

Contents:

Not a “Berry” Good Year	1
Unearthing the Layers of GIS	2
Heat & Drought Affects Vegetable Crops..	4
Genomics.....	5
Ross’s Produce Farm	8
“Doc” Scrivner	9
Cold Frames and Hotbeds.....	10
Developments in Tart Cherry Cultivars and Rootstocks	12
Dr. Dan’s Farewell.....	14
Growing Growers Program	14
Cleaning Up the Fall Garden	15
Berry Basket Subscriptions	17
Coming Events	17

From the Editors

by Marilyn Odneal

As the growing season winds down and we begin to think of late season chores, Jennifer Barnes-Schutter’s article is right on time with hints for cleaning up the fall garden. Gaylord Moore and Ben Fuqua are already evaluating the past season and planning for the next. Whatever you do, make sure to take time from work to enjoy our beautiful Missouri autumn.

Berry Basket Newsletter Staff:

Patrick Byers, Gaylord Moore & Marilyn Odneal
 Pamela Mayer - proofing, layout and mailing list.
 Rebecca Hilmes - posting and sending.

Please direct comments to:

Marilyn Odneal
 Missouri State University - Mountain Grove
 9740 Red Spring Road
 Mountain Grove, MO 65711-2999
 phone: 417-547-7513, fax: 417-547-7540
 e-mail: mbo774t@missouristate.edu
 Internet: <http://mtngrv.missouristate.edu>

Not a “Berry” Good Year!

By Ben Fuqua

Professor, Soil Science

Missouri State University

For most blueberry growers in Missouri, 2005 has been an “unforgettable” year. Cool, wet spring weather, freezing temperatures in May, followed by hot, dry, low humidity conditions in June, July, and August all played havoc with this year’s berry crop. Many growers are reporting significantly lower (40-60%) yields, smaller berries, and a shortened harvest season when compared to 2004. In addition, some plants are showing poor or little growth and no new cane production. On the positive side, berry quality in 2005 was generally good and consumer demand for fresh berries remained high.

Although 2005 was a difficult year, blueberry growers need to be reminded that plans for next year should begin now. Proper care of plants during late summer/early fall and continued attention to pruning, mulching, and fertilization are essential for next year’s berry crop.

Fall Care: Blueberry plants need water and nutrients during September and October for fruit bud initiation. While applying fertilizers during these months is not recommended (plants need to harden off to avoid winter injury), providing adequate water is essential. Normally, irrigation of blueberry plants can be substantially reduced by mid-September, as fall rains provide enough water. But this year, soil profiles are extremely dry, and fall rains (thus far) have been scarce

and widely scattered. Therefore, growers should plan to continue irrigating plants until the fall rains start or frost occurs. This may require irrigations into November in some parts of Missouri.

Controlling weeds is another major task for late summer and early fall. Many plantings are neglected after berry harvest as weed control usually takes a back seat to other more pressing concerns. Weeds, both broadleaves and annual grasses, seem to be attracted to the moist, nutrient rich, mulched blueberry rows and tend to take over many plantings. These weeds rob blueberry plants of valuable water, nutrients, and light and also produce numerous seeds. Allowing weeds to go to seed this fall just increases the potential for more weed problems next year. Herbicides, mechanical tillers, hoes, weed eaters, and even hand pulling may be needed to rid the blueberry rows of these unwanted plants. Areas between rows should also be mowed to keep other weeds in check.

Pruning: Although plant growth and production were rather limited in 2005, pruning, mulching and fertilizing practices next spring should follow the “business as usual” motto. Blueberry plants need to be pruned every year, regardless of the amount of new growth from the past year. Damaged canes and branches, weak spindly new growth, and old canes of low vigor should be removed to promote a healthy, high producing plant. While the majority of pruning is usually done in late winter (February/March) when plants are dormant, the fall months provide a good time to identify and rogue any diseased plants.

Mulching: Plan to renew mulches either this fall or early next spring. Mulches help regulate soil temperatures, keep valuable moisture near plant roots and improve the overall water/air relations in the root zone. Maintaining a 6-8 inch deep layer of mulch along plant rows also helps reduce weed problems and provides a “cushioned” area for pickers.

Fertilizing: Fertilizer plans should be developed and ready to go for next spring. The first application of fertilizer should be done at first bloom (organic fertilizers approximately 6-8 weeks earlier), followed by a second and third (if needed) application at 6-week intervals. Both fertilizer rates and grades need to be based on soil and/or leaf analyses. If these results are not available, growers should follow the same fertilizer plan as in 2004. Do not reduce fertilizer rates this year, unless dictated by the soil or leaf analyses. Regardless of plant performance in 2005, the amount of nutrient carryover from chemical fertilizers will probably be minimal. Organic fertilizers will have a greater nutrient carryover since organic compounds decompose more slowly and release nutrients over a longer time.

Conclusion: The fall months of September and October are crucial to the overall production of blueberries in Missouri. They are certainly not months for growers to sit back and let Mother Nature take care of the blueberry plants. Even though 2005 was not a “berry” good year, growers need to focus on the cultural practices that have proven to work. **All plant growers are optimists**, so keep planning and look forward to a better year in 2006!

Unearthing the Layers of GIS

*By Brandi Parsley
Biology Undergraduate Senior
Missouri State University*

Geographic Information System (GIS) is a rather big name for something many of us don't know anything about. It sounds extremely technical, or maybe even boring. Those were some of the thoughts running through my mind when I was first approached about using GIS software for a mapping project. I am a senior biology student with a love for trees that immediately led me to accept a summer internship at the Mountain Grove Campus

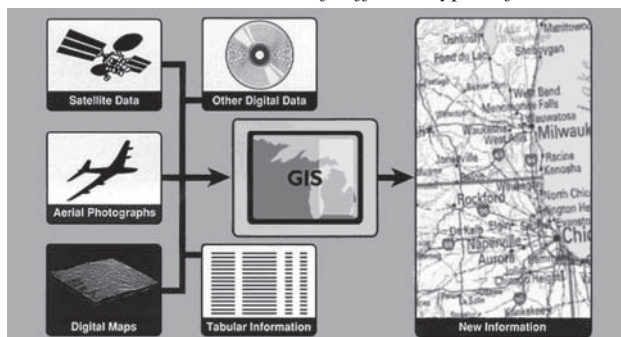
of Missouri State University. My portion of an ongoing campus arboretum project was to identify all the trees in a 12-acre part of campus and to create a database including all the scientific names, family names, age, and location of each tree. The data would then be linked to a map where all the trees had been digitized. However, no one was available to digitize the trees, so my introduction to the world of GIS began.

