



The Berry Basket

Newsletter for Missouri Small Fruit and Vegetable Growers

Volume 5 Number 1

Spring, 2002

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Balance of Power

by *Ben Fuqua*

Seventeen chemical elements (nutrients) are required by highbush blueberry plants for vegetative growth and berry production. Some of these nutrients are needed in larger amounts (macronutrients) than others (micronutrients), but all are essential for growing healthy plants that can produce high fruit yields. Failure to provide nutrients in the correct proportion and in adequate amounts may result in many plant abnormalities, such as few or no new canes produced, little or no growth of existing canes, changes in leaf color, size, or shape, poor fruit bud development, and decreased yield.

Visual symptoms of plant abnormalities are usually easy to spot and should send up a "red flag" that something is definitely wrong with the plant. However, identifying the specific problem or the cause of the problem can be much more difficult. One of the best tools for identifying specific nutrient deficiencies and nutrient imbalances is a leaf or foliar analysis. A foliar analysis measures the amount of nutrients that are actually absorbed by the root and incorporated into the plant leaf. These values can then be compared with the nutrient content from normal, healthy blueberry plants and rated as "deficient", "adequate", or "excess" levels. While foliar tests can be done anytime during the growing season, nutrient levels in blueberry leaves are most stable just after harvest. In Missouri, this means that leaf samples should be collected in late July/early August for the most accurate results. Leaf analyses are excellent guides for developing a sound fertilizer program for the upcoming year.

From the Editors

by *Marilyn Odneal*

Is it spring yet? We know it's a busy time for everyone but we hope you find an interesting item in this issue that will coax you into a relaxing read. Thanks to our contributors and staff for this varied assortment of articles for spring.

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Recent information on nutrient content of blueberry leaves grown in Missouri indicate slightly different levels when compared to blueberry plants grown in other states. This would be expected as our soils differ from those in other areas. The major nutrient problems of blueberries in Missouri center on nitrogen, magnesium and iron, with isolated problems involving potassium and boron.

Nitrogen (N): Nitrogen is required in large quantities by blueberry plants. Annual fertilizer rates of 60 to 120 pounds of N per acre are commonly applied to blueberry plants in Missouri. Nitrogen is one of the mineral components of the chlorophyll molecule and it plays a major role in protein synthesis, thus adequate nitrogen must be available throughout the growing season to maintain healthy, green, productive blueberry plants. Leaf nitrogen content from healthy, producing blueberry plants at several locations in Missouri was in the range from 1.5 to 2.0% N.

Blueberry plants lacking sufficient nitrogen are stunted, slow growing, and exhibit uniform yellow (chlorotic) colored leaves. The deficiency symptoms appear first on older leaves and eventually encompass the entire plant as the deficiency becomes more severe. Nitrogen deficiencies in blueberries can occur anytime during the growing season.

Excess nitrogen also causes many problems in the growth and development of blueberry plants. Too much nitrogen results in very dark green foliage and an abundance of spindly, thin, new growth. Canes and leaves containing excess nitrogen are usually very succulent and are more susceptible to drought stress and winter injury. A reduction in the number of fruit buds formed may occur in plants containing excess nitrogen. Excess nitrogen can also interfere with the absorption of other nutrients, particularly phosphorus and potassium.

Potassium (K): Potassium's role in plant metabolism is that of a catalyst rather than as an integral part of the plant structure. Potassium deficiencies begin on the edges of older leaves and progress toward the leaf center. Leaf edges

turn from yellow to brown as the deficiency becomes more severe. Leaf margins are easily torn, leaving a very ragged leaf appearance. Potassium levels between 0.40 to 0.80% K are found in blueberry plants grown in Missouri. Excessive potassium in blueberry plants causes several nutritional imbalances, particularly in the relationships of potassium with calcium and magnesium.

