commercial growing medium with a mix of pine bark, vermiculite, perlite, and a small amount of peat moss create a balanced growing medium for Mediterranean plants. Potting soil should be well drained, retain the right amount of moisture for the intended plant, and should contain some organic matter in an organic growing system.

Organic Plant Food

When do you feed your plants? At the Heritage Herb Garden, soft rock phosphate, green sand, crushed oyster shell, alfalfa meal, and soybean meal are layered into the compost piles as they are cooking. Compost is mixed into the growing medium of all of our plants. In this way, we provide our plants with the necessary elements and trace elements for healthy growth all year round.

Fish emulsion and liquid kelp is used in the watering solution and as a foliar spray, more so during the growing season. Plants are fed as needed. During the spring and summer plants are actively growing and use nutrients quickly. Daily watering leaches elements stored in the growing medium.

During the winter, even in the greenhouse, plants do not use much nitrogen. Overfeeding nitrogen in winter is not only a waste of resources but may also cause disease symptoms in your plants.

Pest control

The first line of defense in organic pest control is keeping plants happy and stress-free and examining the plants on a regular basis. When pests move in, the first control to try is strong streams of water. Spray away aphids, scale, spider mite, and mealy bug. If the critter is feeding, its proboscis will likely stay in the plant as the rest of the body is swept away. This will thin out some of the adults and disrupt the colonies. Spider mites especially dislike water and humidity.

Summer or horticultural oil will smother adult and larvae forms of pests. Soap dissolves the mantle of many adult and larvae pests. The larvae and the eggs are very small. This is why regular examinations are necessary to keep pests in check.

A troublesome disease of rosemary is called Pseudonymous syringae or rosemary stemgall or stemknot. The disease is characterized by growths on the stem, which resemble root knobs. These knobs clog up the vascular system of the plant. Eventually the knobs girth the stem and shut off water and nutrients to all parts of the plant above the growth. The disease is spread in the air. The only known treatment is pruning away the affected parts. Mulching with sharp sand or chicken grit may help discourage the disease as well. Though rarely deadly to the plant, this disease is disfiguring.

Mildew is another disease we've been challenged to handle. The best control so far has been spraying with garden sulfur. Root diseases include Rhizoctonia and pythium. The best control for these is proper watering practices and well-drained growing medium.

It is also good to know when to discard pest-ridden or sick plants. Fungal diseases can spread on air currents, on moving physical surfaces (like bugs and fingers) and through water. Insects can spread by walking, flying, or in the mandibles of ants. Consider trashing the vectors of trouble.

Containers
The container has to be large enough to accommodate the roots of the plant and be wide and deep enough to support the above ground part of the plant. A tall plant will need the support of a proportionate container to look right and stay upright in a wind if it is growing outdoors.

The container must have drainage holes. It is surprising, the number of people who do not consider how much root space a plant will need. There are also a surprising number of plant pots with no drainage holes on the market.

Plant containers are made of many different materials, all with varying degrees of advantages and disadvantages. For instance, old metal wheelbarrows, enamel chamber pots, and emptied tin food containers can make charming plant pots. The sun heats up the metal around the roots of your plants. This can be beneficial in the spring but may get too hot for them in the summer. Metal containers are best used on shady porches or other places out of the full sun. After a while the metal will begin to rust. Iron oxide can become toxic to plants. To solve the rust problem, find a plastic pot that will fit inside the metal container or line the inside of the metal container with plastic (that has holes punched in it for drainage) or coconut hull matting.

Clay pots look good and breathe well. The drawbacks to clay are high cost, weight, permeability (the plants require more water), and the pots crack, break, or disintegrate in winter if left outside.

Plastic pots are cheaper and retain water longer than clay. They are lightweight and wash up nicely. There is a stigma around plastics and solid waste issues. Some plastics have a shorter chemical life than others and become brittle in direct sunlight.

High-density poly foam or Thermo-Lite pots can be excellent plant containers. Some look exactly like clay pots. These materials are lightweight. They insulate plant roots from cold and heat extremes. They rival plastics in water retention. These pots are easily dented but are not damaged by freezing or summer heat. There is a stigma of polystyrene production and the depletion of the Earth’s ozone layer.

Wooden planters, window boxes, and half whiskey barrels make nice containers. The best wood types are redwood and cypress. Check that screws are used as fasteners rather than nails. To increase the longevity of wooden containers, put them up on blocks rather than setting them directly on a surface.

Hypertuffa containers are made with Portland cement, vermiculite, peat moss and other fillers. I love my hypertuffa pots for growing herbs. The Herb Companion, 1994 April/May edition ran an article entitled "Rough, Tough Planters" by Kathleen Halloran. Please refer to that article for ingredients and instructions.

A word about pot underlines—the purpose of an underline is to protect the surface under the potted plant. Actually, all too often the underline becomes a home for hidden condensation. I suggest that the purpose of the underline is to serve as a temporary reservoir for water and nutrients. When we water potted plants the water goes through the root ball along the course of least resistance leaving much of the ball dry. If water is left in the saucer for an hour or so, the potting medium has time to wick up more of the solution. Afterwards the remaining water should be discarded. The remaining water should not be poured back on to the plant's soil surface. Salts are leached out of the potting soil with each watering. This process of moving the plant and dumping the saucer helps keep the furniture in better shape as well.

Transplanting
It is handy to think of containers as halfway houses for bare-root plants or plants you want to transplant from one place in the garden to another place. By first potting the plant and setting it in a shady place for extra nurturing you will encourage new feeder roots to develop into a neat, contained root ball. After two or three weeks in the pot, the plant will make a much easier transition into the garden.

Transplant when a potted plant dries out too quickly, looks hungry, or looks cramped. Gently dump the root ball out of the pot. If the roots fill the pot and are surrounding the outside of the root ball, it is past time to transplant.

Acquire an awareness of roots. This is a key to understanding plant culture. They are numerous in number and matted. They form a deep, spreading mass. The ball needs to keep integrity but it enjoys being pruned. The pruned root tips will branch, increasing the number of capillary tips. Root prune by using a sharp knife to cut or shave the outer roots away. Maintain the integrity of the root ball. Use common sense and sensitivity in deciding how much of the outer root to prune away.

The medium should not be compacted around the roots when planting.
Pot the root ball back into the original container with fresh potting soil or move it into the next size larger pot. Moving plants to overly large pots can stunt the growth of some plants. The growing medium in an overly large pot will stay wet too long. The young roots will not get enough oxygen. The wet medium encourages the growth of fungal diseases.

Take Cuttings
New Mediterranean plants are best obtained as rooted cuttings. The seed may germinate poorly and is rarely true to variety. Cuttings are easy to make. Simply make four to six inch cuttings from the top of the plant. Strip away the lower half of the leaves on the stem and score one side of the stem with a sharp, clean knife. Put the cuttings in a glass of water on a sunny window. Change the water daily. The cuttings should root in four weeks or so. Alternatively, stick the cuttings in a sterile medium with

warmth provided from below and water or mist as needed. Cuttings really strike well in spring and early summer. Any other time is OK but the cuttings will take more time to root.

Other nurturing
From time to time, it is helpful to the potted plant to be cultivated. Gently stir the surface of the soil to introduce oxygen and break up the surface tension so water can penetrate more evenly. Top dress with just a little compost or potting soil to cover exposed roots. Container plants benefit from a mulch composed of lava rock, oyster shell, green sand, sand, and granite meal.

Tough Love
Our best container grown rosemary, thyme, sage, and lavender plants are pampered through the winter by being allowed to stay outside the greenhouse unless the temperatures are to dip below 25 degrees. They respond to the special treatment by looking very healthy and less bothered by insect pests.

An extra step to protect your plants from heat of summer or cold of winter (in the case of hardy perennials) is to insulate the root zone by potting a pot within a pot. Hardy perennials left outside should be nestled down into mulch to protect the root zone, which is less hardy than the tops.

Finally
A green thumb is an opposing digit that flips through magazines, reference materials and telephone books to aid an inquiring mind. A green thumb aids the hand in using pruning shears, shovels, scissors, and a gardener's knife. A green thumb and forefinger is the superior predator in the war on pests. A thumb is not born green.

Gardening in containers is an excellent way to develop green thumb skills. When you are the sole provider of every basic need of a living entity there is a level of intimacy that surpasses the in-the-earth variety of gardening. To succeed, pay attention to signals the plants are giving you, ask the right questions, find the answers, and act. Happy Gardening!

Recipes for Comfortable Mediterranean Herbs

Tina Marie Wilcox
Heritage Herb Garden
Ozark Folk Center
Mountain View, AR

Mrs. Maude Grieve, in A Modern Herbal, describes the land along the Mediterranean coastline as chalky with very little soil. She compares the wild form of our garden sage, Salvia officinalis as "…more shrubby in appearance and … a more penetrating odour, being more spicy and astringent than the cultivated plant". We grow herbs for use and pleasure. These recipes are formulated to grow comfortable plants that may produce useful parts that are higher in essential oils, tannins, alkaloids, minerals, and etceteras. This is pleasure. The goal of these recipes is to create a habitat that 'feels like home' to our gray/green Mediterranean herbs.

There are about eighteen species of subshrubs native to the Mediterranean region, many of which are our gray/green herbs. Common Mediterranean gray and gray/green plants include rosemary (clings to sea cliffs and occurs throughout the region), lavender (mountains of Southern France and Spain, Portugal, coastline), thyme (mountains of Spain and European countries bordering the Mediterranean), winter savory (Southern Europe), sage (native to the northern shores), and santolina (Italy, Majorca, Minorca, and Yugoslavia).

Plants that are very hairy and/or require sharp drainage such as lamb's ear, Cuban oregano (Plectranthus sp.), and Thelma's lemon mint (Plectranthus sp.) respond well to these recipes.

The Mediterranean Growing Mix is rich in "chalk" (lime/calcium) and beneficial minerals. Many of the elements needed for plant growth are in the ground rocks, crushed oyster shell, and sand. These particles serve as aggregates that help the mix drain well. When the water drains, oxygen replaces the space that the water held. The mix contains greensand, vermiculite, bark, and peatmoss to serve as sponge-like moisture reservoirs. Plants in containers cannot grow out in search of needed moisture.

The Meal Mix is added to the Mediterranean Growing Mix to provide a balanced, "fast food" for the plants. They are of agricultural, geological, and ocean origin, ground into fine powders that will break down quickly.

Humic and carbonic acids and beneficial bacteria from the compost or worm castings help the natural elements dissolve over time. The resulting solution becomes 'soup' for the plants to use. The goal is to provide soup that "tastes like home" to the plants.

The Mediterranean Mulch Mix contains many of the same aggregates as the Growing Mix. The mulch cools the surface of the soil, drains well, conserves moisture around the root ball, breaks down very slowly, and is attractive. The goal is to create a potted "Mediterranean coastline".

Mediterranean Growing Mix

A 3 cubic foot bag of commercial growing medium (preferably a mix of bark, vermiculite, perlite, and peatmoss)

2 gallons worm castings or compost (to add bacteria and organic acids to help make the mineral elements available to the plants)

Aggregate Mix
1 gallon each:
Oyster shell (35-55% calcium, 40% carbon dioxide, trace amounts of aluminum, copper, iron, magnesium, manganese, phosphate, silica, zinc, organic matter, chlorine, fluorine, and nitrogen.)
Coarse sand (to enhance drainage)
Charcoal (to enhance drainage, porous carbon, potassium, and other minerals)
Greensand, Glauconite (marine potash, silica, iron oxide, magnesia, lime, phosphoric acid, and 30 other trace elements. also retains water)

Combine 1 gallon of each of the four ingredients in a 5-gallon bucket. Box ingredients together to mix well.

Meal Mix
¼ cup sugar
2 cups each:
Fish meal (10-2-2)
Bone meal (5-12-0 plus 15% calcium)
Feather meal (13-0-0)
Kelp (variable N 1.7-2.5%, P .5%, K 2.25-6.25%)
Granite dust (3-5% potassium plus trace elements, non-alkaline
Rock dust (5% calcium, 5% sulfur)

Combine meals and dusts into a one-gallon container. Box together to blend well.

Mix 3 cubic feet bag of growing medium, 2 gallons worm castings or compost, one recipe Aggregate Mix and one Meal Mix recipe in a wheelbarrow until homogenous.
Store unused portion in a covered container.

Mediterranean Mulch
Equal parts:
Crushed oyster shell
Greensand
Charcoal
Coarse Sand
Granite or rock dust
Lava Rock

Box ingredients together to mix well.
Apply to soil surface, 1/4 to 1/2 inch thick.
Bibliography

Anderson, A.B. Science in Agriculture the Professional's Edge. Kansas City, Missouri: Acres U.S.A., 1989

Grieve, Maude. A Modern Herbal. New York: Dover Publications Inc., 1982

Tucker, Arthur O., Ph.D., and DeBaggio, Thomas. The Big Book of Herbs. Loveland, Colorado: Interweave Press, 2000.

Organic Gardening® Staff. The Encyclopedia of Organic Gardening. Emmaus, Pennsylvania: Rodale Press, 1978

Sources
Hint: Use your green thumb to flip through your local telephone book or go on-line to fine distributors of organic amendments closer to home. Save shipping.

Earthly Goods Farm and Garden Supplies
PO Box 4164
Tulsa, OK 74159

Gardens Alive!
5100 Schenley Place
Lawrenceburg, IN 47025

George Christ
13998 Holmes Road
Cabool, MO 65689

Nitron Industries
PO Box 1447
Fayetteville, AR 72702

Your local feed store (crushed oyster shell and chicken grit containing oyster shell and ground granite)

Promising Plants Presentation 2004

Herb Society of America Annual Conference
Cleveland, Ohio

Presented in Cleveland by Deni Bown, Jim Adams, Dorothy Bonitz, Andy van Hevelingen, Madalene Hill, Scott Kresge
Presented at the 2005 HIS Convention by Rae McKimm, owner of Grystal Hill Gardens, Sims, AR

Apium graveolens (wild celery, smallage) Biennial, easily grown from seed. All parts have a strong celery flavor. Sun, part shade. Z 7-9. Source: seed is widely available.

Datura netel (devil's trumpet, horn of plenty) Large fast-growing annual with sweetly fragrant trumpet-shaped flowers. Poisonous plant. Sun. Z 9. Source: J.L. Hudson Seedsman in LaHonda, California and from The Fragrant Path P.O. Box 328 Fort Calhoun, Nebraska 68023.

Prunus mume 'Peggy Clarke' (Japanese apricot) Small deciduous tree with double, fragrant, rose-pink flowers in winter. Fruits useful for preserves. Sun. Z 7-10. Source: Edible Landscapes, Afton, Virginia or at www.nurseryman.com

Salvia microphylla (cherry sage) Small twiggy shrub with aromatic foliage and bright, dark pink flowers all summer. Many cultivars and varieties, differing in hardiness. Sun. Z 7-9/10. Source: Plant Delights Nursery in Raleigh, North Carolina, www.plantdelights.com

Satureja spicigera (creeping savory) Hardy herbaceous perennial with wiry creeping stems with white flowers. Leaves have the same flavor as summer and winter savories. Sun Z 7-8. Source: widely available from many herb nurseries, including Richter's Herbs, Goodwood, Ontario, www.Richters.com and Well Sweep Herb Farm, Port Murray, New Jersey.