I have discovered that GIS is a hot new technology. It is used in agriculture, geology, biology, environmental sciences, economics, mining, politics, and the list continues. With new and better technology evolving rapidly, it seems that the applications for GIS may be unlimited! But what is GIS? The Environmental Systems Research Institute (ESRI), a leader in the field of GIS software, uses this definition:

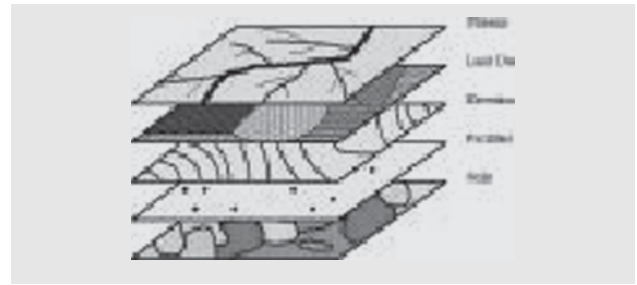
‘An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display geographically referenced information.’

This definition may not help newcomers understand what GIS really is. Basically, it is a computerized or electronic way to store, manage, manipulate, and analyze data from multiple sources that can be viewed as a map.

This shows the combination of different types of data all



combined in GIS to produce the map with many different features.



An advantage of GIS is that it depicts information by layers. You may select only the layers that contain data at which you wish to study. You can view one or several information layer(s) as a map or in whatever format best suits your needs. GIS technology also has the capability of allowing cities, companies, environmental groups, or research firms to estimate or predict future outcomes of a given action.

For example, ‘green infrastructure’ is becoming more and more important in urban areas. The Urban Forest Center at American Forest, a non-profit conservation group, has studied 25 metropolitan areas using satellite and aerial imagery to show the relationship between the loss of trees and increased cost to the city. Trees reduce the need for huge storm water systems; as illustrated when 10 counties in Atlanta, Georgia had to spend \$2 billion dollars on these systems due to loss of trees during development projects. Based on GIS analysis, it is estimated that the city of Roanoke, Virginia would save almost \$28,000 a year to control storm water if the city increased its tree population by 25%. This is just one example of the benefits of trees. Air pollution in cities increases almost proportionally to the decrease in the percentage of trees. Many metropolitan cities are planting trees in boulevards and other public properties and are offering homeowner incentives to plant trees in order to reduce the amount of carbon monoxide, ozone and other pollutants. Using GIS to calculate potential savings through tree use is leading to better planning, cleaner air, more shade, and increased beauty in lands of concrete infrastructure.

Agriculture is another important field where GIS is catching on and vineyards are one of



A. D. Daniels (left), a graduate student studying GIS, Dr. Michelle Bowe, co-curator of the Ozarks Herbarium and MSU Biology professor, and Brandi Parsley (right), senior biology student, discuss the Mountain Grove campus GIS mapping project.

the most active and GIS integrated areas. The quality of grapes is key in the winemaking industry and matching the right variety to the site improves quality and yield. GIS makes this possible by mapping layers of soil types, soil depths, water sources, temperatures, elevation, and other data. Not only does this information optimize yield, but also simplifies the presentation of environmental compliance to the government. When expanding a vineyard, GIS software can draw the expansion, taking maximum advantage of available space after distance between rows, plants, margins, and other parameters have been entered. It is also possible to estimate the entire cost if price of materials, equipment, and labor are placed in the database.

This was a very brief preview into GIS technology and the possibilities that it offers for people from businessmen, biologists, farmers, and everything in between. The websites listed at the end of this article offer even more examples of GIS in our everyday world with links to interactive maps and exciting studies using this technology.

Resources and information:

~The Guide to Geographic Information Systems. www.gis.com

~GIS and Mapping Software. www.esri.com

~USGS: Science for a Changing World. http://erg.usgs.gov/isb/pubs/gis_poster/

~USA Today. 'Some cities are finding money does grow on trees.' El Nasser, Haya. 7/28/2005.

~'Using a Geographic Information System in Vineyard Management.' Coggan, Marne. www.vwm-online.com/Magazine/Archive/2000/Vol26_No5/GIS.htm

Heat and Drought Affects

Vegetable Crops

Gaylord Moore

Regional Horticulture Specialist

University of Missouri

What a summer we have experienced in 2005! Some areas of the state have followed from the extremes of excessive moisture in the spring to exceptional heat and drought for the summer months. Needless to say this had a negative effect on many of our horticultural crops including fruits and vegetables.

Irrigation was a must this year. The 2005 growing season certainly was a testimony to the need of supplemental water and moisture conservation practices. Available water supplied by trickle irrigation or overhead irrigation was a must for production. If you find your irrigation capabilities inadequate and see a need for improvement, resources are available through University of Missouri Extension. A good contact is Bob Schultheis, agriculture agent in Webster County. Contact Bob by email at schultheisr@missouri.edu or by phone at 417/859-2044.

Hot and drought conditions emphasized the need for better soil structure and organic matter. Water holding capacities and structure may need to be improved by organic matter such as cover crops for plow down. In my opinion more attention should be given to soil improvement

in most truck farm and garden situations. I have an excellent reference guide [Cover Crops for Vegetable Growers](http://www.oznet.ksu.edu/library/hort2/MF2343.PDF) that I will be willing to share by way of Kansas State Extension. You may also download this guide to your computer from <http://www.oznet.ksu.edu/library/hort2/MF2343.PDF>

Heat and drought was responsible for lack of pollination and poor fruit set with several crops. Beans, cucurbits, tomatoes, peppers, sweet corn and other crops are sensitive to heat during pollination. As temperatures soared into the mid to upper 90s pollen from some crops become sterile due to the heat.