Magnesium (Mg): Soils in parts of Missouri have low magnesium content that can cause magnesium deficiencies in blueberry plants. Early stages of a magnesium deficiency appear as interveinal (leaf area between veins) chlorosis of the older leaves, with the leaf veins remaining dark green. As the deficiency becomes more severe, leaves may turn red, yellow, or brown and prematurely drop from the plant. Leaf content of 0.10 to 0.20% Mg is commonly found in Missouri grown blueberry plants.

Other macronutrients: No deficiencies of phosphorus (P), calcium (Ca), or sulfur (S) have been observed in blueberry plantings in Missouri. Phosphorus leaf content in the range of 0.07 to 0.11% P appear to provide adequate amounts of phosphorus for plant growth and production.

Calcium deficiencies in blueberry plants grown in Missouri are unlikely due to the high calcium levels in the soil. Excess soil calcium can be a problem as it interferes with the absorption of potassium and magnesium. Excessive calcium also causes higher pH levels in the soil, which reduces the availability of iron for plant absorption. Leaf content in the range of 0.40 to 1.0% Ca were measured in healthy Missouri blueberry plants.

Sulfur deficiencies are also unlikely in Missouri due to the addition of sulfur compounds to the soil to lower the pH to the optimum level for growing blueberries. Applications of sulfur and sulfuric acid supply sulfur for plants as they acidify the soil. Applying ammonium sulfate fertilizer provides both sulfur and nitrogen to plants. Blueberry plants in Missouri containing 0.11 to 0.15% S exhibited no visual symptoms of sulfur deficiencies.

Iron (Fe): Although iron is classified as a micronutrient for plants, it is required in rather large amounts by blueberry plants. Iron deficiencies are common in blueberry plants grown in Missouri's mineral soils, particularly in soils with a high pH. Lowering the soil pH to the recommended 4.8-5.2 normally eliminates most of the problems of iron deficiencies. High levels of phosphorus, calcium, magnesium, or manganese in the soil can also cause iron deficiencies in blueberries. Iron leaf content in Missouri blueberries generally ranges from 50 to 100 ppm (parts per million).

Boron (B): Boron affects the growing parts of plants. Deficiency symptoms in blueberries include: deformed tips of canes and branches, cane and root die-back, and cupped, bluish-green leaves. Boron content of 30 to 50 ppm is routinely found in blueberry plants in Missouri. Some blueberry plantings have shown a decrease in the extent of dieback of cane tips and an increase in flower buds when boron was applied. Other plantings have not responded to boron applications.

Other micronutrients: Very little information is available on the optimum levels of other micronutrients for the growth and production of blueberries. Most soils appear to contain adequate levels of micronutrients for growing blueberry plants. One nutrient, manganese, can be toxic to blueberry plants growing in extremely acid soils. Manganese levels in the blueberry leaves collected in 2001 contained 100 to 500 ppm and did not show any toxicity symptoms.

Summary: One key to growing vigorous, healthy highbush blueberry plants capable of producing high yields of quality berries is good nutrient management. Good nutrient management requires regular monitoring of soils and plants to insure that the correct amount and the proper balance of macronutrients and micronutrients are provided to blueberry plants. Too little and too much of a specific nutrient or having a nutrient imbalance in the soil/plant negatively impacts the overall growth and production of blueberries in Missouri.

Blues News

by *Earnie Bohner*

Jay Chism's excellent work as president of the Missouri Blueberry Council is greatly appreciated. I am now honored to serve as council president, with vice-president Linda Jones and secretary/treasurer Jean Klapmeyer. Please note that we do not have the plastic picking bags available this year. I also urge all members to seek new people interested in joining the council. Please have them contact me for details:

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Have a great season!



The annual meeting of the Blueberry Council is held in conjunction with the Missouri Small Fruit and Vegetable Conference. Here a future blueberry grower (?) claims one of the door prizes at the 2002 conference.

Irrigation System Planning

by *John Avery*

The Midwest is fortunate to have an ample amount of annual rainfall and at times irrigation is not needed. Inconsistency in the rainfall pattern generally makes it economical to irrigate a fruit planting. Young plants are especially susceptible to drought conditions. During the first two years after planting, irrigation can pay for itself in plant survival and growth. Mature plants benefit from irrigation to supply water during extended periods without rain that would otherwise reduce fruit size and quality. Systems should be sized to take care of the new planting, that is the first 3 or 4 years, and then to help with the older planting in those years when extended dry periods occur.