Schisandra chinensis (schisandra) Important Chinese medicinal herb. Large, hardy, deciduous vine with glossy pointed leaves and fragrant white flowers in spring on separate male and female plants. Clusters of red fruits on females. Yellow autumn color. Sun. Z 5-8. Source: Richters Herbs, Goodwood, Ontario, www.Richters.com

Acanthus balcanicus var. hungaricus (Bears' breech) clump-forming perennial with bold, deeply lobed leaves and spikes of bicolored turtleheads. Sun. Z 7-8 Source: www.plantdelights.com

Baptisia sphaerocarpa 'Screamin Yellow' (false yellow indigo) Perennial with yellow-green foliage and bright yellow flowers. Drought tolerant. Sun Z 5-9. Source: www.plantdelights.com

Codonopsis pilosula (Bonnet bellflower, bastard ginseng, dang shen) Chinese medicinal herb, similar to ginseng in uses. Twining herbaceous perennial with small pale greenish-yellow, bell-shaped flowers. Dappled shade. Z 6. Source: seeds from www.Richter's.com

Echinacea 'Art's Pride' (Orange meadowbright coneflower) Herbaceous summer flowering perennial with deep tangerine-orange flowers smelling like orange spiced tea. Heat and drought tolerant. Sun. Z4-9. Source: www.plantdelights.com, Wayside Gardens, Hodges, SC; White Flower Farm

Phlomis ‘Edward Bowles’ (hybrid Jerusalem sage P. fruticosa x P. russelliana) Evergreen shrub with sage-like felty leaves and golden yellow flowers. Sun Z 7-10. Source: www.plantdelights.com

Salvia nemorosa ‘Caradonna’ (Caradonna sage) Herbaceous perennial with dark purple flower spikes, wonderful for summer floral arrangements. Sun. Z 4-8. Source: www.plantdelights.com Wayside Gardens, Hodges, SC, www.waysidegardens.com

Calycanthus floridus ‘Michael Lindsey’ (Carolina Allspice) Deciduous shrub (semi-evergreen in worm areas) with glossy dark glossy green foliage and clove-scented maroon-colored flowers. Pennsylvania Horticulture Society Gold Medal Plant Award 2005. Part sun. Z 4-9 Source: www.goldmedalplants.com

Symphytum x uplandicum ‘Axminster Gold’ (gold-variegated Russian comfrey) Vigorous hardy herbaceous perennial with huge gold-margined leaves. Superb landscape plant for rich moist soil. Scorches in full sun. Part shade. Z 4-9. Source: Heronswood Nursery, Kingston, WA. www.heronswood.com

Zingiber mioga ‘Dancing Crane’ (variegated Japanese ginger) Culinary Japanese herb. Hardy clump-forming herbaceous perennial with white-variegated foliage. Excellent for brightening shady sites and containers. Shade, part Shade. Z 7-10 Source: Terra Nova Nursery, Portland, OR, www.terranovanurseries.com

Laurus nobilis ‘Sunspot’ (Sunspot sweet bay) Similar in appearance and uses to sweet bay, but with attractive random gold-variegated foliage, especially in Spring and Fall. Sun, part shade. Z 7-9 (marginal at 7a) Source: Cistus Nursery http://cistus.com

Podophyllum ‘Kaleidoscope’ (Mayapple) Hybrid mayapple with stunning foliage. Large hexagonal shaped leaves have central patch of white or silver, edged with radiating deeper purple mottling. Blood-red flowers in spring. Susceptible to early frosts. Shade. Z 6-9. Source: Collectors Nursery, Battle Ground, WA, www.collectorsnursery.com

Viola odorata ‘Alba Plena’ (double white sweet violet) Rare form of the common sweet violet, with highly fragrant double white flowers. Good groundcover. Shade, part shade. Z 6-9. Source: Well Sweep Herb Farm, Port Murray, NJ, www.wellsweep.com

Lavandula stoechas ‘Madrid Blue’ (Spanish lavender cultivar) Selection from the Madrid Series of French lavender with the sky blue corollas and whitish bracts. Compact and early blooming. Sun. Z 8-9. Source: Champion Acres Nursery, Cottage Grove, OR, www.championacres.com

Lippia alba var. globiflora (Oaxaca lemon verbena) Fast-growing, lemon-scented shrub with a mounding habit and rounded white blossoms like those of Lippia graveolens. Sun. Hardiness uncertain. Source:

Lippia spp. (caraway verbena) Similar to Oaxaca lemon verbena in habit, but with pink blossoms and caraway-scented leaves. Sun. Hardiness uncertain. Source:

Westringia fruticosa (Australian rosemary, coast rosemary) Evergreen, rounded shrub with white blossoms, produced almost all year in warm areas. Variegated form W. fruticosa ‘Morning Light’ Both

good container plants. Sun. Z 10. Source: Well Sweep Herb Farm, Port Murray, NJ www.wellsweep.com

Quisqualis indica (Rangoon creeper) Rampant climber with fragran white flowers that age to pink then red. Freezes to the ground in zone 8b but grows 15-20 feet in a season. Difficult to propagate. Source of the heart drug quisqualine. Sun. Z 10. Source: Logee's Greenhouses, Danielson, CT, www.logees.com

Tamarindus indica (tamarind) Tropical evergreen tree, grown as semi-evergreen container plant in Zone 8b. Bears small yellow orchid-like yellow flowers and pods containing tart pulp, used as a souring agent. Sun, part shade. Z 10. Source: seed from Richters, Goodwood, Ontario, Canada, www.Richters.com

Salvia brandegei Evergreen shrub with handsome glossy foliage, small pale lavender flowers and violet-gray calyces. Maintenance-free, good in containers. Sun. Z 8-9. Source: Goodwin Creek Gardens

Salvia officinalis 'Variegated Berggarten' (variegated Berggarten sage) New U.S. cultivar derived from Berggarten sage sport. Same as parent in uses, habit and vigor but with broad, irregular creamy-white edges to the leaf. Sun. Z 5-8. Source:

Calamintha ashei (Ashe's savory) Dense bushy shrub with aromatic needle-like leaves and pink flowers all summer. Germinates rapidly after fire. Endangered Florida native from the Lake Wales ridge area. Sun. Z 8-9. Source:

Pimenta dioica (allspice, pimento, Jamaica pepper) Evergreen tropical shrub with aromatic, clove-like aroma. Use leaves in same way as berries. Good container plant in cool areas. Sun. Z10. Source: Well Sweep Herb Farm (with limited availability)

Ballota nigra 'Archer's Variegated' (variegated black horehound) Hardy herbaceous perennial with cream-marbled, wrinkly foliage. Less invasive than the species. Comes true from seed. Sum. Z 4-9. Source: Manor Nursery, UK www.gardenplantsco.uk

Monarda fistulosa var. menthifolia (mint-leaved bergamot, mint-scented bee balm, oregano de la sierra, wild oregano) Lesser known bee balm with a wonderful minty flavor. Good for teas. Hardy herbaceous perennial native to high altitudes in Arizona, central and northern New Mexico. Sun. Z 3-9. Source:

Tanacetum vulgare 'Isla Gold' (gold leaf tansy) Hardy herbaceous perennial with bright golden, ferny foliage that retains its color well through the growing season. Superb contrast with purple-leaved plants. Sun, part shade. Z 4-8. Source: Avant Garden, Dartmouth, MA and Plant Delights Nursery, Raleigh, NC

Diplotaxis muralis (wild rocket, sylvetta) Perennial – good alternative to annual rocket/arugula (Eruca versicaria subsp. sativa). Sun. Z 5. Source: seed from Richters, Goodwood, Ontario, www.richters.com

Glycyrrhiza uralensis (Chinese/Manchurian licorice, gan cao) Most widely used of all Chinese medicinal herbs. More impressive than common licorice (Glycyrrhiza glabra) as a garden plant with interesting bristly pods. Sun. Z 6. Source: seed from Richters, Goodwood, Ontario, www.Richters.com ,Southern Seed Exchange, Mineral, Virginia.

Hippophae rhamnoides (sea buckthorn) Deciduous thorny shrub with narrow silvery leaves and rusty-orange berries on female plants, rich in vitamin A and C. Source of anti-ageing oil. Ornamental, good

for hedges in coastal areas and sandy soil. Sun. Z 3-4. Source: seed from Richters, Goodwood, Ontario, www.Richters.com Forest Farm Nursery, Williams, Oregon

Opopanax chironium (Opopanax) Handsome perennial with bold, pinnate leaves and umbels of bright yellow flowers. Stout stems yield opopanax resin, used medicinally and in perfumery. Sun. Hardiness uncertain. Does well in Z 8. Source: Deni Bown, contact for seed.

Pinus mugo (dwarf mountain pine, mugo pine) Small-growing shrubby pine, source of pumilio pine oil. Sun. Z 3. Source: Nurseries specializing in conifers and/or alpines.

Sambucus ebulus (dwarf elder, danewort) Herbaceous perennial with vigorous underground rhizomes. Otherwise similar to common elder but stronger medicinally. Sun. Z 4-5. Source: www.jeremymcburney.btinternet.co.uk

Sources for Herb Seeds and Plants

Companion Plants
7247 N. Coolville Ridge Rd.
Athens, OH 45701
740-592-4643
http://www.companionplants.com
P

Nichols Garden Nursery
1190 Old Salem Road NE
Albany, OR 97321-4580
800-422-3985
http://www.nicholsgardennursery.com
S/P

The Cook's Garden
PO Box 535
Londonderry, VT 05148
800-457-9703
http://www.cooksgarden.com
S/P

Renee's Garden Seeds
7389 W. Zayante Rd.
Felton, CA 95018
888-880-7228
http://www.reneesgarden.com
S

Goodwin Creek Gardens
P.O. Box 83
Williams, OR 97544
800-846-7359
http://www.goodwincreekgardens.com
S/P

Richters
Goodwood Ontario L0C 1A0,
Canada
905-640-6677
http://www.richters.com
S/P - some organic/wildcrafted

Johhny's Selected Seeds
955 Benton Avenue
Winslow, ME 04901
207-861 - 3901
http://www.johnnyseeds.com
S - some organic

Thompson & Morgan Seedsmen Inc
P.O. Box 1308
Jackson, NJ 08527-0308
800-274-7333
http://www.thompson-morgan.com
S

Mulberry Creek Herb Farm
3312 Bogart Road
Huron, OH 44839
419-433-6126

Seed Savers Exchange
3076 North Winn Road
Decorah, IA 52101
563-382-5990

http://www.mulberrycreek.com
P - organic

P=Plants S=Seeds

http://www.seedsavers.org
S - heirloom

Well-Sweep Herb Farm
205 Mount Bethel Road
Port Murray, NJ 07865
908-852-5390
http://www.wellsweep.com
P

Public Gardens & Master Gardeners Session

Sudden Oak Death: an Arkansas Update

Dr. James Robbins, Associate Professor
Dept. of Horticulture
University of Arkansas Division of Agriculture

Sudden Oak Death (SOD) or Ramorum Blight is a relatively new disease caused by the fungus-like pathogen, Phytophthora ramorum.
P. ramorum was first described in 1993 after its discovery on nursery stock in Germany and the Netherlands. In 1995 several Coastal Live Oaks and Tanoaks (Lithocarpus) were reported to be dead or dying along the coast of Northern California. During the next five years similar symptoms were reported on dead and dying trees in 12 coastal counties in California. The first confirmation that the fungus-like disease was in the United States was made in 2000 by a researcher in California. Infections in Europe and the United States have now been determined to involve two different genotypes or races of P. ramorum. Experiments suggest that the European genotype may be more damaging to nursery crops.
In March 2004 P. ramorum was confirmed in two nurseries in Southern California. Because these nurseries had shipped large numbers of plants across the United States, the Animal & Plant Health Inspection Service (APHIS) initiated what is called a trace-forward search for suspected plants. By May of 2004 the disease had been detected in nurseries in 14 states including Arkansas.

Should we be alarmed in Arkansas?
No. While Ramorum Blight/SOD is a potentially serious disease that affects a large number of ornamental trees and shrubs, the disease does not appear to have established itself in Arkansas at this time. Since the disease favors cool, wet weather, we do not even know if it would survive in our climate with our hot, dry summers. In addition, several agencies are monitoring this situation very closely and working vigorously to eliminate future spread of this disease. Concern that this disease may severely impact the natural forest ecosystem of Arkansas seems unwarranted at this time. Based on observations in California, the disease is a secondary pathogen that attacks only trees weakened by an unhealthy ecosystem. A number of dead or dying trees in California have now been confirmed to not be infected with P. ramorum. If someone has a plant they believe to possibly be affected with Ramorum Blight/SOD they are urged to contact their local county extension office. A discussion of symptoms follows.

Is SOD different from Ramorum Blight?
No. Depending on whether the disease is found on a tree (i.e. SOD) or a shrub (i.e. Ramorum Blight) distinguishes which name we use for this disease. SOD and Ramorum Blight involve the same pathogen, Phytophthora ramorum. Use of multiple names for this disease has contributed to additional confusion.

What plants are affected?
Initially the concern was for disease risk on camellia's. Now the list of ornamental plants that can serve as a host for this disease has grown to over 60 plants many of which do not grow in Arkansas. The most likely host plants in Arkansas landscapes include camellia, rhododendron, azalea, Pieris, Leucothoe, lilac and tree species in the red oak group (e.g. Pin Oak, Northern Red Oak). An update list of host species can be found at: http://www.aphis.usda.gov/ppq/ispm/sod/pdf_files/usdasodlist.pdf .

What are the symptoms?

The challenge in identifying this disease is that symptoms are easily confused with other plant problems and the test to confirm the organism is expensive and time consuming.
Discussion on this disease is broken into two categories depending on the type of plant involved. The first group of plants are tree species including trees in the red oak group (e.g. pin oak, red oak). The other tree species do not typically grow in Arkansas. When the pathogen is associated with trees we refer to the disease as Sudden Oak Death (SOD). Symptoms on trees typically involves a bark canker or bleeding spot. Removing the bark reveals brown discolored phloem tissue. The term 'sudden' oak death is a misnomer since death of trees is typically a very slow process. Symptoms of SOD should not be confused with other problems including boring insects and wetwood disease.
For non-tree species we commonly refer to this disease as Ramorum Blight. For shrubs the symptoms typically involve a foliar blight and/or twig dieback. These irregular diffuse necrotic leaf lesions can easily be confused with other fungal problems. Foliar symptoms appear most visibly in late spring/early summer in Arkansas.
Since the symptoms of Foliar Blight or SOD are easily confused with other disease and insect problems, initial screening must be done by either plating on a selective media or an ELISA test, both of which are time consuming and expensive. A positive test by either of these methods must then be further confirmed by another expensive laboratory test (PCR).
To minimize confusion and help in the identification process the Arkansas SOD committee has developed a pre-screening questionnaire and photographs. The materials are available at your local Cooperative Extension Service office. If it is determined following appropriate screening that your plant may have Ramorum Blight/SOD, a sample submission sheet can be obtained from the same office. The sheet gives clear instructions on how to collect and ship samples to the Diagnostic Laboratory.
In summary, symptoms for this disease are easily confused with other biotic and abiotic problems, thus requiring more sophisticated testing to confirm presence of this pathogen.

How is Ramorum Blight/SOD spread?
Moist, cool, windy conditions are thought to spread the pathogen by dispersing spores from infected hosts. Transport of infected foliar host plants or plant tissue (bark) may aid the spread throughout the U.S..

Management:
If your symptoms are confirmed to be associated with P. ramorum, infected plants will need to be destroyed since no chemical control measures are currently available.

Resources:
http://www.aphis.usda.gov/ppq/ispm/sod/

http://www.txnla.org/pdf_files/pramorum/OSUPramorum.pdf

http://www.agctr.lsu.edu/eden/Issues_View.aspx?IssueID=6f50dd52-cca0-4434-8173-b6b44c18a65c

Public Garden Development in Northern Oklahoma

Kelley Conaghan
Northern Oklahoma College
Tonkawa, OK

Kelley has been an employee of Northern Oklahoma College for 14 years, a Kay County Master Gardener for 5 years while currently serving as president, and she works with the Tonkawa 4-H group as a Junior Master Gardener leader. She serves on the city of Tonkawa—Downtown Beautification for the chamber and is a member of the Pride Committee, a sub-committee of the city council. Kelley is frequently invited to share her gardening experience with various civic groups throughout Kay and Grant counties. Northern has been an Affiliate Garden member of the OBGA since 1996.

NORTHERN OKLAHOMA COLLEGE BOTANICAL GARDENS PLANT LIST

1. Acer campestre Hedge Maple
2. Acer campestre stem
3. Acer campestre stem and leaves
4. Acer pseudoplatanus sun scald Sycamore Maple
5. Acer pseudoplatanus shape
6. Acer pseudoplatanus leaf
7. Alnus maritima Seaside Alder
8. Alnus maritima
9. Alnus maritima fruits
10. Asimina "Paw Paw"
11. Betula ermanii Golden Birch
12. Betula ermanii
13. Betula ermanii bark
14. Blue Salvia and butterflies
15. Blue Salvia
16. Blue Wave Petunia West Central Hall
17. Lady in Red Salvia
18. Eastern Red Cedar hit by lightening
19. Eastern Red Cedar hit by lightening
20. Eastern Red Cedar dagger
21. Cedrela sinensis
22. Central Hall plantings
23. Ceanothus ovatus
24. Chlorotic pin oak
25. Cornus florida
26. Cornus florida leaves
27. Cotoneaster glaucophyllus and eucalyptus
28. Crepe myrtle fall color
29. Crepe Myrtle fall color
30. Euphorbia dulcis "Chameleon"
31. Euphorbia tiricilla
32. Fiber Optic Grass
33. Ginko biloba
34. Hydrangea Pink Bouquet
35. Hydrangea King George
36. Group of hydrangea
37. Hypericum
38. Hypericum
39. Hypericum erectum Gemo
40. Hypericum fruits
41. Jasminum stephanense
42. Acer fremanii Autumn Blaze Maple "Jeffers Red"
43. Acer fremanii
44. Lonicera pericylnum Harelquin
45. Lonicera pericylnum
46. Lonicera pericylnum
47. North Admin Hypoestes and caladiums Postman Joyner and White Christmas
48. Phellodredron lavalei
49. Sambucus nigra Pulverata
50. Lysimachia punctata Alexander Sun Drops
51. Quercus bark
52. Quercus leaf
53. Quercus leaf and bark
54. Quercus leaf
55. Quercus leaf
56. Quercus aliena
57. Quercus aliena bark and leaves
58. Quercus saulii
59. Quercus saulii leaves
60. Quercus saulii leaves
61. Acer saccharum fall color
62. Quercus rubra
63. Butterfly garden
64. Rhamnella franguloides fall color
65. Rhamnella franguloides
66. Rhamnella franguloides trunk
67. Rhamnella franguloides fruits
68. Rhamnella franguloides trunk
69. Rose Desert Peace

70. Rose Peace
71. Rose Peace
72. Rose Veterans Honor
73. Rose WW II Memorial
74. Sorbus alnifolia Korean Ash
75. Stapelia gigantea
76. Stapelia gigantea
77. Sweet Potato Harold
78. Sweet potato Wilkin
79. Texas Ebony
80. Tilia japonica
81. Ulmus serotina
82. Ulmus szechuanica
83. Up close Jeffers red
84. Vibernum
85. Vibernum
86. Vibernum Autumn Jazz
87. Vibernum Blue Muffin petiole
88. Vibernum Blue Muffin
89. Vibernum Blue Muffin
90. Vibernum Blue Muffin
91. West Admin
92. White Salvia

Garvan Woodland Gardens: An Overview

Bob Byers, Garden Director
University of Arkansas
School of Architecture

Garvan Woodland Gardens, an endowed gift from Malvern industrialist and philanthropist Verna Cook Garvan, is the botanical Garden of the University. Located 3 miles south of Hot Springs National Park, the Gardens reside on a 210 acre peninsula in Lake Hamilton, the most popular recreational lake in the Mid-South. Deeply forested hillsides are reflected in the crystal clear waters of this second largest of the 'Diamond Lakes', creating one of the most picturesque sites for a public garden in the United States.