Nutritional problems such as nitrogen, calcium and boron deficiencies can occur under dry conditions. This was evident this year with the increased number of calls describing blossom end rot on tomatoes, peppers, squash, cucumbers and other cucurbit crops. Without the movement and uptake of adequate calcium into the fruit of the plant, deficiency symptoms such as rotting of the fruit on the calyx end may occur. The best method to reduce this problem is to provide adequate soil calcium and consistently available moisture to allow movement into the plant.

Droughty conditions affect nitrogen availability to the plant due to lack of movement within the soil. Nitrogen must move toward the root or the root must grow toward the nutrients. Either way, limited moisture affects nitrogen availability. Boron may become deficient in cole crops due to insufficient moisture as well. However, calcium and boron foliar sprays may help overcome both potential problems under these conditions.

Often, there is a fine line between adequate and inadequate moisture for fruit and vegetable crops. There is a great difference between sustaining plant life and crop productivity. Know your crops water needs and be prepared to supplement when natural rainfall is insufficient. Information is available on specific moisture needs of various fruit and vegetable crops for maximum production through your University of Missouri Extension Centers.

Genomics *A new science promises better understanding of fruit crop biology and the development of improved cultivars*

By Laszlo Kovacs

*Associate Professor, Biotechnology
Missouri State University*

The turn of the 21st century has seen an unprecedented growth in our understanding of life. This rapid progress in biology was brought about largely by a new cutting-edge science - genomics. Within just a decade, this new discipline has pervaded all trades dealing with living organisms, from bioengineering to medicine, to agriculture. Horticulturists have also begun to apply this new science with the ultimate goal of deciphering the genetic blueprint of the economically important fruit crops.

What is genomics, and how is it different from the century-old field of genetics? Genomics, as the name suggests, is the genome-scale study of organisms – not necessarily at the level of the entire genome (the full DNA sequence of an organism), but at a very large scale. This approach enables scientists to observe how genes function in their interactions, and how these interactions bring about various biological phenomena, such as fruit ripening, dormancy, or reactions to a pathogen or drought. Genomics allow us to view an organism as an entity and not merely as the sum of its parts. This is a major change in perspective from the traditional reductionist view of genetics where the goal is to dissect the effect of a single gene from the effect of the rest of the genome. This is what Gregor Mendel practiced in his classic hybridization experiments to decipher the heredity of distinct characters in peas. Thus, genomics emphasizes the inter-relatedness of the genes and affords a global, holistic view of the molecular basis of life.

The establishment of the genomic approach required major technological advances. Such technological prerequisites were dictated by the large size of the genomes. Grapevine,

for example, has a genome size of about 490 million basepairs (490 Mbp), and even the humble yeast cell contains a genome of 12.1 Mbp. Bacteria that cause diseases in orchards contain a DNA blueprint of about 6 Mbp in size. For sake of comparison, the human genome contains about 3,300 Mbp of DNA and some crop plants have even larger genomes than we do. It happened only recently that the sequence analysis of such enormous amount of DNA was made possible by high-throughput DNA sequencing and electronic data storage and data analysis technologies. By now, DNA sequencing is fully mechanized and automated: it is performed in industrial scale laboratories and is coupled with the digitalization and cataloguing of the resulting data by powerful computers. The enormous data sets are then organized into searchable databases and made accessible to researchers over the Internet.

Physical mapping. The most commonly applied technology is the sequencing of randomly generated large DNA fragments. The resulting fragments are ordered to recreate the long sequence of the DNA as it is present in its natural form in the chromosomes. This form of genomics is referred to as physical mapping, and its best known example is the Human Genome Project. Surprisingly, the only plant genome that has been sequenced thus far is that of a small, economically insignificant weed, named thale cress (*Arabidopsis thaliana*). The reason this plant was chosen for such a costly analysis is that it is highly tractable for molecular studies, and has become the favorite model organism for plant biologists – an indication of the clout basic biologists have in science policy nowadays. Of fruit crops, the grape and the banana genomes are under consideration for complete physical mapping. The realization of these plans, however, are contingent upon the procurement of funding.

Genetic mapping. Another approach, genetic mapping, utilizes large populations of plant progenies created by traditional cross-pollination between two parents that differ in some horticulturally important characteristics,

for example, fruit size or cold tolerance. Scientists then follow the inheritance of the trait in the population and compare it with the inheritance of certain DNA markers. The co-inheritance of the trait with DNA markers indicate that the gene or genes for the trait is located in the same region of the chromosome as the DNA markers. Genetic mapping research holds great promise for fruit breeding: Once the location of a gene is known, breeders can follow its inheritance on the basis of the presence of its DNA markers, a technique known as marker-assisted selection. This can be done even if the precise biochemical function of the gene product is unknown. The most significant novelty of marker-assisted selection is that it relies on the detection of DNA markers as opposed to the presence of the expression of traits encoded by genes. DNA markers can be quickly identified from minute amount of DNA, whereas such traits as cold tolerance or fruit quality can be confirmed only through years of observation. It is easy to see, therefore, that marker-assisted breeding can greatly accelerate the improvement of fruit crops, many of which are slow developing, woody perennial species.

Furthermore, the location of DNA markers can be identified within physically mapped DNA sequences. This enables scientists to determine the location of sequenced regions on a genetic map. Such “anchoring” of DNA sequences increases the resolution of genetic maps. More precise maps will enable breeders to select progeny plants that inherit the genes of the desired trait, but not the genes that are deleterious to quality or to agronomic performance. The resulting increased precision will further accelerate fruit breeding. Thus, the combination of physical and genetic mapping is a highly promising direction in horticultural genomics.