Irrigation design is a broad topic, which cannot be covered in a few pages. Always look into the future in your plans and design your system with the option to expand. Utilize the services of an irrigation specialist from the beginning. It's much easier and less expensive to correct a problem on paper than in the field.

This article is designed to help you get started with questions and considerations for your irrigation specialist, as well as to help you build your "irrigation" vocabulary.

Water source

There are several questions that must be answered first before planning your irrigation system. What is the source of irrigation water? Do you have a well? Will you dig a well? What is the expected output of the well? Generally, the deeper the well the higher the output and the greater the cost. The deeper the well, the higher the cost to drill and more expensive pumping equipment will be needed.

Will you be using a pond or a creek/river for your irrigation water? Ponds are expensive to build but can provide a source of water. But there must be a site for pond construction near the planting site. Then the pond must be sized to provide the needed water for the proposed planting and any future expansion. If a stream/river is to be used then government permits

must be obtained to withdraw water from the source. Will the government allow sufficient water removal to meet expected needs? When using open water sources the water must be filtered to remove contaminants, which would plug emitters. Filter systems can be expensive and require constant upkeep.

Sizing the System

The size of the system will depend on the answers to a few questions. What is the size of the planting or proposed planting? Is the planting established or not? What is the expected output per plant or per acre of the system? What funds are available to obtain a water source? All of these questions are interrelated and the answers for one question depend on the answers for other questions.

Components

The basic component of an irrigation system is the emitter, the part that waters the plant. There are many styles with varying outputs to consider. There are the drip emitters and then there are the micro-sprinkler emitters that spray a relative large area under the plant. Generally the drip emitters are used in small fruits. With drip emitters there are plug-in types and in-line types. With in-line emitters there are differences in spacing in addition to different water outputs. Output is given in gallons per hour or liters per hour. Spacing can vary from 1 foot to 10 feet between emitters. Generally, for small fruits, we use two emitters per plant with one or two gallons per hour output each. If, for example, plants were spaced 8 feet apart in the row, then emitters are spaced at four feet apart on the line resulting in two emitters per plant. The output of the emitter is selected based on the total output of the water supply and the size of the planting to be irrigated. Another consideration would be the number of zones (areas that can be irrigated separately in a cycle) the planting can possibly be divided into.

The next component is the black polyethylene tubing, that carries water down the row. These lines are referred to as the laterals. The emitters are either punched into the tubing or built into the tubing when manufactured. The size of

tubing is dependent upon the emitter output and the number of emitters the line must support. Generally, 16-mm tubing is standard for row lengths of 400 to 800 feet. An irrigation specialist can assist in sizing the lateral lines.



Irrigated vineyard with lateral lines attached to the bottom wire that runs down the row.

Definitions

The following definitions will aid your understanding of irrigation systems and help you when talking with irrigation designers or sales representatives. The design of an irrigation system can be complicated and a design engineer or specialist should be consulted.

Output-the amount of water released in units per time at the reference point. Example: an emitter has an output of 1 gallon per hour or a well has an output of 100 gallons per minute at the head.

Pump-a device that provides a prescribed amount of water at a given pressure. There are many types of pumps. The right one for you will depend on the water source, the irrigation system needs, and the amount of money available to spend on the pump.

Pressure relief valve- Device for releasing excess pressure at any place the pressure might exceed the system design.

Air vents- Devices for releasing air from the irrigation system. Two basic types are continuous and non-continuous. The non-continuous type releases large volumes of air as the system is being pressurized and is sealed when the system is fully pressurized. The continuous vents release air while the system is pressurized and functioning.

Check Valves- Devices to prevent water from flowing back in the direction from which it came. Check valves are needed where fertilizer/chemical injectors are used. They are also needed at the well head to keep water from flowing back down the well thus allowing air back in the system.