Mrs. Garvan inherited numerous assets from her father, Arthur B. Cook, upon his death in 1932. Among those properties was the site of the gardens, which she started developing in 1956 as a personal garden. Over the years, her vision grew and she began to realize the potential of the property for public use. The site is covered by a ninety year old second growth forest and Verna was adamant that the woodland character of the site be preserved.

With no heirs to whom she could leave the gardens, the property was deeded to the University of Arkansas Program in Landscape Architecture in 1985 through a trust agreement. That agreement left the property, valued at $21 million, and all her liquid assets and real property as an endowment, to the University. At the time of her death in 1993, the endowment was valued at approximately $3.5 million and that endowment had grown to $5.1 million by 1998.

The garden left by Mrs. Garvan included about 1.8 miles of service roads and trails, a pavilion and restroom facility designed by internationally acclaimed architects E. Fay Jones and Maurice Jennings, a large and very well built shop building, a small antique rose garden, a collection of about 800 azaleas of 135 varieties, 65,000 daffodils, a nice collection of established Japanese maples, and a large collection of unusual taxa Verna had collected over the years.

This left the University and the young garden, which Verna had named Twentieth Century Gardens to signify her wish it be maintained as a tribute to natural preservation in that century, positioned extremely well. With more than adequate space, endowment with which to maintain the existing gardens and plan an expansion, a existing collection of some merit, and a tourist population of two million annually at the national park, the chances for success with a public garden were very high.

While the property was quite beautiful in spring and of interest year-round to aficionados of naturalistic gardens, it lacked many basic visitor services and adequate planning for year-round interest. So, after 3 years of documenting the collections and the site, the University began the process of a master plan for the Gardens. Botanical garden planning specialists Behnke and Associates of Cleveland, OH, in cooperation with local landscape architects Ritchie Smith & Associates, biologist Bill Pell of the US Forest Service, and a physical plant specialist from the Missouri Botanical Gardens, led that effort.

Following a year and a half of site analysis, input sessions, reviews with the School of Architecture, and audience research, a 25 year master plan, projecting $65 million in capital improvements, was presented to the University and accepted in the spring of 1998.

The master plan provided the last piece needed for a capital funding campaign. It was decided that due to the lack of many basic facilities and need for major financial investment in infrastructure, a public funding drive should be the first step of the process. It provide a two or three venues of outstanding quality, after which the focus of fundraising would shift to the private sector.

Between 1998 and 2002, approximately $7.5 million in public funds were generated and applied to improving the gardens through a joint effort of the School of Architecture and the UA Cooperative Extension Service. Primary sources for that funding were the Arkansas Natural and Cultural Resources Council, the Arkansas Legislature, and the Arkansas Economic Development Commission.

That funded completed an entry road and Phase I parking facility, a new 5,100 sq. ft. Welcome Center, the Garden of the Pine Wind(a new Asian Garden), the Flowering Border (outdoor event space and mixed perennial border), a 600 seat amphitheater, and improvements to make most of the existing trail system compliant with the Americans with Disabilities Act. Many major new plantings and several water features were also included.

Beginning in late 2002, while public fundraising continued, attention began to shift to private fundraising. Those efforts have resulted in approximately $5 million in gifts to date. Most of those funds are dedicated to the Anthony chapel, a wood frame and glass structure in the style of Thorncrowne Chapel in Eureka Springs. The chapel complex will also include a carillon, celebration garden, and two secondary buildings for dressing, restrooms, and small receptions and meetings. Construction on the chapel itself began in late October 2004 with a projected completion date of January 2006.

Upcoming projects are the Evans Children's Garden, with construction beginning in February 2005 and completion expected in late 2006 or 2007. Numerous other improvements are projected in the next ten years, including an expansion of the Welcome Center, a new rose garden by P. Allen Smith now in design development, major improvements to the maintenance facilities, and an education center and demonstration gardens.

Staff has grown from 3 full-time in 1994 to 15 full-time and 2 part time sales and management staff and 7 full time and 18 part time maintenance and construction workers. Most structures and landscapes improvements at the gardens have been built by in-house staff, yielding much greater control over projects and major cost savings.

Numerous special events are taking place now annually, including daffodil, tulip, chrysanthemum, and holiday lights festivals and the Gardens are an increasing popular wedding venue. Last year, 84,000 visitors enjoyed the property throughout the year, as the gardens is open 50 weeks of the year, closing only the first two weeks of January.

Garvan Woodland Gardens is a wonderful asset for all residents and visitors to Arkansas and the Mid-South, illustrating good design and good horticultural practice. We at the Gardens and the University hope it will become a premier facility for the people of our region.

Plant Obsessions

Jon T. Lindstrom, Department of Horticulture, University of Arkansas,
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tranell@uark.edu

Jon T. Lindstrom is an associate professor in Horticulture at the University of Arkansas. He teaches woody plant material courses and his research areas include hybridization, selection and evaluation of plants suitable for Arkansas landscapes.

I like the broad definition of obsession: "a compelling motivation." This accurately defines my hybridization work with several groups of ornamental plants at the University of Arkansas. The two main groups discussed herein are two genera in the family Agavaceae, Polianthes L. and Manfreda Salisb., and the genus Buddleja L.

Manfreda and Polianthes

Polianthes tuberosa L. is the best known member in the genus Polianthes. This species was originally thought native to Mexico but now exists only in cultivation (Ogden, 1994). It is commonly cultivated as a summer cut flower. Because it does not ship very well, most cut tuberose are found in local farmer's markets (Armitage and Laushman, 2003). The species is also extensively grown for use in the perfume industry (Ogden, 1994). The other members of the genus are also Mexican natives but are much less commonly encountered. Several species (e.g. P. geminiflora (La Ll. & Lex.)Rose. and P. howardii Verh.-Will.) have brightly colored, orange or red, tubular flowers borne well above a basal rosette of slightly fleshy, linear leaves. Interspecific hybrids between P. tuberosa and the orange or red-flowered species have resulted in a number of hybrids slowly gaining popularity as cut flowers (Howard, 2001; Huang et al., 2002). These hybrids include Polianthes (species #2 × P. tuberosa) 'Sunset' (Howard, 2001) and two cultivars of P. ×bundrantii Howard (P. howardii × P.tuberosa), 'Mexican Firecracker' and 'Chirp'.

Closely related to Polianthes, the genus Manfreda has a more extensive range from the southeastern United States through Mexico to Central America. There are approximately 20 species in the genus (Howard, 2001). Perhaps best known is the false aloe, Manfreda virginica (L.) Salisb. This Arkansas native is found on prairies and bluffs. The flowers, opening in summer, are found on a slender inflorescence emerging from the center of a basal rosette. Under cultivation, the false aloe is typically deciduous and most plants have rather fleshy, gray-green, unspotted foliage. Manfreda species found in Texas and Mexico are more ornamental. Foliage on these plants is attractively spotted and the flowers are, in some species, shades of green, chartreuse or white. Flowers are also fragrant, but some find the medicinal fragrance objectionable. Verhoek-Williams (1975) first produced a number of interspecific and intergeneric hybrids between Manfreda and Polianthes. Her hybrids between Manfreda virginica and Polianthes tuberosa are mentioned both by Howard (2001) and Ogden (1994) but no pictures are provided.

The goal of this breeding project is to produce intergeneric hybrids that combine the spotting found on certain Manfreda species with the orange flower color of P. geminiflora. Increasing winter hardiness of the intergeneric hybrids through the use of M. virginica is also a possibility. Hybridization between the two genera is easy. Under greenhouse cultivation, both genera typically flower in late spring into early summer. Exceptions in the greenhouse include M. angustifolia Rose., flowering November-January and

M. variegata (Jacobi) Rose., flowering February-April. Since the reproductive parts are large, emasculation is accomplished easily. Typically the anthers shed pollen before the pistil extends to full length and the stigma becomes receptive to pollination. Depending on the species, the capsule matures 30-60 days after pollination. The large, flattened black seeds have no pre-germination requirements and usually germinate 14 days after sowing. Seedlings grow quickly during the warm months of the year, so the best time to sow is in late winter. Interspecific Polianthes hybrids can flower in less than a year from sowing. Interspecific Manfreda hybrids and intergeneric hybrids take two to three growing seasons to flower. Although mature plants can tolerate or even require a cool, dry winter rest, I tend not to allow such a strict rest on the seedlings the first winter. Here too, the genetic make-up of the seedling will affect the need for winter rest. Most Manfreda species do not require a cool, dry winter rest. Manfreda virginica is an exception. With Polianthes, P. geminiflora and P. tuberosa are best kept dry in winter; P. howardii and P. geminiflora v. clavicola McVaugh are watered infrequently through winter.

Buddleja breeding

The tendency of Buddleja davidii Franch. to escape cultivation is well-documented (Oregon Dept. of Agriculture, 2004). The winged seed of B. davidii is lightweight and easily dispersed by wind. Seed germinate rapidly and seedlings mature quickly, flowering in the first growing season. The breeding program at the University of Arkansas is designed to attack this invasive tendency in two ways. The first is to alter seed and fruit morphology and the second is to produce sterile hybrids through ploidy manipulation.

Buddleja in the section Nicodemia Leeuw. (e.g. B. indica Lam. and B. madagascarensis Lam.) have a large, fleshy, berry-like capsule as a fruit. The seeds, especially in B. indica, are large and have no wings. Both B. indica and B. davidii are tetraploids and hybridization between the two species is easy. Hybrids using B. davidii as the female are best since the fruit on B. indica is slow to mature. Hybrid plants between the two species are intermediate in character. The fruit is a capsule that, when it ripens, becomes fleshy. The capsule on the F1 does not dehisce as occurs with B. davidii. Despite the tropical origin of B. indica (Madagascar and the Mascarene Islands), the F1 has been hardy in Zone 6b/7a through the last two winters, albeit herbaceous. Although the foliage is attractive, the low flower count precludes the use of the F1 as a landscape plant. F1 plants have been backcrossed to the B. davidii parent to increase flower number. Progeny of these backcrosses will be selected for desired fruit and seed characteristics.

Tetraploid (2n=76) and diploid (2n=38) species of Buddleja exist (Moore, 1960) and the progeny of the cross between these two should be a sterile triploid. A single seedling was raised from the cross between the tetraploid B. davidii v. nanhoensis Rehd. ‘Moonshadow’ and the diploid B. asiatica Lour. Chromosome counts were done on the progeny and they showed the plant to be a triploid with 57 chromosomes (Renfro, 2004). To date, seed production on the F1 has not been observed. The plant has survived 2 winters in Fayetteville (including above-ground growth). This particular hybrid may be suitable for use in areas where other Buddleja cultivars escape from cultivation.

Literature Cited

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Red Oak Borer and It's Impacts on Arkansas Woodlands

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The Ozark National Forest of north central Arkansas is experiencing a widespread oak mortality event. Mortality was first detected in the late 1990's and Forest Service field surveys estimated that >1 million acres were affected. Observations by Forest Service personnel during this period also indicated that there were rather large numbers of red oak borers present in affected stands. The UA Forest Entomology lab began research on this oak mortality event and the red oak borer outbreak in the summer of 2001, trapping insects and developing sampling procedures for quantifying red oak borer populations.

Red oak borer are native long-horned wood-boring beetles normally found at low endemic population levels that attack and reproduce in living oaks. Based on trapping data from 2001 to 2004, we have confirmed their rather unique synchronous life cycle with adult emergence only occurring in summers of odd-numbered years. Females emerge, mate and oviposit on red oaks and upon egg hatch, larvae bore into the tree and feed in phloem tissues. They over-winter the first year in this feeding gallery, and in the summer of the second even-numbered year, forage in living tree tissues. Simultaneously, they excavate galleries into the heartwood in which they pass their second winter. In the spring of the following odd-numbered, year larvae pupate into adults in preparation for emergence.

To quantify red oak borer populations, we developed an intensive sampling procedure. This procedure starts with harvesting a tree, cutting it into 0.5 m sample units, and transporting it back to the lab for intensive dissection. This consists of counting and mapping all attack and emergence holes, shaving the outer bark, counting and measuring the area of current generation galleries, chiseling into the heartwood to find previous generation galleries, and then finally splitting and counting live larvae in heartwood galleries. Based on our intensive data, we then developed an extensive sampling procedure where we take 9 sub-samples from a tree and using the data from those 9 samples, we extrapolate to the whole tree level. From both intensive and extensive data, we developed a survey method, a rapid estimation procedure (REP), to estimate the five measured population parameters. The REP is based on two variables, crown condition and basal stem (<2 m) emergence holes, which can be assessed in less than two minutes per tree. Based on the REP variables, trees are grouped into one of three infestation histories, Class I (low history), Class II (moderate), and Class III (high).

Using data derived from these techniques, we have been able to answer several important research questions. First, the Ozark National Forest is experiencing unprecedented numbers of red oak borer with attacks averaging >2,000/tree, live larvae at 77/tree and emergence holes >170/tree. Historically, attacks averaged 2-5 per tree and 1 adult red oak borer emerging was considered outbreak conditions. We have also found through stand data measurements that ridges are experiencing greater tree mortality than stands on other topographic positions, e.g. north, south, and east benches. We have also found more red oak borer on ridge stands using passive intercept traps.

We are hoping that this research will lead to greater insights into the biology of red oak borer as well as elucidating reasons for the current outbreak. These methods should be of use in determining red oak borer populations under outbreak conditions and exploring biotic and abiotic conditions associated with outbreaks. Based on data derived, models can also be developed for predicting when and where outbreaks might occur in the future and help landowners manage their forests.

Vegetable Session

Pumpkin Cultivar Trials, 2003 and 2004

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Pumpkin cultivar trials were held in 2003 and 2004 at the Agricultural Experiment Station Fayetteville, AR. 18 cultivars were direct seeded the 4th week of June. Plots 8 plants each, spaced 3 feet apart , 12 feet between rows were randomly replicated 6 times. Pumpkin fruit were harvested October 1 and evaluated for number, size shape, and quality. Plots were irrigated by drip irrigation and standard production practices were followed. During 2004, the same practices were followed except plots were planted during the second week of July. In 2003, large fruited pumpkins yielded 700 to 1950 fruit per acre. Howden, the industry standard yielded 700 fruit, averaging 16 lbs each, with a gross return of $700 per acre. Cultivar fruit size ranged from 15 to 27 lbs, and yields ranged from 10200 to 52000 lbs to the acre. Based on the Oct. 1, 2003 prices from USDA AMS, gross returns ranged from $744 to $1760 per acre. Specialty types, Jack be Quick, Rouge , and Long Island Cheese yielded 15700, 1800, and 1470 fruit per acre valued at $2100, 1950, and 3400 respectively. Excessive rain in June of 2004 , and cooler that normal weather during July and early August significantly affected quality and yields of pumpkin fruit. Fruit number and size per plot were reduced up to 75%. Yields ranged from 10 to 20% of 2003 yields. Fruit quality was significantly affected making the majority of the fruit harvest unmarketable due to immaturity and size.