Transcriptome analysis. The third major form of genomics is transcriptome analysis. The term transcriptome denotes the information in the genome that is deployed in a cell and, therefore, determines the characteristics of that cell. The term “transcriptome” refers to the

fact that this information is transcribed from DNA into RNA. RNA can be extracted from the tissues using relatively simple physical processes. Following various chemical transformations, RNA can be assayed for the types of messenger RNAs (mRNAs) it is composed of, and for the abundance of each type of mRNA that is represented in a sample. Because each type of mRNA represents a specific gene, transcriptome analysis provides a “snapshot” of how the genome functions under a certain condition. Microarray hybridization, a recently developed technology, allows the analysis of thousands of genes at a time. This provides scientists with a panoramic view of gene expression and allow them to discern patterns in gene activity. As the function of many gene products are known as enzymes, structural proteins, or signal transduction proteins, some well-characterized biochemical pathways and physiological responses are recognizable in this way. Co-expression of unknown genes with genes of such well-characterized pathways shed light to the potential role of the unknown genes, thereby deepening our understanding of plant life.

An example of a transcriptome analysis project is our Vitis Gene Discovery Program at the Mountain Grove Campus of Missouri State University (“*vitis*” is Latin for grapevine). This research program attempts to understand the molecular basis of disease resistance in native North American grapevine species. We challenge the local disease-resistant grape variety ‘Norton’ and the European disease-susceptible grape variety ‘Cabernet sauvignon’ with the fungal pathogen powdery mildew. At various time points following inoculation, snapshots of the transcriptome are taken by analyzing the mRNA composition of leaf cells in both grape varieties. We hope that by comparing the results from ‘Norton’ and ‘Cabernet sauvignon’, we can understand how the pathogen-elicited molecular events differ in a grape that can defend itself from events in a plant that succumbs to the disease. We expect to see a difference in the gene expression

patterns that will tell us, for example, if there are unique genes in ‘Norton’ responsible for its resistance, or if the same genes are expressed in ‘Norton’ as ‘Cabernet sauvignon’, but perhaps in a different timely manner. There are a great number of similar transcriptome analysis programs being performed around the World in many economically significant fruit crops to understand the molecular underpinnings of such diverse phenomena as fruit ripening, aroma and flavor development, dormancy, winter hardiness, drought tolerance, and resistance to various diseases.

Is the sole purpose of The Vitis Gene Discovery and other fruit transcriptome analysis programs to generate pure and basic scientific information about horticultural plants? Far from it! Identifying molecular events and novel genes that confer favorable fruit and agronomic characteristics will enable us to better exploit a plant species’ innate, genome-encoded potential. Using the example of the Vitis Gene Discovery Program, we can utilize defense genes from resistant grape species to enhance the resistance of the cultivated grape. Such new varieties will require less chemical input to protect the plants from fungal infections, a condition that is highly desirable for the producer, the consumer, and the environment. *Vice versa*, we can utilize genes that confer high fruit quality in the cultivated grape to enhance the value of disease-resistant grapes, such as Norton.

Researchers do not only expect the new science of genomics to accelerate progress, but to open up novel ways in which fruit crops can be improved. There is a real possibility that genomics will help our progress toward more sustainable fruit production systems, which will bring forth high-quality products, but not at the expense of compromising environmental integrity or compromising public health.

Ross's Produce Farm

By Marilyn Odneal

Horticulture Outreach Advisor

Missouri State University

Growing produce for market is certainly a family affair at Ross's Produce Farm. June Ross, her husband Lonnie, and daughters Crystal and Amanda sell bedding plants and vegetables at the Mountain Grove Farmers' Market. The market also offers honey and baked goods from spring to fall at the town square on Tuesdays, Thursdays and Saturdays. June has been selling at the Mountain Grove Farmers' Market since 1997. Lonnie recalls "The first time June went to the farmers' market here, she came home with only 50 cents and she said never again!" Fortunately, June continued to sell at the market through the years, watching it grow from 7 to 10 vendors regularly selling produce from April to October. The Ross's also sell direct from their 27-acre farm located on the south side of Mountain Grove on Mondays, Wednesdays and



June and Crystal help their customers at the Mountain Grove Farmers' Market.

Fridays. June and Lonnie figure "We earn about half of our household income from the 20 acres that we plant in crops and the other half from work outside the farm."

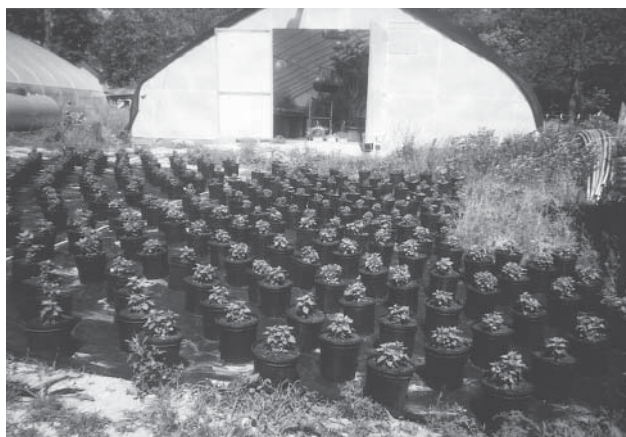
The Ross's have been selling produce since 1987. In Tennessee, they managed 10,000 laying hens as well as vegetable crops. They moved to Missouri in 1993 where they raised dairy cows along with vegetables until 1996 when they sold the cows. "We now raise bedding plants, tomato, eggplant, peppers, squash, beets, turnips, onions, lettuce, radishes, spinach, birdhouse and ornamental gourds, ornamental corn, sweet corn, potatoes, beans, purple hull peas, brown crowder peas, okra, cabbage, broccoli, spaghetti squash, pumpkins, and mums. We have also planted 1/2 acre of peanuts for the first time this year." They also planted sorghum this year and plan to extract, process and sell the syrup. "We have a mill and have done this before" says Lonnie while Crystal adds "yes, my job was turning the crank."

The Ross's still have animals on the farm including two well-fed hogs and one Belgian horse named Jessie. Lonnie plans to buy another Belgian to make up a draft team. "Lonnie really likes to use draft animals to work the soil," June says "but I prefer just turning the key on the tractor. It's a lot easier!"

Pricing is kept simple. "We generally charge a dollar a pound. That makes it easy to calculate. We don't charge more or less during the season either." June explains.