Valves- Devices that control the flow of water from one line to another at various points in the system. Generally there is a main valve at the source or pump. There are also valves at filters, sub-main lines, chemical injector locations and finally at drainage points. There are two main types of valves: butterfly or gate valves. They can be either manual or automatic.

Mainline- The main water line that carries water from the pump to the field and distribution lines.

Sub-Mainline- Water lines that break the system down at various points and distribute water to individual plantings.

Lateral lines- Water lines that move the water down individual rows of the planting and usually contain the emitters.

Heirloom Vegetables - From the Past to the Present

by *Gaylord Moore*

Heirloom vegetables are defined in several ways. However, I think of them as open-pollinated crops that have been handed down as a favorite because of some specific trait or quality that makes them special to grow. They may be special only because they were something that grandpa grew and you want to keep the traditional planting alive. Growing heirlooms is a great way to keep history alive and to enjoy a taste of the past.

Many gardeners grow heirlooms that have a superior flavor. Often quality of flavor has been replaced in the newer varieties with shipping and keeping characteristics and luscious beauty. We know consumers purchase fresh vegetables often with their eyes instead of their tastebuds. However, if the product does not have good flavor, the consumer may not be as anxious to buy the next time.

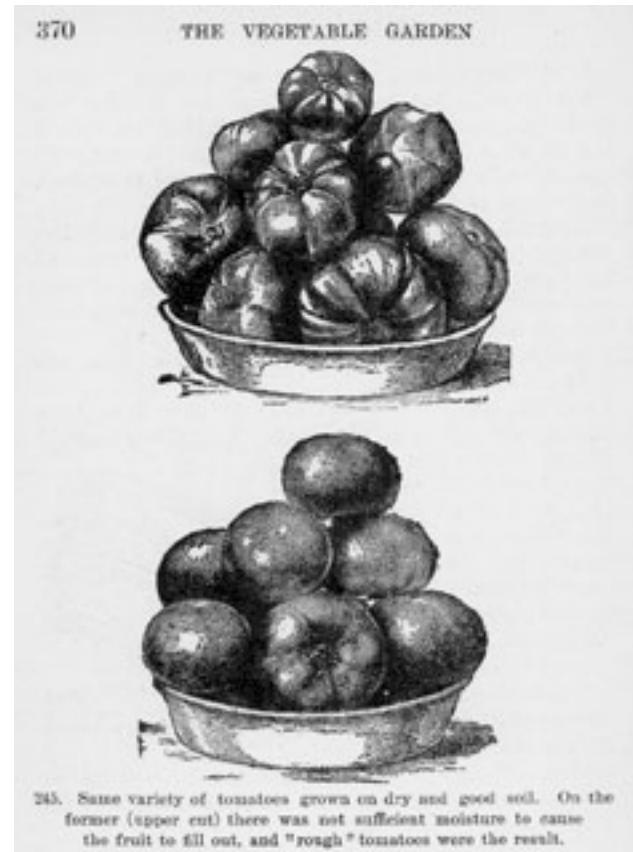
To some extent gardeners may grow heirlooms to save money on seed but that is not the prime reason. Seed costs for the gardener are the least of gardening expenses as compared with time, fertility and preparation.

There are several ways that home gardeners can maintain their seed stock without unwanted crossing (the sexual recombination between two different plants). Some vegetables are mainly self-pollinating and seeds will produce plants like the parent. Beans and tomatoes are two most popular crops that maintain heirloom status because they are easily maintained true to type. Insects occasionally cross varieties with self-pollinating varieties, so to be safe it is best to isolate varieties at least 10 ft. apart.

If you plan to save seeds from open-pollinated varieties, be sure seeds are fully ripened before they are harvested. Select seed from healthy vigorous plants to promote good germination and healthy growth.