2003 Pumpkins Ratings

	Handle Rating 5 best 1 poorest	Mean Ht (cm)	Diameter (cm)	Ht/Dia ratio	Mean Indiv. Fruit Wt (lb)	# Fruit/plot	# Fruit/Ac	lb/Ac	Gross $/ A
Autumn Gold	4	17	16	1.1	6.0	19	2798	16705	1170
Autumn King	4	30	25	1.2	19.0	9	1323	25132	1759
Baby Bear	3	9	11	0.8	1.4	18	2647	3706	900
Early Autumn	3	21	21	1.0	11.5	14	2155	24765	1732
Gold fever	4	23	22	1.1	12.0	9	1286	15479	1102
Gold gem	4	24	20	1.2	14.0	8	1255	17550	1240
Gold Medal	5	24	21	1.2	15.8	8	1210	19142	1340
Gold Rush	4	27	31	0.9	23.4	5	726	16996	1225
Howden	4	27	25	1.1	15.3	5	696	10638	744
Hybrid 510	4	27	26	1.1	16.8	8	1180	19855	1350
Jack B Quik	3	4	8	0.6	0.4	104	15730	6323	2100
LI Cheese	2	12	24	0.5	9.7	9	1301	12656	2500
Lumina	2	7	9	0.8	11.0	12	1755	19352	1950
Mammoth Gold	2	27	30	0.9	26.9	13	1936	52020	3120
Pam	5	13	14	1.0	4.3	16	2390	10372	2489

Rouge	1	15	32	0.5	19.0	10	1467	27817	3384
Snackjack	4	12	11	1.2	2.4	23	3403	8133	975
Triple Treat	1	15	16	0.9	4.3	7	1059	4510	500

2004 pumpkin Ratings	Handle Rating	Mean Ht (cm)	Diameter (cm)	Ht/Dia Ratio	Mean Indiv. Fruit Wt (lb)	# Fruit/plot	# Fruit/A	lb/A
Autumn Fever	3	6.7	6.7		6.3	4.8	726	4,566
Autumn Gold	3	6.3	6.2	1.0	4.4	3.9	584	2,580
Autumn King	2	9.3	7.5	1.2	9.5	3.4	519	4,943
Baby Bear	2	3.6	4.6	0.8	2.8	4.9	735	2,089
Early Autumn	2	6.6	6.6	1.0	5.2	5.1	777	4,005
Gold Gem	3	8.8	7.4	1.2	8.3	3.3	498	4,108
Gold Medal	3	9.6	8.7	1.1	9.2	1.4	216	1,999
Gold Rush	2	9.5	8.9	1.1	10.7	0.7	107	1,145
Howden	2	8.1	9.0	0.9	8.9	1.4	216	1,927
Hybrid 510	4	9.6	7.9	1.2	9.8	3.9	584	5,708
Jack B Quik	3	1.6	5.9	0.6	0.2	17.9	2701	459
L I Cheese	1	4.6	5.9	0.8	3.1	2.0	303	952
Lumina	2	5.2	6.2	0.9	3.5	2.0	303	1,066
Mammoth Gold	1	7.1	7.3	1.0	5.9	5.1	777	4,611
Pam	3	4.8	7.1	1.0	2.5	4.3	649	1,610
Rouge	1	4.9	5.1	0.7	4.0	2.7	410	1,652
Snackjack	4	3.9	3.8	1.0	4.3	4.4	670	2,895
Triple Treat	1	5.2	5.1	1.0	2.5	3.4	519	1,290

Canning and Tasting Evaluation of the Southern Pea Cooperative Trial in Arkansas

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There are four Southernpea breeding programs left in the United States: USDA-South Carolina, Louisiana, Texas and the largest at University of Arkansas. Selected breeding lines from these programs are grown in the Southernpea Cooperative Trial. The trial is a cooperative group comprised of members from Alabama, Arkansas, Louisiana, Oklahoma, South Carolina, and Texas. The yield trial is grown at one or more locations in each state. There are two trials: the replicated and the observational. The replicated trial consists of approximately 12 breeding lines and three commercial standards; each entry is replicated 4 times. The observational trial is similar, except the entries are only planted twice. Each location collects the same yield data; at the University of Arkansas-Fayetteville we take it one step further. Mechanically harvested samples grown at the University of Arkansas Vegetable Substation at Kibler, Arkansas are canned using the University of Arkansas Department of Food Science Pilot Plant Facility.

The process we use for canning southernpeas is similar to that used in the industry. A set amount of dry peas are weighed, soaked overnight in water. The next morning the peas are drained, blanched, cooled and then the weight of the soaked peas is recorded. A weighed amount of peas are placed in each can; prepared brine (water, salt, preservatives) is poured over the peas, level with the top of the can. The cans are sealed then cooked in a retort. We let the cans set for about a month before we open the cans and perform the tasting evaluation.

For the tasting evaluation we use a minimum of 10 individuals for a consumer panel. The cans of peas are opened and poured into a large white plate, so that both the peas and the liquid can be viewed. The liquid surrounding the peas in the can is referred to as the liquor. The liquor color is one criteria looked at, one that is too dark or too light is generally unacceptable. Other traits on the survey are pea color, wholeness, texture, flavor, and the general appearance. Panelists are asked to look at and to taste the peas, then rank the samples on a scale of 1-10, 10 being the best. Anything under a 6 is considered unacceptable by industry. Most of the samples will be around an 8. The industry standards are also tasted, these are used as checks.

Results from the canned and tasting evaluation are shared among the cooperators. Canned samples are also taken and displayed at the annual meeting. Not only will the breeders see how their lines yielded across the south, but also how they look and taste as a canned product.

The Food Bank Connections with Vegetable Producers

Chris Kirby – Urban Harvest Director
Regional Food Bank of Oklahoma

Chris Kirby received her degree in Marketing from the University of Oklahoma and has used her experience and knowledge in promoting locally grown agriculture products while also making links between the underserved communities and the local growing community. Chris is the former founder and director of the OSU-Oklahoma City Farmers Market which became the largest year round Oklahoma grown farmers market in the state. Chris is now director of Urban Harvest at the Regional Food Bank of Oklahoma with a mission of providing better access of fresh fruits and vegetables to Oklahomans that are dealing with hunger. Chris serves on several agriculture/horticulture related boards and is a strong advocate for the Oklahoma grower and people in need.

Introduction
At any given moment, 500,000 Oklahomans are at risk of going hungry and 1 out of 5 children are at risk.

The average income of client households receiving food from emergency food programs is less than $10,000.

46% of households have one or more adults working.

The Regional Food Bank of Oklahoma serves 53 counties in central and western Oklahoma and the Eastern Oklahoma County Food Bank in Tulsa serves the other 24 counties. The mission of the Regional Food Bank of Oklahoma is to "help the charitable community effectively feed people in need" and acts as a central clearinghouse through which the food industry and community may donate surplus food and other products.

Feeding programs served include mobile meal programs, children's programs, women's shelters, alcohol and drug treatment centers, homeless shelters, and senior centers.

Unfortunately, fresh produce is often unavailable to senior citizens, homeless families with children, disabled individuals and others in need. A recent study found that low-income women report that high cost and lack of availability are the top reasons they don't eat more fruits and vegetables.

Fresh fruits and vegetables provide valuable nutritional benefits and are part of a healthy diet. Fresh produce provides important vitamins and nutrients (especially for children and senior citizens) that help decrease the incidence and severity of malnutrition. Also, making fruits and vegetables available to children can help establish healthy eating habits for a lifetime.

Even though these statistics are specific to the 53 counties that the Regional Food Bank serves, they are very similar to the 24 counties that the Community Food Bank of Eastern Oklahoma and the state of Arkansas.

The mission of Urban Harvest, an urban agriculture program of the Regional Food Bank of Oklahoma, is to provide people dealing with hunger better access to fresh nutritious fruits and vegetables through on

site vegetables production, growing education, assistance with community gardens, and crop gleaning with the local growing community.

There are several opportunities for the Oklahoma & Arkansas growers with either the Regional Food Bank of Oklahoma, the Community Food Bank of Eastern Oklahoma, Arkansas Food Banks, local food pantries, on-site feeding kitchens and senior centers.

Have you harvested your crop and there is still a lot of good produce left in the field?
Has the bottom dropped out of the market on a certain item and you can't sell it?
Have you had a shipment refused by a company for a minor imperfection?

The Urban Harvest crop gleaning program could be the answer for you. Use your talents and gifts as agriculture producers and donate to your local food bank, emergency food pantry or on-site feeding program to help those in need in your community or state.

No donation is too large or too small. There are tax incentives for your donation. The grower is permitted a charitable deduction for an amount equal to the taxpayer's basis in the contributed property, not its fair-market value. Check with your tax preparer for the exact computation.

There are also liability law that protect you from legal issues for your donations.

Protected by the Good Faith Donor Bill –HB 1052 – Oklahoma law on liability exclusion
This state law protects you as a donor.
Section 1
A. Any donor who makes a good faith donation of food which is at the time of donation fit for human consumption to a charitable organization or nonprofit corporation shall not be liable for damages in any civil suit or subject to criminal prosecution for any injury resulting from the nature, age, condition or packaging of the donated food, unless the injury or death is a direct result of the gross negligence, recklessness or intentional misconduct of the donor.
Section 2
Section 1 of this act shall be codified in the Oklahoma Statutes as Section 5.6 of Title 76, unless there is a created duplication in numbering.
Section 3
It being immediately necessary for the preservation of the public peace, health and safety, an emergency is hereby declared to exist, by reason whereof this act shall take effect and be in full force from and after its passage and approval.
The Good Faith Donor Bill has been in effect since April 1981.

Bill Emerson Food Donation Act – federal law - On October 1, 1996, President Clinton signed the Bill Emerson Good Samaritan Food Donation Act to encourage the donation of food and grocery products to nonprofit organizations for distribution to needy individuals. This new law makes it easier to donate. Here's how: · It protects the donors from liability when donating to a nonprofit organization.
This federal law protects you as a donor.

· It protects donors from civil and criminal liability should the product donated in good faith later cause harm to the needy recipient.
· It standardizes donor liability exposure. Donors and their legal counsel no longer have to investigate liability laws in 50 states.

· It sets a liability floor of "gross negligence" or intentional misconduct for persons who donate grocery products.
· Congress recognized that the provision of food close to recommended date of sale is, in and of itself, not grounds for finding gross negligence. For example, cereal can be donated if it is marked close to code date for retail sale.
For more detailed information visit our website at www.regionalfoodbank.org – click on "how to help" and then go to "donate product". To make a donation, call Chris Kirby at 405-604-7108.
The Urban Harvest program is also hoping to begin a fresh vegetable purchase program in which produce will be purchased at reduced rates and then distributed to the communities dealing with hunger. Access to fresh nutritious produce is almost non-existent.
Where does the produce go after the research is done?
Oklahoma and Arkansas has several fruit and vegetable research and trial farms/gardens
Cornell University donated 96,000 lbs of research fruits and vegetables not including hundreds of pounds of apples, apple cider, milk, etc. last year to their local food bank
Several other universities are partnering with local food banks to help those in need
You can truly make a difference! Don't throw away good produce that can make such an impact in people's lives.
Plant A Row for the Hungry (PAR)
We are looking for PAR coordinators at each farmers market to collect produce at the end of the market and deliver or gather for pickup by a local agency, on-site feeding program or emergency food pantry. Call Chris Kirby for local contact information at 405-604-7108 or email ckirby@regionalfoodbank.org
"Be the change that you want to see"

Herbicide Carryover in Vegetable Rotations Following Field Crops

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Vegetable crops are commonly grown in rotation with other crops including agronomic crops such as field corn, soybeans, and cereal grains. Little is known about the persistence of these herbicides including a lack of information regarding potential carryover and the risk of injury to vegetable crops. Identifying how long a herbicide, once applied to the soil, remains active and causes injury to vegetable crops is necessary information to the vegetable grower in developing a crop rotational system.
Separate field studies with warm-season crops (corn 'Merit', cowpea 'Early Scarlet', snap bean 'Benton', summer squash 'Early Prolific', muskmelon 'Hales Best', cucumber 'Marketmore' and transplanted processing tomato "7985") and cool-season crops (cabbage 'Blue Dynasty', collard 'Champion', kale 'Dwarf Siberian, mustard 'Savannah', spinach 'F380' and turnip 'Alamo') were conducted at the Arkansas Agricultural Research and Extension Center, Fayetteville, Arkansas in 2004 to evaluate the persistence of 14 herbicides at 0, 1X and 2X rates of application in lb ai/A. For warm season crops Stinger at 0.18 and 0.36, Valor at 0.1 and 0.2, Callisto at 0.19 and 0.38, Define at 0.3 and 0.6, Peak at 0.027 and 0.054, Firstrate at 0.016 and 0.032, and Dual Magnum at 1.3 and 2.6; for both warm and cool season crops Raptor at 0.03125 and 0.0625, Sandea at 0.047 and 0.094, Spartan at 0.375 and 0.75; and for cool season crops, Pursuit at 0.0625 and 0.125, Command at 0.75 and 1.5, Reflex at 0.375 and 0.75, and Matrix at 0.0625 and 0.125 were included. The experimental design is a randomized complete split-split plot with four replications with herbicide as the main plot, herbicide rate as sub plots and rows of crops as the sub-sub plots. With warm-season crops: herbicides were applied on the surface of the soil May 15 and the crops planted into a freshly rotary tilled seedbed, starting at the time of herbicide application and at one month intervals through September. With cool–season crops: herbicides were applied on the surface of the soil July 15 and the crops planted August 15, September15 and October 18. Crops were visually rated for injury 3 to 4 weeks after planting.
Herbicide activity on all of the warm season crops had dissipated by one month for Dual Magnum at both rates and activity was very slight at both rates of Define and Firstrate. After two months, activity had totally dissipated for both rates for Stinger, Valor, Raptor and Callisto and very slight activity at both rates for Sandea. At three months Sandea dissipated completely. At four months, Spartan and Peak at both rates still persisted.
All herbicide activity persisted in the cool-season study at one month with the exception of Command. All crops tolerated Command when planted one month after application. Spartan was very damaging to spinach, 100% injury at 3 months after application. However, the other fall-planted crucifera greens were more tolerant than spinach to Spartan carryover. At one month, cabbage injury from Spartan carryover was 75%, kale was 50% collards, turnip and mustard was approximately 25%. Reflex residues were very injurious to all crops, decreasing form 100% injury at one month after application to 50% or more injury at 3 months after application. Matrix, Sandea and Pursuit were very injurious to all crops when planted one month after application. By two months injury to all crops was moderate (below 50%) and by three months after application these herbicides had dissipated to below phytotoxic levels on all crops. Raptor was tolerated by mustard and turnip at one month. Cabbage was injured by Raptor carryover to near 100% at one month with injury dropping to moderate (25%) at two months and dissipating by 3 months. Spinach, kale and collards suffered moderate injury from Raptor at 1 month, with injurious levels dissipating below phytotoxic levels at two months.

Appearance and Taste Evaluations Comparing Amelia and Mountain Spring Cultivars

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The introduction of new tomato cultivars occurs in response to producer or consumer desires for particular production or consumption characteristics. For fresh market tomatoes, variety appearance characteristics may or may not be positively correlated with the variety taste characteristics desired by fresh market consumers. Furthermore, the variety characteristics desired by fresh market producers do not always correspond with consumer preferences. This research seeks the appearance and taste preferences of fresh market tomato consumers when comparing a Southeast Arkansas industry standard cultivar to a new cultivar introduced for desirable production characteristics.

Desirable characteristics of fresh market tomatoes include good taste, with regard to both flavor and juice; long shelf life to permit distant distribution; proper color; appropriate fruit size; and proper fruit shape. Producers in Southeast Arkansas have been especially hard hit in the past decade by tomato spotted wilt virus outbreaks. The extent of losses in these outbreak years has led producers to adopt resistant/tolerant cultivars.

Fruit used in this research was produced in small plot, outdoor tests of two commercial tomato cultivars on the University of Arkansas at Monticello campus. Transplants were placed in raised bed plots of six plants each on April 6, 2004. Five replications were made for each cultivar. The beds were covered by black plastic mulch with a plastic drip line system for both irrigation and nutrient application.

The industry standard cultivar was Mountain Spring, a traditional variety released by Dr. Randy Gardner of North Carolina State University. Mountain Spring matures in 69-72 days, is determinate in growth, produces high yields with many extra-large to jumbo red fruit, and has good firmness with resistance to cracking and blossom end rot. The major weakness of Mountain Spring is no resistance to tomato spotted wilt virus.

Amelia was the new cultivar that has recently been adopted for Southeast Arkansas production. Harris Moran Seed Company originally released Amelia as 800HK. Fruit mature in approximately 80 days. Amelia is described as a vigorous determinate with smooth medium-large fruits that are firm and aromatic. The cultivar has multiple disease resistance/tolerance including Fusarium 3. Southeast Arkansas producers have adopted this cultivar primarily due to its resistance/tolerance to tomato spotted wilt virus.

This research was conducted to identify consumer preferences by appearance and taste. Disease resistance of Amelia was expected to result in superior fruit appearance. The consumer familiarity with Mountain Spring was expected to make its fruit prefered on the basis of taste. Harvesting began on June

10 for the earlier maturing Mountain Spring and June 17 for Amelia. Harvest were continued at 3-7 day intervals according to ripening rate. All harvests for yield and grade results concluded on July 12.

Consumer evaluations were conducted in the UAM Agriculture Building on July 8, 2004. Forty five participants first compared fruit of the two cultivars on the basis of appearance. The setting simulated a grocery or fresh market situation where consumers had three fruit of each cultivar on separate paper plates identified only by a number. Consumers could handle, feel, smell, etc. the fruit as in a supermarket. They marked their preferred cultivar number and submitted the paper to the researchers. The same consumers then were taken across the hall for a taste evaluation. Participants were given numbered fruit slice samples and allowed to add salt if desired. The participants were told that taste identification numbers did not necessarily correspond to the numbers used for cultivars in the appearance evaluation. Taste preferences were submitted as in the appearance part.

Appearance results indicated that 28 of the 45 participants preferred the Amelia fruit over the Mountain Spring (Table 1). This result corresponded with our expectations. Comments of the participants included "firmer," "nicer shape," and "better color" for the Amelia cultivar.

Taste results showed 33 of the 45 participants preferred the Mountain Spring fruit over the Amelia (Table 2). Mountain Spring comments, as expected, included "more juicy" and "better flavor" than the Amelia that was described as "flat" and "off flavor."

Consumers evaluating tomato fruit from the Mountain Spring and Amelia cultivars preferred Amelia on appearance and Mountain Spring on taste. These results support our expectations that a conflict appears to exist between the tomato spotted wilt resistant Amelia cultivar versus the traditional Mountain Spring cultivar. Unless consumers can be convinced to buy the less tasty Amelia, producers must evaluate costs and probability of a tomato spotted wilt virus outbreak versus decreased demand for their fruit compared to Mountain Spring.