June, Lonnie and Crystal have noticed some differences between Tennessee and Missouri consumers. "Missourians like bush beans and Tennesseans like string beans. Some other crops that don't sell as well in Missouri are purple hull peas, brown crowder peas, okra, and Silverqueen corn. It also seems like Missourians like green zucchini squash better than yellow squash and it is the opposite in Tennessee.

Crystal manages the two 30 X 48 foot greenhouses that operate from January or February through July and later for fall mums. The greenhouses have gas heat and use only fans for cooling. Crystal's first greenhouse was



Crystal's mums in production for the fall market.

an 8 X 10 foot plastic house that she built as a Future Farmers of America (FFA) project and she has been starting seeds for the plantings and for bedding plant sales ever since. The Ross's grow most of their crops from seed and everything they sell, they grow. "That is one of the farmers' market rules, you sell what you grow yourself" says June.



Lonnie and Jessie work a corn field.

June cites one of the keys to success is the use of mulch. Many of the crops are planted on plastic with "T" tape irrigation. Crystal adds that it is also important to make successive plantings to ensure a constant supply of crops throughout the season.

As far as future plans, the Ross's may look into growing strawberries on plastic mulch, "but we haven't decided yet" Lonnie mentions. Lonnie's father still lives in Tennessee and, at 89, is still growing produce for market as he has all his life. It looks like market gardening just runs in the family.

C. L. "Doc" Scrivner

Teacher and Blueberry Pioneer

The Missouri blueberry industry has lost a pioneer. Clarence Leland Scrivner, 84, of Hartsburg passed away Tuesday, Aug. 2, 2005. Dr. Scrivner, known affectionately as "Doc" by his many friends in the blueberry industry, was born July 7, 1921, in Modesto, California, to Arzie Lee and Ella Adeline Bauman Scrivner. On Oct. 28, 1944, he married Alleen Faith Plessner of Marshall, and she preceded him in death on June 2, 2005.

He served with the U.S. Army during World War II. He received his bachelor's degree in agriculture in 1946, master's degree in soils in 1953 and doctorate in soils in 1960, all from the University of Missouri. He was professor of agronomy with the University of Missouri until 1985, at which time he was awarded professor emeritus. During his tenure, he had 26 publications on agronomy, supervised the dissertations of 17 students and had two overseas consulting assignments in Nigeria and the Dominican Republic.

His greatest contribution was as a teacher and student adviser. His greatest source of pride was to help a struggling student become a success. Doc, along with Alleen, created SGB Farms, which became a testament to his teachings and belief in taking something unproductive and making it productive. This farm became known for its blueberries and Christmas trees.

Survivors include three children, Carol Marie Busacker and husband Greg of St. Paul, Minn., Janet Lee Gross of Independence, and Alan Eugene Scrivner and wife Linda of Milwaukee; three grandchildren, Meredith Gross and Christine Gross, both of Independence, and Julie Brodie of San Bernardino, Calif.; and a brother, Gene Scrivner of Canyon Lake, Calif. He also was preceded in death by his parents and three siblings, Jeanette, Arzie Lee and Alice Lee.

Cold Frames and Hotbeds as Growing Season Extenders

By Suzi Teghtmeyer

*Evans Library of Fruit Science
Head Librarian*

Few people I know want to say goodbye to the garden's bounty as fall and winter set upon us. Seasonal change is inevitable, but there is a way to extend the growing season a bit longer by utilizing cold frames and hotbeds. A cold frame encloses a plant bed with either plastic film or glass, which traps and holds solar heat. The sun-heated bed extends the growing season in the fall and allows seedlings to mature quickly or harden off in the spring. A hotbed is similar to a cold frame but it is heated additionally from an outside source, often light bulbs, manure, steam, or electrical appliances. Another method is a "*cloche* (pronounced klohsh), originally a bell-shaped glass jar set over delicate plants to protect them from the elements. The definition has expanded, however, to include many types of portable structures that shelter plants from drying winds and cold air" (Relf and McDaniel).

Fall is an excellent time to construct a new cold frame or hotbed. It can be used immediately by starting or extending the life of cold weather vegetables, and it will be ready in the spring for starting seeds, cuttings, and seedlings. Placement and construction of a hotbed or cold frame takes planning. Site location is especially important. The proximity to the home (for convenience), the aspect, the shadiness, and the drainage of the site all factor into site selection. As one must dig two or more feet to place the frame, the soil condition needs to be considered.

The frame size will depend on the potential use. Many sources recommend limiting the width to three feet. You will have to reach all the way to the back to take advantage of the full space, and reaching the back can be difficult when kneeling in front of the frame. Length can be as long as you want, consider, though

purchasing materials such as lumber, glass, or polyurethane glass in their standard sizes or increments to avoid custom cutting charges and wasting materials.

Seeking out the best design for cold frames and hotbeds, I looked in the Evans Library collection and found designs in a 1935 Farmers' Bulletin (no. 1743 by Beattie), in old gardening books and in several extension publications. I found there are numerous designs and recommendations to their construction, but they are in resources not easily accessible to many of *The Berry Basket* readers. Therefore, I turned to Internet and found many credible guides to the construction of cold frames and hotbeds, including a few much older books that have been scanned (digitized). I recommend that you take a look at numerous guides to find a design you like and the instructions you understand before you purchase the materials. I have listed the sites below with a few words about each.

Building and Using Hotbeds and Coldframes (G6965) by Denny Schrock, Department of Horticulture, University of Missouri. 1998. 7 pages.

<http://muextension.missouri.edu/xplor/agguides/hort/g06965.htm>

This guide, in HTML, provides excellent guidelines to the design and construction of hotbeds and cold frames. The author goes into detail when describing hotbed heating cable length, layout and spacing, other heating methods, thermostat settings, temperatures necessary for certain plants, ventilation, pest control, and other topics. There aren't many figures, but the few are easy to understand. Within the article there is a link to a hotbed construction plan with detailed lumber dimensions, perspective drawings, and heating cable instructions.