Most vegetable seeds remain viable for three to five years when stored properly. Place

thoroughly dry seed in a tightly closed glass jar and keep the jar in a cool dry location. Store seed in the refrigerator to further increase its life expectancy. Some of the long-lived seeds include melons, peppers, tomatoes, cucumbers and cole crops. Short-lived seeds can only be depended on to last to the next growing season. Sweet corn is a good example of short-lived seed.



Growing heirlooms is part of the fun in gardening. It may be to continue a family tradition or to retain part of a culture, handed down from generation to generation. It may be a gardener's way of preserving American history. Whatever the reason, heirloom plants are our living links to the past. And, a little nostalgia once in awhile is good for the mind and the soul.

Preparing to Plant Perennials

by Jennifer Barnes

Do you enjoy plants but don't have a lot of time to maintain them? If so, you should choose perennials for your garden. Perennials are plants that come back year after year without replanting or reseeding. They include bulbs, woody trees and shrubs, cacti, succulents, grasses, ferns, some herbs, and many groundcovers. They are an effective, low-maintenance way to beautify your garden.

Perennials can be used in a variety of ways and there are hundreds to choose from that offer the gardener a good deal of versatility for all areas of the landscape. You can select plants that grow well in dry or wet sites; full sun or shade; shallow, poor soils or deep, fertile soils. Perennials may be used to solve the problems of difficult to manage areas like steep embankments, hillsides, and rocky sites. You may choose to select several different species based on bloom time so that you will have a colorful garden all season long. Note that bloom times may vary due to weather and growing conditions. You may choose to select a few accent plants and fill in with annuals for extended color during the season.

Before selecting any plants for your garden you should sketch out a plan showing existing plants and where you wish to place new plants. Keep in mind the amount of sunlight available to your plants and the quality of soil. Select plants that are hardy for your area. Plant hardiness generally refers to how tolerant a plant is to cold temperatures. Other things to consider are plant size (spread and height), texture, form, and color. Colors can be used to create special effects and moods. Blue, green, white, and pale shades of lavender and yellow are cool colors. Orange, red, and bright yellow are warm colors. Red and other vibrant colors make a display seem closer than it is, and can create the idea that the garden is larger. Cool colors of purple and blue can make a garden appear smaller and more distant. For a garden with interest all season long, plants should be chosen so that

when one is finished blooming, others will overlap in bloom time or bloom soon after. Plants can also be chosen simply for their attractive foliage, which will contribute to the overall effect of the garden all season long.

Evenings or cloudy days are the best times to plant. Avoid planting on a hot, sunny day as this may cause the plants to wilt. A good watering schedule especially the first year is very important. Care should be taken to keep water off the foliage, as the wetness at night will promote disease problems. Watering in early morning gives the foliage a chance to dry off before nightfall without worrying about scorching the leaves.



Coneflowers tolerate dry sites and attract butterflies.

Generally, perennials do not need much fertilizer and if you are striving for low maintenance plantings, an annual application about four weeks prior to flowering is adequate for most perennials.

Prevention is the key to raising a healthy perennial garden. By mulching after you plant, you can minimize weeding and eliminate the need for herbicides, which may harm your plants. Allowing weeds to build up provides a home for disease and insect problems to start that can easily spread throughout your garden. Be sure to monitor your plants throughout the summer for insect and disease problems. Mulching also helps the soil conserve moisture. Perennials generally benefit from mulching after the ground freezes.

To create an attractive perennial bed, keep the

following things in mind: **First**, select plants for hardiness, blooming period, color, and easiness to grow; **second**, select plants that are not invasive, not highly prone to diseases and insects, are low maintenance, and are adapted to the place you put them; and **third**, follow a preventative maintenance schedule by monitoring plants for diseases and insects, watering properly, fertilizing when needed, and keeping weeds out of the beds.

The following is a list of plants that grow well in specific sites to help you choose the right plant for the right place.