Table 1. TOMATO APPEARANCE RESULTS

VARIETY	Mt. Spring	Amelia
First Choice	17	28

Table 2. TOMATO TASTE RESULTS

VARIETY	Mt. Spring	Amelia
First Choice	33	12

Heirloom Tomato Evaluation in Arkansas

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A fresh market tomato trial was conducted to evaluate new and old tomato varieties of interest to home gardeners and farmer's markets. Craig Andersen, the Vegetable Specialist for the Arkansas Extension Service, uses these trials for recommendations of varieties. In 2003, the trial was held at two University of Arkansas locations: Vegetable Substation at Kibler and the Experiment Station at Fayetteville. The trial consisted of 43 varieties, indeterminate and determinate. Entries included small types, pastes, heirloom/specialty, commercial, and processing tomatoes. We transplanted (April 14 at Kibler and May 6 in Fayetteville) into raised beds with black plastic mulch and drip irrigation. One 12 ft plot of each variety was planted at each location. Each plot consisted of five plants, spaced 2 ft apart with 6 ft row spacing. We harvested from the interior 3 plants for five weeks.

The focus of this presentation will be 'heirloom' tomatoes. The definition of heirloom tomatoes varies greatly with the source, but typically, they are tomatoes that have been around for 3 generations, with some exceptions. The term heirloom is used loosely; it seems that the term is being used to describe anything that does not resemble the uniform red tomatoes we can buy in the local supermarkets. Heirlooms are rapidly gaining popularity. I expect them to be in demand throughout the country in the near future. Heirlooms are unique and very eye-catching. There is immense variety in shape, size, and color. Colors range from white, purple, green, black, yellow, orange, pink, red, striped, and anything in between. They can be large or small, many times the shape is irregular, and the fruits flawed (cracking, cat-facing, green shoulders). The fruit may not store or ship well, so they are grown and sold locally, with a few exceptions. As with any developed cultivar, performance may greatly vary across the location. Most true heirlooms came from seed shared among neighbors and eventually made nationally available. These lines survived through time because of one main factor, flavor. Heirlooms are notorious for having superior flavor. The fruit is picked ripe and used soon after harvest. Shelf life and shipping characteristics were not a factor in the deep past. Many of these lines are fragile, but not all.

I believe much of the initial draw of heirlooms to the public is the nostalgia, the history. Many of the tomatoes have a story, and that is much of the sell, but the flavor will be what gets a tomato fan hooked on a particular variety. Consumers buy something that tastes good to them, and that may not always be what looks good. And with heirlooms they can be sold by name, just like a fine wine. There are good and bad heirlooms, yields can be high or low; flavors vary from sweet to tart, mild to acidic. It all comes down to personal preference, and heirlooms give consumers a choice. There is a tomato to suit every person and their every mood. One suggestion, if you are going to try to sell heirlooms, sell them by name and offer samples.

The Arkansas 'Pinks' (Bradley, Traveler 76, and Ozark Pink) may not fall into the heirloom category, but many times are listed alongside heirlooms in catalogs. These lines were once grown commercially, but have been replaced by larger more disease resistant varieties. These tomatoes are preferred by many Arkansas gardeners. The flavor is sweet, the skin is thin, and they perform well in Arkansas summers.

Table 1. 2003 Tomato Evaluation in Arkansas

Entry	Days to Maturity	Plant type1	Description	Fayetteville Yield lb/plant2	Kibler Yield lb/plant2	Comments
Abraham Lincoln	78	I	10 oz red round	15.1	12.8	Great Flavor
Dona	65	I	Deep red	13.9	12.9	Excellent balanced flavor
Costoluto Genovese	90	I	6 oz Red ruffled fruit	13.4	21.0	Good 'tomato' flavor Good slicer
Brandywine	90-100	I	> 1 lb pink	3.3	8.5	Fruit had lots of flaws
Red Potato Leaf Brandywine	90-100	I	Red fruited Brandywine	2.5	9.3	Fruit had lots of flaws
Red Regular Leaf Brandywine	90-100	I	Red fruited Brandywine	5.8	12.2	Fruit had lots of flaws
Yellow Brandywine	90-100	I	Yellow Brandywine	6.5	5.8	Good flavor Fruit had lots of flaws
Persimmon	80	I	1-2 lb orange fruit Vigorous plants provide good cover.	-	-	Excellent flavor Fruit has few flaws
Green Zebra	75	I	3 oz uniform; green striped skin, green flesh	5.0	5.8	Plants have good cover; BER
White Beauty	85	I	8 oz white skin & flesh	7.5	7.0	Mild flavor; prone to crack and fruit rot
Cherokee Purple	90	I	10 oz Purple skin, red flesh	5.3	9.9	Green shoulders and cracking
Carbon	80	I	10 oz, black skin,	2.7	9.2	Cracking, sunburn
BradleyAR	80	SD	7 oz Pink, FW resistance	8.9	8.5	Heat resistant; prone to crack.
Traveler 76AR	78	SD	6 oz Pink	5.5	6.1	Heat Resistance; Less cracking than Bradley
Ozark PinkAR	80	I	7 oz pink	9.2	11.0	Larger than Traveler 76; Heat resistant
Arkansas 7985AR		D	2-3 oz red paste Resistant to fruit rot	7.9	7.1	Uniform fruit is firm; Holds on plant
San Marzano	80	I	3.5" Blocky Fruit Holds well on plant	11.5	8.2	Fruit holds well on plant; stores well
Super Marzano VFNT	90	I	5" red paste fruit Bacterial Spec resistant	3.3	7.0	Fruit stays hard; never seemed to ripen, no flavor

1 D=Determinate I= Indeterminate SD=Semi-determinate FW=Fusarium Wilt
2 For a per acre yield: multiply by 3800 plants/A BER= Blossom End Rot
AR Released by University of Arkansas Experiment Station

Many more varieties were grown in the trials in 2003 and 2004 that were not discussed. For more information on this trial please contact Danielle Williams, dbradfo@uark.edu , or Craig Andersen, crander@uark.edu, or either at University of Arkansas Department of Horticulture 479.575.2604.

Seed Source: Totally Tomatoes 800.345.5977 www.totallytomato.com

Digital Assisted Diagnosis of Plant Problems

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The use of digital imagery for assessing plant problems has become increasingly common during the past five years. Digital photos are routinely used in medicine and other fields of science for information exchange. Since digital photographs are very versatile, they offer several distinct advantages to film photos. One major advantage is that digital photos can be taken instantly and sent electronically. Several hundred photos can be stored on a small electronic chip or card compared to storage required for several rolls of film. Modern computer software programs also enable the photographer to edit the digital photos in a multitude of ways before submitting or printing them.

Plant health diagnosticians at many universities and other professionals around the United States commonly use digital imagery to assess plant health problems. Photos are most commonly taken by a "troubleshooter" in the field in response to a client's request. Photos are often submitted as an email attachment or within an electronic document to a plant disease diagnostician or other trained professional who can view and use the photos as tools to formulate a solution to the problem. In some instances, a diagnosis can be made directly from the photos. In other cases, a physical plant sample may be requested for diagnosis, especially when lab testing may be required by the plant health professional.

Several factors should be considered when taking digital photographs for the purpose of diagnosing plant problems. The primary objective of the photos is to clearly define the problem that is to be examined by the professional. Thus, a series of photos is often necessary to define the problem. For field photos, an overall view of the area in question should be included with closer views of individual affected plants. Photographers are often afraid to take close-up images. Closer views create a more useful story to the professional who evaluates the photos. It is always best to take plenty of photos. Extras can be deleted later.

The photographer needs to be familiar with all of their camera's settings provided in the instruction manual. The quality and type of light is an important component in taking good photos. Diffuse light is often the best. It prevent shadows that may obscure important details. Correct color balance provides true colors of the subject being photographed. Using an appropriate background for the subject also helps to bring out details. As a general rule, use a lighter background for darker subjects and a darker background for lighter subjects. Many photographers routinely use a neutral gray background. This color can be used with a multitude of different colored subjects. Avoid cluttered backgrounds as they may conceal details of the main subject.

Digital photos can be edited in a variety of ways using the software available today. Before digital images are submitted to a plant health professional for examination, they should be reviewed and edited if necessary. Proper editing can enhance the photo, bringing out details that may be important. Editing cannot correct an out-of-focus image. Make sure the image is in focus before submitting. An out-of-focus image is useless to the recipient.

Image file size is an important consideration, especially if it is to be sent electronically. Many plant professionals receive digital photos as email attachments. The file size of most digital images taken with newer cameras may reach more than 2 MB. These larger images are often saved in the camera as a TIFF format. For many email systems, this size is too large to be sent effectively. Submitters should reduce the image file size before sending. Photographers should consider saving the original photo to their computer hard drive or disk and sending a reduced size image electronically. A digital image file size of 125-200 KB and saved in a JPEG format is quite satisfactory for most applications when sent electronically. Images with a larger file size are often used for printing high quality photographs for publications. File size can be reduced in a number of ways. One common way to reduce the image size is by cropping the photo using software included with the digital camera or purchased separately.

As digital images become more commonly used in diagnosing plant problems, photographers should become familiar with their camera's capabilities to produce high quality images that offer many distinct advantages over conventional film cameras. The versatility of digital images and ease of handling make digital imagery a valuable tool for plant health professionals.

Effects of Supplemental Foliar Fertilization of B, Ca, and K on Pear and Large-Fruited Tomato

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Foliar application of plant nutrients can sometimes increase crop yields and improve the quality of harvested fruit. The situations where foliar application of plant nutrients may be warranted are where soil and tissue tests indicate potential nutrient deficiencies or when the grower seeks to try and improve yield and quality by preventing potential nutrient deficiencies. Although the primary means of nutrient uptake by plants is the root system, it has been shown that plants are able to absorb and utilize foliar applied nutrients. The uptake, translocation and utilization of foliar applied nutrients is affected by several factors such as degree of plant coverage, moisture status of the crop, time of day, general vigor of the crop, plant nutrient and crop growth stage. A study was initiated in 2004 to investigate the effects of four foliar nutrient treatments on the fruiting characteristics and yields of fresh-market pear ('Classica') and large-fruited ('Amelia') tomato. Treatments applied were 1) an untreated check (UC); 2) 'Perc Plus'® bio-stimulant (Delt-Ag Formulations, Greeneville, MS) transplant drench applied at 3 oz/plant at a 16 oz/acre rate followed by a foliar application 7 days later at 16 oz/acre rate (PP); 3) a foliar program of 0.06 lbs Ca/acre + 0.015 lbs B/acre at first bloom followed by 4 weekly applications of 0.06, 0.15 and 0.82 lbs/acre Ca, B and K beginning at second cluster set (FF); and 4) treatments 2 and 3 combined (PPFF) in a randomized complete block design with five replications. Pre-harvest flower and fruit counts revealed a significant treatment effect of foliar treatments on the number of set fruit for the 'Classica' cultivar. Treated plants averaged 40 fruit per plant compared to 33 fruit per plant for the untreated check. There were no differences in fruit set between treatments 2-4. No treatment effects were observed on the number of clusters or flowers for 'Classica' or for clusters, flowers or set fruit for the 'Amelia' cultivar. At the end of the harvest period, no treatment effects were observed on marketable fruit yields for any cultivar studied. Rainfall for the 2004 growing season was 2.2 times greater than average and water damage to fruit quality was subsequently higher than normal, which might have influenced the effects of the foliar treatments on fruit integrity. The study will be repeated in the 2005 growing season.

Corn Gluten Meal Application Methods for Weed Control

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Introduction

Turfgrass research conducted at Iowa State University in 1986 demonstrated a reduction in creeping bentgrass (Agrostis palustris Huds.) establishment after the incorporation of corn meal into the top 3 to 4 inches (7.5 to 10.0 cm) of the soil surface (Christians, 1993). The original intent of the Iowa research was to determine the weed control potential that a Pythium fungus cultured on corn meal would have on creeping bentgrass establishment. The experimental treatments compared the effect of soil surface incorporation of the inoculated corn meal (Pythium and corn meal), the incorporation of non-inoculated corn meal (corn meal only), and a "control" treatment in which neither the inoculated nor the non-inoculated corn meal was applied or incorporated. Creeping bentgrass was then seeded into each plot. Although creeping bentgrass development was not inhibited as a result of the inoculated corn meal, its establishment was reduced in the plots where fresh non-inoculated corn meal was applied (Christians, 1993). This unexpected finding generated research questions regarding the role of corn meal in weed control.

Christians (1993) conducted further research to evaluate the weed control potential of applying corn starch, corn gluten meal, corn germ, corn seed fiber, or corn meal to the soil surface with the objective of determining the weed control efficacy of the various corn seed components. The research determined that corn gluten meal (CGM) produced the greatest inhibitory effect and reduced root formation in several weed species, including creeping bentgrass and crabgrass (Digitaria spp.).
Corn gluten meal is the by-product of the wet-milling process of corn (Quarles, 1999; Bingaman and Christians, 1995). Chemical analysis of this protein fraction of corn (CGM) is approximately 60% protein and 10% nitrogen (Quarles, 1999). CGM, normally a yellow powder1,2 (McDade, 1999), has been used as a component in dog, fish, and livestock feed (Quarles, 1999; Christian 1991, 1995). Corn gluten meal can be purchased in a pelletized form (McDade, 1999) and as a granulated material1.

In greenhouse studies, Bingaman and Christians (1995) determined that CGM applied at 6.6 lb/100 ft2 (324 g/m2) reduced plant survival, shoot length, and root development for the 22 weed species tested, whether the CGM was applied to the soil surface as a preemergence herbicide or mixed into the top 1 inch (2.54 cm) as a preplant-incorporated herbicide. Although plant development was reduced for all of the weeds tested, the extent of susceptibility differed across species. Plant survival and root development was reduced by at least 70% and shoot length by at least 50% for the following most susceptible weeds: black nightshade (Solanum nigrum L.), common lambsquarters (Chenopendium album L.), creeping bentgrass, curly dock (Rumex crispus L.), purslane (Portulaca oleracea L.), and redroot pigweed (Amaranthus retroflexus L.). When CGM was applied as a preplant incorporated herbicide, the following weeds had at least a 50% reduction in plant survival and shoot length and at least an 80% reduction in root development: catchweed bedstraw (Galium aparine L.), dandelion (Taraxacum officinale Weber), giant foxtail (Setaria faberi Herrm.), and smooth crabgrass [Digitaria

[1] Alliance Milling Company 319 East Prairie Street, Denton TX, 76202
[2] The mention of a company or a produce is not intended as a recommendation.

ischaemum (Schreb.) Schreb. ex Muhl]. Plant survival reductions were less than 31% for the least susceptible weeds, barnyardgrass [Echinochloa crus-galli (L.) Beauv.], and velvetleaf (Abutilon theophrasti Medic.).

McDade and Christians (2000) conducted two years of field studies with three planting dates (July 3, 1998, August 20, 1998, and June 8, 1999) and determined that CGM incorporated into the top 2 to 3 inches (5 - 8 cm) of soil at 2, 4, 6, and 8 lb/100 ft2 (100, 200, 300, and 400 g/m2) reduced weed cover by 50, 74, 84, and 82%, respectively, compared to an untreated check 3 weeks after treatment. Weed cover data collected for purslane, common lambsquarters, redroot pigweed, foxtail (Setaria spp.), velvetleaf, and ladysthumb (Polygonum persicaria L.), revealed purslane to be the most dominant weed species. In the same experiment, it was also discovered that the 2, 4, 6, and 8 lb/100 ft2 (100, 200, 300, and 400 g/m2) CGM rates reduced average seedling survival for 8 vegetables by 48, 65, 73, and 83%, respectively. 'Daybreak' sweet corn (Zea mays L.) was the least susceptible to CGM, requiring at least 6 lb/100 ft2 (300 g/m2) of CGM to produce a significant seedling reduction of 26% compared to the control. CGM applications of 2 lb/100 ft2 (100 g/m2) reduced seedling survival by 35% for 'Ruby Queen' beet (Beta vulgaris L.), 41% for 'Red Baron' radish (Raphanus sativus L.), 59% for 'Maestro' pea (Pisum sativum L.), 67% for 'Comanche' onion (Allium cepa L.), 68% for 'Black Seeded Simpson' lettuce (Lactuca sativa L.), 71% for 'Provider' bean (Phaseolus vulgaris L.), and 73% for 'Scarlet Nantes' carrot (Daucus carota L. subsp. sativus) compared to the control. As a result of the reductions in direct seeded vegetable seedling survival for even the lowest CGM application rate, 2 lb/100 ft2 (100 g/m2), McDade and Christians (2000) advised against using incorporated CGM for direct seeded vegetables.

However, the weed control properties of CGM justify further evaluation of the material on additional weed and vegetable species. One limitation to further evaluation of CGM in field vegetable production is the difficulty in achieving a uniform application to the soil surface. The use of equipment to mechanically apply CGM would avoid the difficulty involved with manual application of CGM. Suitable equipment would also enable evaluation of the potential benefits of banded applications for weed efficacy and crop safety of direct seeded vegetables. The objective of this research was to develop and test equipment that would permit either solid (broadcast) or banded application of corn gluten meal.