Gardening: Hot Beds & Cold Frames by Karen L. Panter. University of Wyoming, Cooperative Extension Service Bulletin 1151. 2004. 6 pages.
<http://www.uwyo.edu/CES/PUBS/B1151.pdf>

Gardening (in pdf format) provides

instructions in paragraphs, supplemented by a small number of figures. Most of the publication concentrates on hotbed construction. The cold frames described are portable and can be removed or installed as needed.

Hotbeds and Cold Frames for Montana Gardeners, Fact Sheet #9803 by Ron Carlstrom and Robert Gough, Montana State University Extension. 1998. 4 pages in pdf format.
<http://www.montana.edu/wwwpb/pubs/mt9803.html>

This publication is available in both HTML and pdf formats, handy if you have a dial-up connection. The figures are very detailed with design parameters and lumber dimensions. The authors describe and illustrate heating cable layout, insulation recommendations, and even transplanting guidelines of young spring plants. A good guide from folks “up north”.

Hotbeds and Cold Frames, HO-53-W by Michael N. Dana and B. Rosie Lerner, Purdue University Cooperative Extension Service. 2005. 4 pages.
<http://www.hort.purdue.edu/ext/HO-053.pdf>

Dana and Lerner wrote a guide for the serious hotbed and cold frame builder. They describe the design of standard sizes, but also construction design for large-scale hotbeds, namely pit, electric, flue-heated, and steam/hot-water heated styles. The guide describes standard operations as well as a good soil mixture to use. The illustrations are well-drawn, but are a bit fuzzy and take close scrutiny to read legibly.

Season Extenders, Publication Number 426-381 by Diane Relf and Alan McDaniel. Virginia Cooperative Extension, 2000. 6 pages.
<http://www.ext.vt.edu/pubs/envirohort/426-381/426-381.html>

As with the other publications, Relf and McDaniel describe basic hotbed and cold frame design. In addition, though, they also describe the use of cloches, tunnels, row covers, and hotcaps as alternative means to insulate plants

against the cold. The figures are legible and nicely support the text.

The last three recommendations are digitized books from 1896, 1910 and 1912. They are part of the Core Historical Literature of Agriculture digitization project of Cornell University. To view the books go to the web address, click ‘Search’, and type in the title or author of the book to bring it up. Click on ‘Table of Contents’, and from this page you can look at each page of the book. The pages can be viewed in the original scanned image, in pdf format, or a retyping of the text. You can also search within the text for keywords, such as ‘cold frame’, to quickly identify the exact page(s) you want. (A side note: there are over 1,800 books in this project; I’m telling you about three!) The web address is: <http://chla.library.cornell.edu/>

Dreer’s vegetables under glass: A little handbook telling how to till the soil during twelve months of the year by Henry A. Dreer. Philadelphia: Henry A. Dreer, Incorporated, 1896.

Dreer’s book describes both home and commercial uses of cold frames and hotbeds in the Philadelphia area in the late 1800s. He does not describe explicit construction plans, but tells of how they were used in the area, when, and for which crops. The market value of crops potential profit, and crop rotation systems were also discussed. For those interested, Dreer also describes forcing houses (greenhouses). The book also includes photographs and illustrations of his subjects.

Gardening indoors and under glass: A practical guide to the planting, care and propagation of house plants, and to the construction and management of hotbed, cold-frame and small greenhouse by F. F. Rockwell. NY: McBride, Nast & Company, 1912.

Rockwell describes how to grow plants indoors in Part I and outdoors in Part II, the latter where you will find his chapter on hotbeds and coldframes (spelled as a single word).

He concentrates on their construction and soil quality rather than a ‘cropping system’ as described in Dreer’s book. Rockwell describes how to heat a hotbed using manure and goes into *great detail* about the best kind of manure to use and how to spread it to insure heat generation.

Handy farm devices and how to make them by Rolfe Cobleigh. NY: Orange Judd Company, 1910.

Cobleigh describes hotbeds and cold frames separately, concentrating on the first with different methods of heating the bed. He describes the manure method, but also using fire pits to warm the bed. The author states that with the fireplaces, you have more control over heating the beds and countering cold weather. Regarding their construction, the author recommends brick or pine lumber, and suggests a tile drain along the bottom of the hotbed to encourage proper drainage.

Developments in Tart Cherry Cultivars and Rootstocks

Patrick Byers

Fruit Grower Advisor

Missouri State University

For many years tart cherry production in North America (including Missouri) was based on a single cultivar, **Montmorency**, and two rootstocks, **Mazzard** and **Mahaleb**. In recent years, however, exciting developments in both new cultivars and new rootstocks have expanded the options available for producers of this potentially profitable crop.



Pick-your-own (PYO) cherries.

Montmorency has dominated the tart cherry industry for many years. This cultivar, which originated in Europe many years ago, has large fruit that is medium red in color, light colored flesh, and clear juice. Fruit quality is good, and Montmorency ripens in mid-June in Missouri. Trees are medium to large, spreading, productive, and vigorous. This cultivar is widely recommended for production in Missouri.

Two tart cherry cultivars, **Meteor** and **North Star**, were developed several years ago at the University of Minnesota. Both are genetically dwarf forms of tart cherry, with North Star being a particularly small tree. Both are hardy, produce small fruit, and are currently not recommended for commercial production in

Missouri. Another series of genetically dwarf tart cherry cultivars is under development in Canada, but cultivars from this program are presently not available for testing in Missouri.

Surefire is a recently released tart cherry cultivar from New York. The fruit is bright red, medium in size, and very tart. The trees are vigorous and productive. Surefire is described as late blooming.

Three tart cherry cultivars developed in Hungary are now available in North America. Reports from the Great Lakes suggest that the fruit of these cultivars, which is large, sweeter than Montmorency, and firm, may offer potential for sales as a fresh fruit which is consumed directly, unlike most tart cherries, which are utilized as a processed fruit or in baking. These cultivars produce fruit which is dark red, with red flesh and juice. Trials in other regions suggest that these cultivars are less productive than Montmorency and possibly less hardy. **Balaton** is widely tested, and appears to offer potential for Missouri tart cherry producers. This cultivar ripens a few days later than Montmorency. The complex flavor of Balaton fruit is uniquely adapted for wine, dried fruit, and specialty products such as chocolate covered cordials. The other two Hungarian cultivars, **Jubileum** and **Danube**, have similar fruit characteristics to those of Balaton. Jubileum has had the sweetest fruit in trials. Jubileum and Danube ripen earlier than Balaton, usually at the same time as Montmorency. The Hungarian cultivars have not been extensively evaluated in Missouri.