Perennials for Dry Sites

Yarrow
 Butterfly Weed
 Coreopsis
 Blanket Flower (Gaillardia)
 Liatris (Blazing Star)
 Coneflower
 Veronica

Perennials for Wet Sites

Astilbe
 Yellow Foxglove
 Heliopsis
 Rose Mallow
 Hosta
 Siberian Iris
 Cardinal Flower

Perennials for Shade

Lily of the Valley
 Coralbells
 Hosta
 Siberian Iris
 Bluebells
 Primrose
 Violet

Perennials That Attract Butterflies

Butterfly Weed
 Monarda (Bee Balm)
 Rudbeckia
 Liatris
 Coneflower
 Coreopsis
 Foxglove
 Globe Thistle
 Gaillardia

Strawberry Highlights of the Missouri Small Fruit and Vegetable Conference

by Patrick Byers

The 2002 Missouri Small Fruit and Vegetable Conference was held February 18-20, in Springfield. The strawberry session included presentations from Dr. Gail Nonnecke, researcher from Iowa State University, and Cindy Haeffner, strawberry grower from Hermann, Missouri.

Dr. Nonnecke discussed a project that involves the transition from conventional production to organic production. In recent years increasing demand for organically produced fruits and vegetables by consumers has been coupled with a new interest in organic production by conventional growers. Organic certification agencies usually require a transitional period of time before conventionally cropped land is eligible for certification. This transition period can be a difficult and risky time for producers. Dr. Nonnecke and her associates at Iowa State University are investigating a rotation that includes muskmelon, day neutral strawberries, and cover crops. Pest control and fertility management practices must follow approved organic guidelines during the transition period, and this study includes the use of manures, corn gluten meal, and biological disease and insect control agents. Certification agencies vary from state to state; Missouri growers can contact the Organic Crops Improvement Association or other agencies.

Contact information is listed at the website <http://www.attra.org/attra-pub/orgcert.html>.

Cindy Haeffner described the trials and rewards of strawberry production in the family strawberry operation, Strawberry Fields Farm, near Hermann. The Haeffner family started in strawberries in 1991. Ms. Haeffner detailed production practices, such as site preparation, weed management, planting, fertilization, mulching, harvest, and marketing. Among the “marketing tools” in use at Strawberry Fields Farm are group emails, postcards, silk screened picking containers, t-shirts, advertising, and farm signs. Ms. Haeffner discussed the future of



Cindy Haeffner discusses her marketing tools after her presentation in the strawberry session.

the strawberry planting. Last year (2001) was to be the last year of production, but the Haeffner children expressed interest in taking over management of the planting. Matthew and Janine are planning to expand the patch, and, as Ms. Haeffner put it, “My husband Joy and I look forward to watching this drama unfold.”

Manuscripts from these two presentations, as well as manuscripts on many other topics of interest to small fruit growers, are available in the Proceedings of the 2002 Missouri Small Fruit and Vegetable Conference. Contact Pamela Mayer at pam621t@smsu.edu or 417.926.4105 for information on ordering current or back issues of the Proceedings.

The Luscious Strawberry

by *Suzi Teghtmeyer*

May is National Strawberry Month, so what better time to highlight resources on this wonderful berry.

For the history of the strawberry, I recommend three sites...

Foods From Around the World: Geographic Study for the Taste Buds - Jamming With Strawberries

<http://www.umkc.edu/imc/strawber.htm>

This site provides a history lesson including references to strawberry taboos of the Greeks and Romans, cultivation in the Middle Ages and by Native Americans, and current production in the US. The site also lists strawberry books and classroom activities for kids.

A Lesson in Strawberry History from the USDA Fruit Lab

<http://www.barc.usda.gov/psi/fl/strawb.html>

A concise page describing strawberry cultivation, breeding, and the origin of the name ‘strawberry’.

The Small Fruits of New York - historic images

<http://www.ars-grin.gov/ars/PacWest/Corvallis/ncgr/sfny.html>

The Small Fruits of New York was part of the series of fruit monographs published by U. P. Hedrick of the New York Agricultural Experiment Station in 1925. Images of many of the color plates of cultivated varieties of *Rubus*, *Ribes* and *Fragaria* (strawberry) are available for viewing.