Materials and Methods

An applicator was assembled using various machinery components for the purpose of uniformly applying corn gluten meal to the soil surface in either a solid (broadcast) or banded pattern. A fertilizer box (Gandy[3], model 901-4) measuring 11.8 inches (30 cm) wide by 9 inches (23 cm) at the top, and 14 inches (36 cm) tall, tapering to a rounded point at the bottom was used as the holding container and meter device for the CGM. The fertilizer box had an approximate capacity of 20 lb (9 kg) of CGM with a 2-inch wide, 4-bladed, horizontal rotating agitator at the tapered bottom of the container. Located beneath the rotating agitator blade on the 9 inch (30 cm) base were four circular outlets 2.4 inches (6.0 cm) apart with an inside diameter of 0.6 inches (1.5 cm) and an outside diameter of 0.75 inches (1.9 cm). Although a sliding metering device could be used to reduce the size of the outlets to decrease the application volume, the applicator openings were unobstructed to maximize the application volume.

A 12-volt motor (White's Inc.[4], Model # 9-077746) with a 60-tooth gear, chain drove a 12-tooth gear attached to the agitator to produce a 24 rpm (revolutions per minute) rotation of the agitator. Tubing

[3] Gandy Company, 528 Gandrud Road, Owatonna, MN 55060-0528
[4] White's Inc., P.O. Box 2344, Houston, TX. 77252.

with an inside diameter of 0.75 inches (1.9 cm) was attached to fertilizer box outlets and connected to the inlets of fan shaped gravity-fed row banding applicators (Grandy3, Ro-Bander). The equipment was set up in two different application configurations--a solid (broadcast) and a banded application. The solid application configuration employed three 10-inch row-band applicators placed side by side to achieve a solid 30-inch (76 cm) wide application. As a result of using three application heads, only three fertilizer box outlets were used to meter the CGM. The fourth outlet was blocked. The banded application configuration employed four 7-inch row-band applicators in sets of two placed side by side, with a 3-inch gap in the row center, between the two sets of row-band applicators. The use of four 7-inch row-band applicators allowed the use of all four fertilizer box outlets. The fertilizer box, 12-volt motor, and row-band applicators were then attached to a 3-point tractor hitch and tool bar for calibration and field evaluation.

The equipment was evaluated for the application of two CGM formulations (powdered and granulated), three application rates [5, 10, and 15 lb/100 ft2 (250, 500, and 750 g/m2)], and two application configurations (solid and banded) (Tables 1 and 2). To maintain as much consistency as possible between the setup of the different application systems, as many factors as feasible were held constant. Within formulation and application configurations, tractor speed was varied to achieve the desired application rates (Table 3). Field evaluations were conducted during the summer of 2004 on 32-inch (81 cm) wide raised beds at Lane, OK.

Results and Discussions

Differences between CGM formulations affected the flow rate within each application configuration and between application configurations (Table 2). The granulated formulation flowed at a faster rate than the powdered formulation, and the banded flowed faster than the solid application. The granulated formulation flowed easier, without clumping, and therefore faster than the powdered formulation. Independent of formulation, the use of four application box outlets for the banded configuration resulted in a greater application rate than the use of three application box outlets for the solid distribution. It was determined that the CGM powder used with the solid application configuration was inconsistent and unreliable and thus not feasible for use with the same equipment without further modification. Therefore, the field evaluation of the equipment did not include the use of the CGM powder applied using the solid application configuration.

Field evaluations determined that the equipment setup with the CGM granulated formulation resulted in the most reliable and precise delivery of the three application rates [5, 10, and 15 lb/100 ft2 (250, 500, and 750 g/m2)] for both application configurations compared to the powdered CGM formulation applied in the banded configuration. The powdered formation did not flow as easily and consistently through the application system. To improve this facet of powdered CGM delivery, the equipment could be modified by increasing the size of the outlets for the application box, by increasing the internal diameter of the tubing connected to the outlets, or by adding a device to tap or further agitate the powder as it flows from the outlets through the tubing to be dispersed by the row-band applicators. Indeed, during the field evaluations, manual tapping of the row-band applicators did help the flow of the powdered material through the system.

The precise placement of the powder for the banded configuration was further hampered by wind gusts that tended to blow the CGM powder away from the targeted soil surface and into the desired CGM-free strip intended for vegetable direct seeding. This inadvertent misplacement of the CGM powder had the potential to interfere with direct seeded vegetable survival planted between the banded applications.

Potential solutions to decrease wind interference include attaching small wind shields to each row-band applicator, attaching small shields only on the sides nearest the desired CGM-free area, attaching large wind shields on either side of the equipment as a whole, or completely enclosing the group of row-band applicators in a shielded system. During field evaluations, the use of an 18 inch x 18 inch wind shield attached to each side of the equipment at ground level decreased wind interference of powder application. The use of individual shields on the row-band applicators nearest the CGM-free center strip also decreased the misplacement of the powder CGM.

Summary

These evaluations demonstrated the feasibility of using equipment, rather than manual applications, to apply corn gluten meal to raised beds for organic weed control purposes. A number of equipment alterations will increase the efficiency and potential usefulness of mechanical applications of corn gluten meal. Future equipment developments and evaluations should focus on increasing the application rate to decrease the time to apply corn gluten meal to a field. The granulated formulation worked well at all application rates and application configurations. The powdered corn gluten meal did not flow easily, and its delivery was inconsistent and unreliable when used in the solid application configuration. If research determines equivalent weed control efficacy between the two corn gluten meal formulations, the granulated formulation would be the suggested formulation to use in this equipment.

Acknowledgments

We thank Otis (Buddy) L. Faulkenberry III for his designing, assembling, calibrating, and field-testing the corn gluten meal application equipment.

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Table 1. Conversion table for corn gluten meal applications.

Pounds per 100 Square Feet	Ounces per Square Foot	Pounds per Acre	Grams per Square Meter
lb/100 ft2	oz/sq ft2	lb/a	g/m2
5	0.825	2,250	250
10	1.65	4,500	500
15	2.475	6,750	750

Table 2. Application parameters for corn gluten meal formulations, three application rates, and two application configurations.

Corn Gluten Meal Formulation	Application Configuration	Flow Rate	Outlets/Heads Used	Individual Head Width	Application Width	Non-Applied Strip Width
		g/min	#	In	in	in
Granulated	Banded	1720	4	7	28	3
Granulated	Solid	1418	3	10	30	0
Powdered	Banded	1132	4	7	28	3
Powdered*	Solid	-----	-----	-----	30	0

*The “Powdered Solid” configuration was inconsistent and unreliable, and therefore its use was not feasible without further equipment modifications.

Table 3. Tractor speeds for application formulation and configuration combinations.

Corn Gluten Meal Formulation	Application Configuration	Tractor Speedz for Application Rates		
		5 lb/100 ft2	10 lb/100 ft2	15 lb/100 ft2
		mph	Mph	mph
Granulated	Banded	0.32	0.16	0.11
Granulated	Solid	0.26	0.13	0.09
Powdered	Banded	0.21	0.10	0.07
Powderedy	Solid	----	-----	-----

zTractor speeds were rounded to the nearest 0.01 mph

yThe “Powdered Solid” configuration was inconsistent and unreliable, and therefore its use was not feasible without further equipment modifications.

Vinegar as an Organic Burn-Down Herbicide

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Introduction

Reports in the popular press and weed control research literature indicate the potential of vinegar (acetic acid) as an organic herbicide (Radhakrishnan et al., 2002, 2003; Johnson et al., 2003). In greenhouse research, vinegar applied with acetic acid concentrations of 5.0, 10.5, 15.3, and 20.2% killed five weed species—common lambsquarter (Chenopodium album L.), giant foxtail (Setaria faberii), velvetleaf (Abutilon theophrasti), smooth pigweed (Amaranthus hybridus L.), and Canada thistle (Cirsium arvense L. Scop.) (Radhakrishnan et al., 2002). Weed control efficacy increased with acetic acid concentration and decreased with plant maturity. Radhakrishnan et al. (2002) applied the vinegar with a hand sprayer to "obtain a uniform wetting of all foliage;" therefore, the application volume is unclear.

Field research was then conducted to evaluate the effectiveness of directed-spray applications of vinegar for weed control in corn and soybeans (Radhakrishnan et al., 2003). Increasing the acetic acid concentration from 10 to 20% increased crop injury, and foliar applications produced greater crop injury than basal applications. The results further indicated that although soybean plants are more sensitive to vinegar applications than corn, soybean injury decreases with increasing maturity. Weed control in these field trials ranged from 90-100%. It was also determined that a vinegar soil drench reduced total biomass of Canada thistle and also reduced its stem number by 90%.

Research in Canada (Johnson et al., 2003) investigated the use of a 10% acetic acid for broadleaf weed control in spring-planted wheat. Vinegar was applied at 21.4, 42.8, 85.5, 171, and 256 gpa (200, 400, 800, 1600, and 2400 L/ha) either three days before seeding spring wheat or after the wheat reached the 1-2 leaf stage. In the pre-seed treatments, vinegar applications of 171 gpa (1600 L/ha) or greater decreased shepherd's purse (Capsella bursa-pastoris (L.) Medik.) by 80%. In-crop, post-emergence vinegar applications at 42.8 gpa (400 L/ha) or greater produced significant initial wheat injury; however, 28 days after treatment, crop injury was barely visible. Vinegar application volumes of 171 gpa (1600 L/ha) or greater produced at least 80% control of wild mustard (Sinapis arvensis L.) and cow cockle (Viccaria hispanica (Mill.) Rauschert). Although 171 gpa (1600 L/ha) or greater produced weed control levels comparable to commercial herbicides, the 42.8 and 85.5 gpa (400-800 L/ha) application volumes were sufficient to sustain maximum wheat yields.

Vinegar is a solution containing acetic acid, an organic acid produced though the natural fermentation of plant materials containing sugars. Household vinegar typically contains 5% acetic acid. Acetic acid does not persist in the environment; rather, it readily breaks down producing water as a by-product. Although acetic acid occurs naturally, care must be taken when handling vinegar, especially when the acetic acid concentration increases above the typical 5%. Vinegars with acetic acid concentrations of 11% or greater are available commercially, these products can burn the skin and cause serious to severe eye injury, including blindness. Protective clothing that includes eye protection and gloves should be used.

It has been suggested that acetic acid injures and kills plants by first destroying the cell membranes, which then causes the rapid desiccation of the plant tissues (Owen, 2002). There is no evidence that the acetic acid is absorbed into the plant and translocated to other plant parts to inflict damage; therefore, it is considered to be a contact herbicide rather than a systemic herbicide such as glyphosate. As a contact herbicide, acetic acid should be more effective on seedlings and annuals than on more mature plants and perennials. Plants that readily regrow from the roots, even when the foliage is destroyed, will be more difficult to kill with vinegar or other contact herbicides. Multiple applications and application timing in respect to the weed's size, maturity or life cycle may increase control.

Adjuvants are chemicals typically combined with herbicides prior to use, either during the formulation process or after packaging. Adjuvants are added to herbicide solutions for a myriad of purposes with the primary goal of assuring effective herbicidal activity when used according to the label directions. Adjuvants may be added to herbicide solutions for the following purposes: as spreader-stickers, emulsifiers, extenders (protect against weathering), or safeners (protect crop plants from herbicide damage); for drift control or pH buffering; as anti-foaming or wetting agents; and to enhance compatibility, suspension, or penetration of the herbicide. The registration labels for commercial herbicides provide instructions concerning the addition of adjuvants to herbicide spray solutions, including the type and amount to be added. Normally, if adjuvants are recommended, the adjuvants are added to a spray solution according to the application rate of the herbicide (i.e. amount per area) or by the application volume (i.e. 1 qt/100 gallons of spray solution). The addition of adjuvants to a spray solution can have tremendous positive impact on controlling weeds, increasing the herbicidal activity, protecting the non-target plants, and enhancing the safety and application of the herbicide. Conversely, adding an adjuvant may interfere with the herbicide's delivery and effectiveness, may increase the hazard to non-target plants or to those applying the herbicides, or may simply provide no benefit whatsoever.

Legal issues must be taken into consideration when selling, purchasing, recommending, or using vinegars as organic herbicides. Although numerous commercially produced vinegars are registered, labeled, and sold as organic herbicides, not all marketed vinegars are regulated appropriately.

Although previous studies have yielded important information concerning the use of vinegar as a herbicide, further research is indicated in order to increase the understanding of the relationship between acetic acid concentrations, application volumes, weed species, and weed maturity on herbicidal efficacy of vinegar. There is also a need for scientific information concerning the use of adjuvants with vinegar. In order to address these issues, field research was conducted in southeast Oklahoma (Atoka County, Lane, OK) to determine the effect of acetic acid concentrations, application volumes, and adjuvants on weed control efficacy.

Materials and Methods

Research was conducted through the USDA, ARS 2004 Agricultural Sciences Enrichment Program in cooperation with Houston Community College. The objective of the enrichment program was to introduce university students to agricultural research through a mentoring relationship with USDA, ARS scientists. Charles Webber was the USDA, ARS scientist who served as the mentor for Melissa Harris, a Houston Community College student.

The field experiment was conducted on a 0.5 acre (0.2 ha) of land [Bernow fine sandy loam, 0-3% slope (fine-loamy, siliceous, thermic Glossic Paleudalf)] at Lane, OK. One month prior to spraying the weed control treatments, the land was cultivated in order to kill the existing weeds and to provide a uniform seed bed for new weed growth. The research involved 20 weed control treatments with 4 replications; plots were 6.5 ft (2 m) wide and 10 ft (3 m) long. The factorial experimental design included vinegar at three acetic acid concentrations (0, 5 and 20%), two sprayer application volumes [20 and 100 gpa (187 and 935 L/ha)], three adjuvants (none, orange oil, and canola oil), and two weedy-checks (Table 1). The 5% acetic acid vinegar[1,2] and the canola oil[1] were purchased at a local grocery store, while the 20% acetic acid[3] and the orange oil[4] were sold as horticultural products and obtained through a commercial nursery. The canola oil and orange oil were mixed at a 0.25% volume/volume (v/v), depending on the application volume (20 or 100 gpa). A 0.025% v/v of liquid dish soap[5] was added to the treatments containing canola oil to reduce the surface tension of the oil and thus allow the canola oil to go into suspension. Triclosan was the active ingredient of the dish soap and the orange oil contained d-Limonene.

All herbicide treatments were applied on July 15, 2004, using a tractor mounted CO2 sprayer equipped with four extended range, stainless steel, 0.20 gallons/min nozzles[6] on 20-inch (51-cm) spacing at a height of 19 inches (48 cm). The 20 and 100 gpa sprayer application volumes were achieved by holding all other variables (nozzle size, pressure, and mixture volumes) constant and by adjusting the travel speed to either 3 mph (4.8 km/h) or 0.6 mph (1.0 km/h), respectively.

Data Collection

Visual weed cover and control ratings were collected 4 days after treatment on July 19, 2004. The weed cover ratings represent the percent weed cover within a treatment's plot area that is covered by weeds, irrespective of the weedy-check. Weed control ratings represent the percent weed control for an experimental treatment compared to the weedy-check. A 0 to 100% visual rating system was used in which 0% represented no weed cover or no weed control, while 100% represented complete weed cover or complete weed control. The data were converted using an arcsine transformation to facilitate statistical analysis and mean separation.

Results and Discussions

The experiment had very high weed densities with multiple species of grass and broadleaf weeds. The weeds present at spraying included large crabgrass (Digitaria sanguinalis (L.)), goosegrass (Eleusine indica), carpetweed (Mollugo verticillata L.), cutleaf evening primrose (Oenothera laciniata Hill), spiny amaranth (Amaranthus spinosus), Eclipta (Eclipta prostrata L.), and yellow nutsedge (Cyperus esculentus). Large crabgrass, carpetweed, and cutleaf evening primrose were the most dominant weeds covering at least 50, 24, and 14% of the weedy-check, respectively. At the time of spraying, large

[1] Best Choice, White Distilled Vinegar, 5% Acidity, Distributed by Associated Wholesale Grocers, Inc., Kansas City, KS 66106.
[2] The mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.
[3] 20% Vinegar, Nature's Guide, Manufactured by Creole Fermentation, Abbeyville, LA, and Distributed by Marshall Distributing Company, 2224 E. Lancaster Ave., Fort Worth, TX 76103-2299.
[4] Orange Oil, Nature's Guide, 351 Winter Haven Blvd. NE, Manufactured by Florida Chemical Co., Inc., Winter Haven, FL 33881-9432.
[5] Ultra Joy, Concentrated Dishwashing Soap, Distributed by Procter & Gamble, Cincinnati, Ohio, 45202.
[6] XR TeeJet, XR8002VS, Spraying Systems Co., P.O. Box 7900, Wheaton, IL 60189-7900.

crabgrass plants averaged 1 or 2 leaves; however, the plots did include a few larger crabgrass plants that had regrown from the earlier tillage operation. Carpetweeds averaged 1 inch wide with 4 or 5 leaves, while cutleaf evening primrose seedlings had only 2 or 3 leaves. No other weed species contributed more than 5% to the weed cover. Only the data for the most dominant weeds and the combined ratings for grass, broadleaf, and total weeds was reported in this manuscript.