Mazzard and **Mahaleb** are good rootstocks for tart cherry in Missouri, and will remain standards for several years. However, several recently developed sweet cherry rootstocks may offer potential for tart cherry growers, particularly in the area of size control and precocity. In particular, the Gisela series of rootstocks, developed in Germany, are of interest. Four Gisela stocks have been tested in North America and are commercially available.



Montmorency Cherry.

The information below is from a report from Pennsylvania State University on the performance of cherry rootstocks.

Gisela 5: Tested as Gi148/2, it is reportedly very precocious, producing a tree about 50 percent the size of Mazzard. The rootstock seems to induce an open canopy with wide branch angles. Trees produce few suckers.

Gisela 6: Tested as Gi148/1, it is a precocious rootstock that produces trees about 65 to 95 percent of the size of trees on Mazzard. It is reported to induce early bloom and is tolerant of viruses. Extra care must be taken to ensure that the desired shoot extension growth is maintained

Gisela 7: Tested as Gi148/8, it is reported to be about 50 percent the size of Mazzard. The rootstock produces some suckers. Support is also recommended for trees on this rootstock. Gisela 7 in recent research has shown some sensitivity to Prunus Necrotic Ringspot virus. Therefore, nematode management strategies for peaches should also be used when planting this rootstock.

Gisela 12: Tested as Gi195/2, this is a

Dr. Dan's Farewell

It has been my pleasure to serve the fruit industry of Missouri for the last three years. My work in the Missouri State University Fruit Science Department as an assistant research professor and integrated pest management specialist officially ended on September 9. Last spring I decided to make a career change and take an opportunity to work full time in church ministry. I have started a new position as the Associate Pastor of Spiritual Growth and Administration at the First Baptist Church of Mountain Grove. I look forward to making the transition from pest management of fruit to bearing fruit of a spiritual kind.

Wishing you all the best in your future endeavors,



Dr. Dan admiring his cake with insects in the frosting at his farewell party.

Growing Growers Program Trains Market Gardeners

The Growing Growers Program is looking for would-be Market Gardeners for the Kansas City area. Funded by a grant from the USDA SARE program, Growing Growers offers apprenticeships on organic and sustainable farms within 100 miles of Kansas City. Apprentices, both paid and volunteer, work on local farms through the growing season, attend monthly workshops, and receive individualized training from their host farmer.

“Our goal is to give people both practical, hands-on experience with market farming in the Midwest, and to give them theory and the ‘big picture’ through the workshops and trainings,” says Katherine Kelly, Program Manager and farmer at the KC Community Farm. “A lot of people dream about running a small farm and selling locally, this is a way to start making that dream a reality.”

In 2005, 23 apprentices worked on 15 farms in the metropolitan area. All of the farms primarily produce vegetables, but a number of them also grow small fruit, tree fruit, mushrooms and other horticultural products; some also raise cattle, hogs, poultry and other small livestock.

Growing Growers is a collaboration between University of Missouri, K-State, the Kansas Rural Center, and the Kansas City Food Circle.

For more information about Growing Growers, visit www.growinggrowers.org or call 913-515-2426.

Cleaning Up the Fall Garden & Getting Ready for Winter

*By Jennifer Barnes-Schutter
Regional Horticulture Specialist
University of Missouri*

As summer comes to an end, and days get cooler, trees turn color and drop leaves, and Friday night football games are the place to be, we need to begin thinking about fall garden cleanup. You do need to take some time this fall to clean up your yard and garden and prepare your plants for winter. This needs to be done in September and October, as you don't want to put it off until temperatures drop, snow falls and you would rather be making holiday goodies and spending time indoors. Many people wonder just what does need to be done to the garden or yard in the fall. Here are a few tips to get you on your way to fall garden cleanup.

Start preparing your plants to over-winter in midsummer using only "winterizer" fertilizer. These fertilizers are high in potassium and low in nitrogen. Late applications of nitrogen heavy fertilizers will stimulate new, soft growth, which doesn't have a chance to mature before frost. For the same reason, avoid severe pruning late in the summer. The exceptions are a few late blooming shrubs such as hydrangeas and clematis. Just before a freeze, water all shrubs and plants heavily to ensure that soil around the roots is moist going into winter. This is especially helpful with evergreens, as they transpire moisture all winter. Products such as anti-desiccants can be applied to evergreens to help prevent moisture loss. You can find them at most garden centers.

Lawn care in the fall will yield maximum results the following growing season. Apply herbicides in September to control weed infestations. Aerate if the soil is compacted or if thatch is a problem and apply gypsum and fertilizer to improve soil conditions and provide nutrients for healthy turf growth. The nitrogen should be mostly from water insoluble nitrogen or controlled release nitrogen to prevent

excessive top growth. Continue mowing the lawn so that it is no higher than 1.5 to 2.0 inches going into the winter. A lawn should be only 1.5 inches tall where the snow tends to accumulate and snow mold or powdery mildew might be a problem. Most cool season lawns are best maintained at a 2- to 3-inch height during the growing season. As the month of October nears, the height can gradually be reduced to the over-wintering heights. If the grass ceases growth before all deciduous foliage has fallen, use the mower as a leaf mulcher or vacuum to keep the leaves from packing down and smothering the grass. Have the mower serviced and stored for winter to maximize efficiency and longevity of the machine.

Houseplants that have summered in the garden or patio need attention as the month of September approaches. Most are tropical in origin and will suffer a setback when the night temperatures drop sharply at this time of year. Some may require grooming. An easy way to do this is to assemble them in an outdoor place where you can cut them back if necessary, inspect them for insect and diseases and repot any that have outgrown their containers. Return them indoors in time for them to readjust to their indoor environment before the heat is turned on. Expect some leaf loss or the browning of leaf edges on some plant species. This simply indicates adjustment to lower light and humidity levels indoors.