Treatment Analysis

Four days after treatment, the average weed cover ratings for the weedy check were as follows: 97.6% total weeds; 52.6% grass; 44.4% broadleaf; 51.9% large crabgrass; 24.75% carpetweed; and 14% cutleaf evening primrose (data not shown). Total weed control ranged from 0% control when no vinegar was used compared to 73.9% control when 20% acetic acid was applied at 100 gpa with canola oil. Vinegar was more effective in controlling broadleafs than grasses. Optimum total grass and crabgrass weed control occurred with 20% acetic acid applied at 100 gpa, resulting in weed control that ranged from 44 to 63%. Broadleaf (total, carpetweed, and cutleaf evening primrose) control was 84% or greater for plots receiving either 10% acetic acid applied at 100 gpa or 20% acetic acid applied at 20 or 100 gpa. Also, 5% percent acetic acid applied at 20 gpa provided good cutleaf evening primrose control (77 to 90%). In this research, cutleaf evening primrose was the most susceptible to vinegar applications; however, this response may reflect differences in weed size rather than weed species. Individual comparisons among adjuvants within acetic acid concentrations and application volumes showed little or no advantage to adding either orange oil or canola oil to vinegar spray solutions.

Factorial Analysis

When averaged across application volumes (20 and 100 gpa) and adjuvants (none, orange oil, and canola oil), weed control increased for all species as acetic acid concentrations increased from 5 to 20% (Table 1). In the same respect, when averaged across acetic acid concentrations and adjuvants, weed control increased as application volumes increased from 20 to 100 gpa (Table 2). There were few significant differences among the adjuvants when their responses were averaged across acetic acid concentrations and application volumes (Table 3).

Table 1. Weed control ratings in response to acetic acid concentrations averaged across application volumes and adjuvants.

Acetic Acid Concentration	Total Weed	Total Grass	Total Broadleaf	Crabgrass	Carpet-weed	Cutleaf primrose
%	%	%	%	%	%	%
0	0	3	0	8	7	10
5	36	9	67	12	67	93
20	57	28	94	33	95	100
LSD (0.05) =	5.9	9.9	7.5	11.8	9.9	7.0

Table 2. Weed control ratings in response to application volume average across acetic acid concentrations and adjuvants.

Application Volume	Total Weed	Total Grass	Total Broadleaf	Crabgrass	Carpet-weed	Cutleaf primrose
gpa	%	%	%	%	%	%
20	23	5	44	8	47	63
100	40	22	63	27	66	72

LSD (0.05) =	4.8	8.0	6.1	9.7	8.1	5.7

Table 3. Weed control ratings in response to adjuvants averaged across acetic acid concentrations and application volumes.

Adjuvants	Total Weed	Total Grass	Total Broadleaf	Crabgrass	Carpet-weed	Cutleaf primrose
%	%	%	%	%	%	%
None	35	15	59	17	62	69
Orange Oil	30	13	55	18	57	67
Canola Oil	28	12	48	19	50	67
LSD (0.05) =	5.9	9.9	7.5	11.8	9.9	7.0

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Sweet Corn Cultivar Update

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Sweet corn genetics have become increasingly complex. There are three main types of sweet corn: normal sugary (su1), sugary enhanced (se), and supersweet (sh2). In addition to these three primary types, various new combinations are being introduced. Breeders are attempting to combine desirable characteristics from the different types, including efforts to capture the "true corn flavor" of the traditional su1 types while increasing shelf life through use of the se and/or sh2 genes. The terminology used to name these new combinations varies among companies, furthering the confusion.

There are many reasons to be aware of the genetics when planting sweet corn. Different types of corn vary in their ability to emerge from relatively cool soils; in their ability to hold in good condition before harvest; and in the texture, flavor, and rate of starch conversion of their kernels. Most important, however, is the variation in isolation requirements. Sweet corn is wind-pollinated. Cross pollination between different groups, or between sweet corn and field corn or pop corn, usually results in adverse effects on sweetness and most often produces sweet corn that tastes no different than field corn.

For isolation purposes, sweet corn types can be classified into the su1 group or the sh2 group. It is essential not to allow cross pollination between types in the su1 group and those in the sh2 group. Within these two major groups, isolation between types may not be essential, but it is preferred for optimal quality.

su1 GROUP	sh2 GROUP
Everlasting Heritage	Augmented
Normal (sugary or su1)	Gourmet Sweet TM
Sugary enhanced (se)	Mirai TM
Sweet Breed TM	Multisweet TM
Synergistic (most)	Shrunken (sh2)
Table Sweet TM	Summer Sweet TM
Triple Sweet TM	Supersweet
	Xtra Sweet
	Xtra Tender TM

One other consideration is kernel color. Sweet corn kernels may be yellow, white, or a mixture of yellow and white (termed bicolor). Yellow is dominant to white. Thus, for example, if a white cultivar receives pollen from a yellow cultivar, ears on the white cultivar will have bicolor kernels.

How can isolation be achieved? Since corn is wind pollinated, plant the different sweet corn types so pollen is less likely to be carried from one to the other by the prevailing winds. A distance of 250 feet between cultivars is considered sufficient to prevent adverse effects on ear quality. Five or more border rows will act as barriers to pollen transfer between different sweet corn types; however, quality of ears in the border rows is compromised. Finally, isolation by time of maturity allows different types to be planted close together as long as the cultivars differ in maturity by at least 14 days.

The remaining information in this paper is based on cultivar trials conducted at the OSU Vegetable Research Station in Bixby during the last decade. Descriptions include marketable yield ranks (based on number of 60-ear sacks per acre) in replicated trials in indicated years. Data tables and more information may be found in the yearly Vegetable Trial Reports (see references at the end of this paper). A very limited number of cultivars are highlighted here. There are far more sweet corn cultivars available than OSU can test, and the exclusion of a cultivar from this paper should not be considered as a negative. Also, bicolor cultivars are of limited commercial importance in Oklahoma and are therefore not discussed in this paper. However, some have been in our trials in past years.

I. Yellow Kernel Types

Bodacious - 1995: 4/23; 1996: 14/18; 1997: 8/13; 1998: 6/12; 1999: 4/13; 2000: 4/7; 2003: 13/16. Crookham (se). Usually yields less than 'Incredible', but is earlier. A reliable performer at Bixby.

Cronus - 2001: 7/11; 2002: 8/18; 2003: 9/16. Syngenta (sh2). Average performer.

GSS 0966 - 2000: 1/10; 2001: 3/11; 2002: 1/18; 2003: 1/16. Syngenta (sh2). Combination of high yield potential with Attribute TM insect protection.

Honey Select - 2000: 5/7; 2001: 2/11; 2002: 16/18; 2003: 5/16. Syngenta (Triple Sweet TM). Cull ear production was above average in 3 years out of 4.

Incredible - 1995: 8/23; 1996: 2/18; 1997: 1/13; 1998: 1/12; 1999: 1/13; 2000: 1/7; 2001: 1/11; 2002: 13/18; 2003: 2/16. Crookham (se). High yield potential and a reliable performer at Bixby.

Kandy Plus - 2000: 4/8; 2001: 6/11; 2003: 11/16. Syngenta (se). Full season, average performer with better disease resistance than 'Kandy King EH'.

Legend - 1999: 3/13; 2001: 9/11; 2002: 10/18. Harris Moran (se). Performs fairly well for a relatively early corn; see comment on 'Tablemaster'.

Prime Plus - 1998: 1/8; 2000: 3/10; 2002: 5/18. Syngenta (sh2). Good performer.

Sugar Ace - 2002: 2/18; 2003: 4/16. Harris Moran (Sweet Gene TM brand of se; isolation suggested). Has yielded well in two trials at Bixby.

Tablemaster - 2001: 10/11; 2002: 11/18; 2003: 14/16. Mesa Maize (se). Performs much like 'Legend' but may have a slightly better ear appearance.

II. White Kernel Types

Argent - 1995: 9/23; 1996: 9/18; 1997: 6/13; 1998: 4/12; 1999: 2/13; 2000: 2/7; 2004: 11/22. Crookham (se). A reliable performer at Bixby.

Whistler - 2004: 1/22. Syngenta (sh2). Relatively new and only tested in 2004, but mentioned because it was the only entry statistically superior to 'Argent' for number and weight of marketable ears in that trial.

Whiteout - 2004: 8/22. Mesa Maize (se). Only tested in 2004, but mentioned because it showed promise as an early se type, although ears were not particularly large.

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NOTE: Marketable yield ranks are based on data in our yearly Vegetable Trial Reports from 1995 through 2004. To save space, citations have only been provided for the two most recent Trial Reports:

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Web data on the 1997-2004 trials may be found at:
http://home.okstate.edu/homepages.nsf/toc/VegetableTrialReport

Strategies for Weed Control in Vegetables

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Whether in a home garden or a commercial farm, weed control is a requirement for successful vegetable production. There are both obvious and more subtle reasons for the benefits of weed control in vegetables. Anyone who has grown vegetables on any scale is aware that not much useful produce will be harvested if no effort is made to control weeds. Crop yield and quality will be sacrificed if weeds become firmly established at any time during the production cycle. Numerous studies show that weed control is particularly critical during the first few weeks of vegetable plant growth. However, in vegetables such as onions and lettuce, weeds that become established in the later part of the crop cycle can also be detrimental to yield and quality.

Additional benefits of weed control include long-term effects. Seeds of some weeds can remain viable in the soil for many years. Weeds allowed to mature and shed seed onto the soil surface add to the "weed seed bank" in the soil. A large seed bank results in a need for increased work to control weeds in crops planted in successive years. For perennial weeds, such as horsenettle and johnsongrass, uncontrolled growth results in spreading and accumulation of below-ground food reserves, leading to a greater problem in the future. While it may not be practical to try to completely eliminate weeds from vegetable lands, thorough weed control can ease the yearly demand for efforts to control weeds.

The prevention of weed interference with field procedures such as insecticide and fungicide application and harvest are further benefits of weed control. Weeds growing in a crop can hamper pesticide application by reducing the amount of spray that reaches the intended target. Similarly, harvest procedures are more cumbersome when weeds get in the way. Weeds with thorns or spines, such as spiny amaranth and buffalobur, may pose a serious hazard to harvest crews. Controlling such weeds will help with long-term weed control and will reduce interference with field procedures.

Weeds should generally be controlled early, while still small, to receive the greatest benefit from the least effort. An exception would be situations in which small weeds adjacent to tender crop seedlings may offer protection from wind and blowing sand particles. These weeds should be removed as soon as the hazardous situation is gone. In addition to controlling weeds early and effectively, weed control practices should be non-injurious to crop plants. To avoid crop injury with herbicides, choose products that are approved for the crop and be sure to follow application instructions carefully. Cultivation equipment should be selected and adjusted to minimize disturbance to above and below ground parts of the crop plant.

Weed Control Practices. There are many practices that contribute to weed control in vegetable production. If using clean tillage, soil should be prepared so that no green vegetation remains following seedbed preparation. Plastic and organic mulches can be beneficial for weed control and will provide additional benefits such as conservation of soil moisture and protection of vegetable fruits from soil contact. Planting once the soil has reached suitable temperatures for rapid crop seed germination will reduce the chance for weeds to become established ahead of the crop. Soil applied herbicides can be beneficial for controlling weeds before they emerge in direct-seeded plantings and or transplanted crops. Cultivation and hoeing are often needed for controlling weeds that are not susceptible to herbicide treatments. They may also be needed when no approved herbicides are available for the crops.

Strategies for weed control. Approaching weed control so that immediate crop production needs and long-term weed management are addressed requires that a strategy for weed control be established. The strategy that will be appropriate will depend on how land is used for vegetables. Three possible uses are: 1. Continuous vegetables, where a variety of different vegetables are grown on the same land year after year; 2. Occasional vegetables, where vegetables are planted on land used for row crops, pasture or forage crops, and; 3. "Clean land" rotation, where crops such as watermelon are planted on land that has not had the same crop in recent years. Identification of land use is a first step to developing a weed control strategy.

Clean land rotation is the simplest strategy for weed control. In this case, the main objective is to control weeds so a single crop can be grown. There is probably no interest in longer term weed control. If information is available, it is helpful to know what weeds are in the field and other field history that might be available. Thorough land preparation is suggested to eliminate established vegetation. If perennial weeds are present, a turning plow may help suppress these during the crop cycle. If using at-plant herbicides, select a broad-spectrum herbicide(s) since it is difficult to know what weeds may be present. Cultivate land for as long a possible, being careful to not cause crop injury. Postemergence herbicides for control of emerged weeds and for lay-by prevention of late emerging weeds can be used. Plastic mulch may be considered, but plastic removal is difficult and residual plastic may displease the owner of rented land.

Weed control strategies for the occasional vegetables type of rotation may have an additional objective of longer-term weed management. This may include general efforts to reduce the weed seed bank or may include reduction of specific weeds, such as perennials, that have become difficult to control. In this case, the grower probably knows what weed species are present in the field. If not, these should be identified and information should be sought on how to control these weeds on a long-term basis. The grower should also pay close attention to herbicides that were used in previous crops. Some of these herbicides may have residual activity against the current vegetable crop.

An example strategy for the occasional vegetable rotation is as follows: Begin with well prepared soil to prevent existing weeds from becoming reestablished. Choose at-planting herbicides that will be effective for the weeds found in the field. Cultivate and hoe as needed. Be prepared to expend extra effort against weeds that are considered a particular problem. Postemergence and lay-by herbicides can be used as needed and as available.

In fields used for continuous vegetables it may be desirable to control weeds not only in the present crop but also to reduce the potential for weeds in future crops. For this situation, objectives will include those already listed plus a greater emphasis on reducing troublesome weeds and preventing additions of new weeds. To do this, information is needed on practices that help reduce troublesome weeds. Vegetable rotations are then selected to employ these practices. Documentation of field history regarding herbicide use will help to avoid possible effects of herbicide residues on subsequent sensitive crops.

The strategy for the continuous vegetable situation is more complex than are the other situations. Crop rotation is practiced here in the sense that different types of vegetables are planted in rotation with one another either within a growing season or from year to year. In addition to weed control, rotation should also consider soil-borne diseases that require crop rotation as a means of management. When selecting locations within a field for vegetables, assign specific vegetables to areas of the field where the weeds that will be expected can be controlled. Plant a crop that will allow thorough control of troublesome

weeds. For example, do not plant sweet corn where johnsongrass is a problem since it will be difficult to control. In areas where perennial broadleaf weeds are abundant, plant crops that can be cultivated to control these weeds. In the case of vegetables for which there are few good options for weed control, plastic and other mulch materials may be useful. Soil applied herbicides can be useful in some vegetable to vegetable rotations. Herbicide selection should consider the weeds that are expected to exist in the field to enable selection of the most effective product. Herbicide selection should also consider the potential for injury to subsequent vegetable crops.

Intensive vegetable growers should consider the use of specialized cultivation equipment that can help with the cultivation of delicate vegetable plants. Implements such as “finger weeders”, “flex tine harrows” and “brush hoes” may provide advantages over standard cultivation equipment such as sweeps and rolling cultivators in certain vegetable production situations.

Weed management practices performed after harvest are an important part of the weed control strategy in vegetable rotations. Weeds surviving in the crop should be killed as soon as harvest is completed. This will prevent the addition of weed seed to the soil and will reduce the build-up of below ground food reserves in perennials. Burial is the best way to preserve many weeds seeds. The ideal approach is to kill plants and leave the residues on the soil surface for several weeks. During this period, insects and other animals will feed on weed seed, reducing the amount of seed that is added to the soil when crop residues are turned under. Mowing or non-selective herbicides can be used to kill plants, stop seed production, and keep residues on the surface. Other crop sanitation needs should be considered in this decision making process. The implementation of these various practices should be useful for establishing a weed control plan that will address the needs of a particular farm. Careful consideration of this information will be helpful for developing a strategy for vegetable weed control that should help ease the burden of vegetable weed control for both the present and the years to come.

Regulations and Procedures of the Certified National Organic Program

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The scientists listed are employees of either Oklahoma State University or USDA/ARS. They are located at the Lane Agricultural Center, in Lane, Oklahoma. They are all involved in development of organic production guidelines for Oklahoma.

The National Organic Program (NOP) became effective in October of 2002. This program was designed to standardize organic certification programs among all the states, and to provide a uniform method for an organic producer to achieve certification. This paper is intended to provide some of the regulations and procedures for farmers wishing to produce certified organic crops.

The NOP is a comprehensive program that addresses not only the desire to produce safe and nutritious food, but also to protect and improve the environment. A major objective of the program is to assure that sound management techniques are used in all aspects of production. Growers should at all times strive to protect the soil, minimize erosion, protect and improve water quality, and increase soil organic matter. These goals must be detailed and incorporated into a plan submitted along with the request for certification.

When a potential certified producer develops an organic plan, he must describe how he intends to meet the requirements of the various segments of the NOP. This plan must describe how the farm will be managed and monitored. It must describe the crops to be grown, the techniques to be used in crop production, and the steps that will be taken to insure integrity of the products. This plan must be presented to a certifying agent for approval. In Oklahoma, the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) is the only approved certifying agent located within the state.

The land being used for organic production must not have received any prohibited materials for the three years immediately prior to harvest of the organic commodity. Also, the organic farm, or portion of the farm dedicated to organic production, must be separated from non-organic production areas by distinct, defined boundaries and buffer zones. There is no specific definition of a minimum buffer zone. Instead, the dimensions of the zone must be specific to the farm in question, and must be deemed as satisfactory by the certifying agent.

It is important to realize that the NOP is a process based, rather than a product based, certification program. In working toward organic certification, the procedures and methods used to achieve the product are as important as the product itself. Thus, a producer will be expected to develop and document steps that are being taken to insure that soil and water quality are being protected and improved.

The producer should also list steps that will be taken to prevent co-mingling between organic and non-organic crops and produce. Co-mingling and contamination could develop from other operations on the same farm, or from adjacent farms that are operated by other people. Produce grown on a farm will not necessarily be examined to insure organic integrity, but certifying agents do have the authority to inspect for contamination, if they have reason to suspect that a violation has occurred. If such contamination

should be found, it is important that the producer be able to document that he has a sound management plan, and that the procedures of the plan were followed.

Soil fertility and crop nutrition for an organic farm should be managed through tillage and cultivation practices, crop rotations, cover crops, and animal and crop waste materials. Whenever possible, steps should be taken to recycle farm-derived nutrients. Cover crops may be used to capture nutrients that might otherwise be lost to leaching or volatilization, and to recycle these same nutrients to supply future crop needs. Also, certain deep-rooted cover crops may be used to absorb nutrients from deep in the soil profile, and to transfer the nutrients closer to the surface of the soil, where they can be utilized by subsequent shallow-rooted crops. Legume cover crops may be used to transfer nitrogen from the atmosphere to the soil, where it can be used by non-leguminous cash crops.

When a farm or portion of a farm is lacking in nutrients, animal manures may be used to provide these nutrients. Poultry litter, an excellent source of many nutrients, is available throughout much of Arkansas and Oklahoma. Not only does the poultry litter provide nutrients, but it is also a good source of organic matter.

In certain parts of Oklahoma and Arkansas, poultry litter occurs in large concentrations. Litter supplied in large quantities is suspected of contributing to water pollution. If a grower wishes to use poultry litter as a nutrient source, he should ascertain that the need for these nutrients has been documented by soil test results.

If animal manures are to be used in an organic operation, they should be either composted or incorporated. If they are to be composted, the composting materials should be maintained at a temperature of 131-170 F for 3 days, using an in-vessel or static aerated pile system. Alternatively, the materials may be maintained at 131-170 F for 15 days using a windrow composting system, during which period the materials must be turned at least five times. If composting is not used, animal manures should be incorporated 120 or more days prior to harvest if soil contact is likely with the edible portion of the crop. If the edible portion of the crop will not come in contact with the soil or soil particles, the manures should be incorporated 90 or more days prior to harvest.

If management techniques such as crop rotation, cover crops, and sanitation are not sufficient for nutrient supplies and pest management, certain synthetic materials may be used under certain conditions. Some of these materials are elemental sulfur, humic acids, magnesium sulfate, various micronutrients, boric acid, copper sulfate, copper hydroxide, copper oxide, lime sulfur, hydrated lime, newspaper mulches, and plastic mulches.

It is important to examine the conditions under which each synthetic material is used. The use of many of the materials is limited to a few circumstances. For instance, micronutrients may be used for vegetable crops, provided that a soil test has been taken, and the soil test indicates the need for the micronutrient. The same micronutrient would not be allowed on a soil for which the deficiency had not been documented.

Likewise copper sulfate, copper hydroxide, and copper oxide may be used as fungicides for various crops. If a grower chooses to use one of the copper materials as a fungicide, applications are to be made in such a way as to minimize accumulations of copper in the soil.

While some synthetic materials may be used in a certified organic operation, there are also certain organic materials that should not be used, even though they are of organic origin. Organic materials that should not be used include arsenic, calcium chloride, lead salts, potassium chloride, sodium nitrate, strychnine, and nicotine sulfate.

The materials listed above, including the allowed and the prohibited materials, often apply to specific crops and conditions. The guidelines listed above were an abbreviation of the complete set of rules. Specific materials, and their specific uses, are listed at http://www.ams.usda.gov/nop/NOP/NOPhome.html. All of the materials used should be selected and used in such a way that they will maintain or improve the physical, chemical and biological condition of the soil. The procedures should minimize or prevent soil erosion, and should not contaminate crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.

Organic producers should use a crop rotation that includes sod, cover crops, green manure crops, and catch crops that will maintain or improve soil organic matter content. The choice of crops in the rotation should also provide for pest management in crops, should manage deficient or excess plant nutrients, and should provide for erosion control.

Pest prevention and control should be carried out primarily through management practices, including physical, mechanical, and biological. Crop rotation as well as soil and crop nutrient management practices are encouraged as mechanisms of pest control. Sanitation measures that remove disease vectors, weed seeds, and habitat for pest organisms should be used. Plant varieties with resistance to pests, weeds, and diseases should be selected. When these practices are not sufficient for pest control, a biological, botanical, or synthetic substance that is already on the approved list of organic materials may be used.

Weed control procedures that are recommended include mulching with fully biodegradable materials, mowing, livestock grazing, hand weeding, mechanical cultivation, flame, heat, or electrical means, and plastic or other synthetic mulches. If synthetic mulches are to be used, they should be removed from the field at the end of the growing season or harvest season. Also, the plastic materials should not contain poly-vinyl chloride (PVC).

Once a farmer is approved as a certified organic producer, the certification will remain in effect until terminated, either voluntarily or through some type of enforcement process. Annual certification updates will be required, but when approved, will be seen as an extension of the original certification, rather than as a new certification. Thus, a grower with continued annual updates will be able to show that he has been certified continuously since the first date of certification.

Investigations in Organic Vegetable Production in Oklahoma

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Scientists at the Lane Agricultural Center initiated an organic production study in 2003. The area used for the study had been planted with Virginia Pine since about 1985. The pines remained on the land until about 2000, when they were removed prior to field cultivation. In the fall of 2003, the field was plowed and disked. A "Rayne" land plane was used to smooth the field, provide a uniform surface, and promote even drainage and water movement. Soil tests were taken on a 30 ft by 30 ft grid. In the fall of 2003, lime and poultry litter were applied and incorporated into the soil by disking. After disking, turnips were planted as a winter cover crop.

In the spring of 2004, the field was divided into four equal sections, with each section about 300 feet long and 90 feet wide. Each section was planted with a different crop. The crops were tomatoes, watermelons, sweet corn, and southern peas. Practices in compliance with the National Organic Program were used in all aspects of production. Weed control was primarily by cultivation and hand hoeing, although flame control and rolling cultivators were used on one occasion in the southern peas.

Tomatoes that were grown included both determinate and indeterminate cultivars. Tomatoes were planted on April 15. Rows were 9 feet apart, with plants 3 feet apart within the row. Indeterminate cultivars were trellised by driving a steel t-post every 27 feet within the row, suspending a double-strand, 12 gauge wire along the top of the t-posts, and tying a string from each plant to the 12 gauge wire. The strings were adjusted as needed during the season to provide support for the plants. The determinate cultivars were trellised using a stake-and-weave system, with stakes made from ½" "rebar" reinforcing rods.

Surveys were taken to determine the prevalence of various insect pests. Surveys were taken by examining 30 leaves and 30 fruits per week for six weeks. The primary insect pest, and the only one occurring in significant numbers, was the aphid. On May 27, there were 3.93 aphids per leaf. The next week, on June 11, the number of aphids had increased to 6.93 aphids per leaf. No insecticide treatment had been made prior to June 11.

We had hoped that insect pests would exist only in small numbers, or that natural predators would control the pests at low levels. Small quantities of lady bugs did appear in the field, but in numbers too low to control the large numbers of aphids. On June 11, when there were 6.93 aphids per leaf, we decided that control by natural predators was not going to be sufficient, and we applied a spray application of Azadirect (a neem extract material). The neem material was applied again three days later, on June 14. The Azadirect produced good results. On June 17, the number of aphids was reduced to 1.00 aphid per leaf. On June 25, the number was reduced to 0.13, and on July 9 the aphids were

reduced to 0.00 aphids per leaf. On July 14, the number of aphids again began to increase, but harvest was nearing completion, so we did not apply any additional Azadirect.

The tomato plants were also monitored on a weekly basis for diseases. Plants were sprayed on eight occasions, from June 11 until July 7, with copper sulfate to help control foliar diseases. Disease ratings were taken periodically, and represented the vertical height of the plant which was visibly affected by necrotic lesions on the stems or leaves. The ratings varied from 0 to 100, with 0 representing no visible infections, and 100 meaning that lesions were evident on 100% of the height of the plant.

All cultivars were harvested over a six week period. Results of yield, in tons/acre, along with disease ratings, are shown in the following tables. The determinate tomatoes produced higher yields than did the indeterminate cultivars. It is interesting that the cultivars with the lowest disease ratings (i.e. the least amount of visible disease damage) were not the best yielding cultivars. Apparently some of the cultivars, such as “Solar Set”, “Sun Leaper”, “Sunny”, “Classica”, and “Mountain Fresh” were able to produce relatively high yields, even after sustaining high levels of disease infections.

Determinate Tomato Yield & Disease Ratings

Cultivar	Tons / Acre	Disease Rating
Solar Set	13.7	77
Sun Leaper	11.4	76
Mountain Spring	9.1	74
Sunny	14.9	74
Classica	13.6	74
Sun Master	9.0	72
Mountain Delight	6.7	71
Florida 47	10.6	70
BNH-444	10.2	70
Mountain Fresh	11.1	69
Florida 91	10.9	68
Celebrity	9.5	64
Peron	6.5	63
Amelia	10.2	60

Indeterminate Tomato Yield & Disease Ratings		
Cultivar	Tons / Acre	Disease Rating
Amana Orange	2.8	65
Sioux	1.6	60
Champion	3.0	56
Snow White	2.7	56

In June and early July, there were many days with high humidity, light rain, and heavy cloud cover. These conditions were conducive to foliar disease development. Under normal summer weather conditions in Lane, Ok, we would anticipate less disease development.

The other crops grown in the organic field had fewer pest problems than did the tomatoes. Stand establishment problems occurred with the watermelon, but after the plants were established, there were relatively few pest problems.

Sweet corn and southern peas had relatively few foliar insects, and good yields were obtained. Dipel and Pyrethrum were used on the sweet corn at 3 day intervals during the silking stage. Two cultivars of sweet corn were grown, and yielded 8150 marketable ears per acre with “Honey ‘n’ Pearl”, and 4580 marketable ears per acre with “Incredible”.

The primary problem affecting southern peas was caused by deer grazing on the foliage and pods. Two cultivars of peas were grown, with “Pinkeye PurpleHull” producing 1936 pounds per acre, and “Top Pick Pinkeye” producing 1852 pounds per acre. No herbicides or insecticides were used on the southern peas.

In the fall of 2004, additional poultry litter was applied to the field, and a cover crop mixture of turnips and clover was planted. We plan to duplicate the tests of 2004 in 2005. The crops will be rotated, with tomatoes following watermelon, watermelon following sweet corn, sweet corn following southern peas, and southern peas following tomatoes. We plan to continue this rotation for at least a four year cycle, until each crop has been grown in each quadrant of the field.

Attitudes of Public School Students in Southeastern Oklahoma Toward Agriculture & Horticulture

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A societal concern in the United States is whether there will be sufficient numbers of people to replace the current agricultural producers as they retire. This concern seems to be more immediate as the populace of the United States appears to become increasingly separated from the production, and delivery, of food and fiber. There are negative indicators to support this concern. Children from farm families are seeking careers that take them out of agriculture (Osborne and Dyer, 2000). This may be due to the necessity of farm operators and/or their spouses to work off-farm to supplement farm income (Korb, 2000). In an attempt to gather insight in to this concern, at least on a local level, middle- and high-school students in science and agriculture classes from southeastern Oklahoma were polled for their responses to several questions.

Students from grades eight (middle school) through twelve (grades 9 through 12 high school) in science and/or agriculture classes from five rural counties in southeastern Oklahoma were invited to attend a demonstration field day at the U.S.D.A. South Central Agricultural Research Laboratory, and the Oklahoma State University West Watkins Agricultural Research and Extension Center, in Lane, Okla. As part of the event students were asked to complete a questionnaire. The questionnaire gathered demographic information and inquired about future plans of the students towards agriculture in general and horticulture in particular.

Questions were designed to determine: 1) if the students came from a farm background, and if their families raised animals or grew crops, 2) plans for college, and if they planned to pursue careers in agriculture, and 3) attitudes toward horticulture and/or availability of horticulture classes in their schools. Sixty-four students responded to the questionnaire, with 53% being male and 47% being female. Thirty-four percent were in the eighth grade. From the high school grades, 36% were freshmen, 13% were sophomores, 9% were juniors and 8% were seniors. The middle school and freshman classes had sufficient students to replace sophomore and older students as they cycle out of the education system. Almost nine of ten students planned to attend college. Forty-nine percent of the students were interested in a proposed degree in an agriculture related field and 16% were interested in a degree in science or medicine. The remaining 35% either responded as non-agriculture, undecided or left the answer blank.

Most families raised cattle, and fewer grew peanuts or horticultural crops. Cattle production is very cyclical, and growing peanuts is becoming less attractive due to changes in federal farm support programs. These producers might be interested in diversifying their production with horticultural crops. About half of the schools offered courses in horticulture. Most students were not interested in horticultural or agronomic crops, but about a third of the students were interested in doing a project in horticulture in conjunction with a member of the staff at this laboratory.

When the questions were analyzed on gender, or class standing, it was found that almost all students came from a farm-related family, had plans to attend college, and about 50% planned to pursue a career in agriculture. As class standing increased the number of respondents planning to attend college decreased. However, even in that group a large percentage of respondents planned to pursue a career in agriculture.

Since the middle-1970's there has been a decline in the enrollment in agriculture classes at the secondary education level. This may, in part, be due to desires on the part of children from farm families to seek careers out of agriculture. The data indicate that young people from farm families in southeastern Oklahoma want to be involved in agriculture. A greater problem is that there may not be opportunities for them to pursue their goals in the state. The desire of young people to be involved in agriculture does not guarantee that the family farm will exist when they are in a position to pursue that desire. Approximately one in five students expressed an interest in horticulture, or agronomic crops. This may suggest an interest in diversification of the current agricultural base from the traditional grass:cow/calf operation, or the production of peanuts, to other products.

Urban residents feel that rural areas and lifestyles should be preserved and that economic activities that include farming should be promoted (Willits and Luloff, 1995). The apparent desire of the secondary school students in this survey to remain involved with agriculture suggests that there will be people to replace current agriculture producers in southeastern Oklahoma who will retire.

Literature cited

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Osborne, E.W. and J.E. Dyer. 2000. Attitudes of Illinois agriscience students and their parents toward agriculture and agricultural education programs. J. Agr. Educ. 41:50-59.

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Table 1. Questionnaire inquiring about future plans and attitudes toward agriculture in general in general and horticulture specifically for students from southeastern Oklahoma having farm backgrounds.

	Yes Z	No
1. Do your parents grow horticultural crops?		
2. Do your parents raise cattle?		
3. Do your parents grow peanuts?		
4. Are you interested in vegetable or agronomic crops?		
5. Does your high school offer classes in horticulture?		
6. Would you be interested in doing a project in horticulture in association with a member of the staff of this laboratory?		
7. Are you planning on a career in agriculture?		
8. Do you plan to go to college?		
9. What will be your major _____?		
10. How many years has your family been involved in agriculture _____?		

11. What is your class standing?
    Junior High _____
    Freshman _____
    Sophomore_____
    Junior_____
    Senior_____

12. Are you: Female_____ Male _____? Y

Z If response was “yes” then coded as “1”, if response was “no” then coded as “0”.

Y If response was “female” then coded as “1”, if response was “male” then coded as “0”.

Potential for Salad Greens in Arkansas and Oklahoma

Teddy Morelock

Salad mixes are a growth area in the vegetable business that offers an opportunity for producers in the Arkansas-Oklahoma region. While there are a few small operations that are producing products for local sales there are not any producers that are shipping this type of product. The situation presents an excellent opportunity for growers to produce salad mixes that will fill a part of the growing demand for this type of product.

Most salad mixes that are currently available nationally are lettuce based mixes that utilize iceberg and other types of lettuce as well as other leafy vegetables such as radicchio, chard, mizuna, arugula, beet and occasionally spinach. While some of these vegetables can be successfully grown in the Arkansas-Oklahoma region iceberg lettuce is not adapted to our region. It seems logical that it should be possible to develop unique salad mixes that would comply with the lettuce based mixes that are commonly produced is California and Arizona at the present time.

Spinach is the logical choice to based salads mixes on in our region. Many other components of a basic mix can be successfully grown in our region. A few years ago we produced the leafy vegetables and made several types of spinach based salad mixes. The mixes were shown to a limited number of consumers and also to members of a professional taste panel in an informal setting. This limited audience was favorably impressed with our spinach mixes and they stated that the spinach mixes were as appealing as the traditional lettuce mixes for both appearance and taste. While this was a non scientific study it seems very likely that these types of mixes would be accepted by consumers and that they would be superior to lettuce mixes for overall nutrition and that this fact could be used as a marketing strategy for spinach based mixes.

The materials used to produce our salad mixes include semi-savoy spinach, ‘Southern Giant Curled Mustard ‘Bright Lights Swiss Chard’, ‘Giant Red Mustard’, ‘Osaka Purple Mustard’, ‘Red Orach’, ‘Red Ace Beet’, ‘Bulls Blood Beet’, ‘Rhubarb Swiss Chard’, ‘Hon Tsai Tai’ and ‘Red Russian Kale’ and ‘Tuscano Kale’. There are also several other vegetables such as various kale and collards, arugula, fennel and numerous mustards that could be successfully grown in our region and used to produce spinach based salad mixes.

To produce these various vegetables it is important that similar vegetables such as the mustards be grouped together and spinach and chards be grouped together because of the relative growth rates and similar response to herbicides.