Two plants that will require special care after their summer outdoors are the poinsettias and Christmas cactus. Both have similar requirements in that they need a 14-hour period of continuous darkness each day from October 1 until mid-December to set flower buds. Two methods to accomplish this are to either set the plants in a closet or place a cardboard box over them from 6 p.m. until 8 a.m. for the period listed above. At all other times, the plants should receive normal light exposure.

Dig tender bulbs and corms that are desired for next season. These would include but not be limited to gladiolus, dahlias and tuberous begonias. Many can be enjoyed right up until

a good frost blackens their tops. Be sure to dig the bulbs carefully, retrieve any offsets that may have developed, and leave the foliage intact. Place the bulbs in an airy, sheltered spot to dry for a two to three week period. Except for begonias, foliage and stems can be cut off with a sharp knife near but not at the point where they emerge from the bulb. Allow begonia stems to dry until they are brittle enough to break off from the bulbs. The bulbs will over-winter well in a dark, cool place (45 to 50 degrees F) when stored in vermiculite, peat moss, or similar material. It is also recommended to dust with a fungicide (Bordeaux mixture) and insecticide (Sevin dust) to curb disease and insect development in storage. Except for daffodils, mice and other rodents consider bulbs of all kinds to be premium food, so store bulbs where these pests will not have access to them.

Finish planting spring flowering bulbs (i.e., tulips, daffodils, hyacinth) and dormant, deciduous nursery stock while the soil remains manageable.

After a heavy frost, remove all blackened plants such as zinnias, petunias, marigolds, vegetable plants, etc. Remove and destroy plant stems on any perennials that may have had diseased foliage (i.e., peonies and lilies). Good sanitation now will result in fewer disease problems next spring. Diseased vegetation should always be removed so spores won't germinate early and infect your plants next year. After clean up, let your garden air dry for at least a week. Mark the location of any young plants that have self-seeded over the summer. You can then transplant them when spring arrives. It is a good idea at this time to draw a rough sketch showing where all your plants are growing. After the airing, spread an inch of compost over the flower garden followed by a loose mulch. I've used leaves in the past, but you can also use straw. Leaves tend to mat down and smother the plants when the spring thaw comes. Also at this time, you should till the vegetable garden to expose insects and insect eggs to the surface that might otherwise over-

winter in the soil.

Mulch is not meant to keep the soil warm, but to keep the temperatures around your plants even. This keeps the plants from heaving during an early thaw followed by freezing. It also keeps the plants from starting growth too early in the spring. Lay mulch around shallow-rooted plants after the ground freezes. Avoid piling it against trunks or crowns, which can cause rot. If mice are a problem where you live, a thick mulch may not be a good idea. Mice are very fond of straw.

Roses need winter protection too. Final winterizing is usually done in late October after a deep freeze, but tying the canes loosely beforehand will ease the job. For the final winterizing, cut the canes back to about 6 to 12 inches and mound the plants with fresh topsoil. Many gardeners successfully over-winter their roses and other tender perennials by covering with bags of leaves collected in the autumn.

One last tip, as you prepare to put away your tools and equipment for the winter, give them a thorough cleaning. Bring out the soap and water, sponge and scrubber. Clean your hand tools, lawn mower, weed whackers and all other equipment. Hand dry them or let them air dry. Now you are ready to store them for winter, as winter can be hard on them too.

It may seem like a lot of chores to do, but I love this time of year with the fall colors and cooler temperatures. I even like fall cleanup. It gives me a good excuse to be outside enjoying the last weeks of nice weather before the long, gray winter sets in.

Berry Basket Subscriptions

The Berry Basket Newsletter is a free publication for market growers and gardeners produced cooperatively by University of Missouri Extension - Greene County and the Missouri State University Fruit Experiment Station - Mountain Grove.

A free electronic version of this newsletter is available at

<http://mtngrv.missouristate.edu/newslet.htm>

Listserv members will get an email notice each quarter when a new issue of the newsletter is available.

For a print subscription to this newsletter (free to Missouri residents), contact:

Pamela Mayer
Outreach/Publications Specialist
Missouri State University
Dept. of Fruit Science
9740 Red Spring Road,
Mountain Grove, MO 65711-2999
phone: 417-547-7500, fax: 417-547-7540
e-mail: pam621t@missouristate.edu
Internet: <http://mtngrv.missouristate.edu>

PLEASE NOTE:

The web page addresses and the newsletter contact information has changed from the past and is as listed above.

Coming Events

13th National Small Farm Trade Show & Conference

November 3 - 5, 2005

Stock Dog Clinic
November 2, 9:00am - 3:00pm
Columbia, Missouri
800/633-2535
www.smallfarmtoday.com

Missouri Small Fruit and Vegetable Conference

February 20 - 22 2006
Clarion Hotel and Conference Center
Springfield, Missouri

Monday, Feb 20
PreConference Bus Tour

Tuesday Feb 21
Keynote, Marketing, Vegetable and Blueberry Sessions
Tuesday Evening Feb 21
Organic Marketing Workshop

Wednesday Feb 22
Strawberry and Alternatives Sessions
Concurrent Session
Wednesday Feb 22 10am - 4 pm
Missouri Farmers' Market Assn. Workshop
Also featured, an **Ornamentals Session**

For more information go to:

<http://mtngrv.missouristate.edu/>

or contact:

Pamela Mayer, Outreach/Publications Specialist
Missouri State University
Dept. of Fruit Science
9740 Red Spring Road
Mountain Grove, Mo. 65711-2999
417/547-7500 FAX 417/547-7540

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Your editors of The Berry Basket:

Gaylord Moore, Area Horticulture Specialist,
University Extension, Springfield, Missouri.



Patrick Byers, Fruit Grower Advisor, and
Marilyn Odneal, Horticulture Outreach
Advisor, Fruit Science, State Fruit Experiment
Station, Missouri State University, Mountain
Grove, Missouri.



Send address changes and comments to:
Dept. of Fruit Science, 9740 Red Spring Road,
Mtn. Grove, MO 65711 or mbo774t@missouristate.edu.