For deeper reading I highly recommend....

The Strawberry: History, Breeding and Physiology – A full-text publication by George M. Darrow. 1965.

<http://www.nal.usda.gov/pgdic/Strawberry/darpubs.htm>

Dr. Darrow was America’s premier strawberry expert and his excellent 1965 work is available in full text. The publication addresses the

strawberry throughout history in art, cultivation, and international research and breeding programs. The rest of this site also provides detailed breeding and research data about strawberries.

For practical information visit the sites...

Home Fruit Production: Strawberry Cultivars and Their Culture by Michele R. Warmund, Department of Horticulture, University of Missouri-Columbia

<http://muextension.missouri.edu/xplor/agguides/hort/g06135.htm>

This is a good guide for the Midwest grower to the selection, planting, and caring for strawberries.

Strawberries by Alan Erb, Horticulture Department, Kansas State University

<http://www.oznet.ksu.edu/library/hort2/samplers/mf598.asp>

A 6-page guide to growing strawberries in Kansas and the Midwest. Cultivar selection, planting tips, pest and disease management, irrigation, fertilization, and bed renewal, are among the topics covered. Note, the web address provided links to the guide in .pdf format.

And one more....

Fun Fruit Facts from the USDA Fruit Lab

<http://www.barc.usda.gov/psi/fl/funfacts.html>

This site has two strawberry sites. The first is a link to the anatomy of the strawberry. The second site lists strawberry trivia and commercial strawberry organizations.

Tree Carpets

by Marilyn Odneal

Tree rings made from recycled rubber are a relatively new product that I have seen in the gardening catalogs and centers. The product looks like rubber bark mulch and the rings are placed around the base of a tree to suppress weeds and to conserve soil moisture. They come in sizes of 20, 24 or 30 inches in diameter and can also be made of other materials such as coco-mat.

John Avery and I decided to make some of our own tree rings out of discarded wall-to-wall carpeting to place under some young trees in the Horticulture Demonstration Area at the State Fruit Experiment Station. Old carpet is often used as mulch between raised beds to keep these areas weed free.

The process we used to make our tree carpets is detailed in the following photos. Before marking the circles, place the carpet right side down to make the marks on the carpet back.

First:



Mark out circles using a string of the desired radius (we used 15" string with two loops at either end to make a 30" diameter circle). Put a metal screw in the middle and put one loop of the string around the screw and the other around a permanent marker to mark the ring. After marking the circle, make a straight line from the edge of the circle to the center and continue to mark about 2 inches past the center. Mark a shorter line (about 2 - 3 inches or so) perpendicular to the long line and through the center to make a cross.

Second:

Use a utility knife with a sharp blade to cut the ring out.

Third:

Cut a straight line to just past the center of the circle from the edge. Make a short cross cut through the center perpendicular to the line. Cut off the four flaps created by the cross cut.

Fourth:

Place the "tree carpet" around the base of the tree with the back side up to suppress weeds and conserve moisture.

A Future for the Perennial Matted Row?

by Marvin Pritts

Reprinted from Proceedings of the Southeast Strawberry Expo 2002.

Perennial strawberries have been grown using the matted row system for more than 150 years. Matted row culture was the predominate system for growing strawberries in the United States through the 1950s, and still predominates in colder climates throughout the world where strawberries are grown. However, the perennial matted row is being replaced by annual plasticulture systems, even in areas which, until recently, have been exclusively in matted row production. Annual plasticulture production gradually replaced matted rows in California in the 1950s, then spread to warmer areas of the world, such as Spain, Italy and Mexico, in the subsequent decades. Lately, plasticulture has replaced most matted row production in North Carolina, and is used commercially in Virginia, Maryland, Pennsylvania, New Jersey, and even New York and New Hampshire.

Clearly, there are advantages to an annual system grown on plastic. A major benefit is weed control. Since plants are set in autumn and fruited in spring, a grower has a very short period where weeds are of concern. Furthermore, plastic mulch provides an additional suppressive effect on weeds. Matted row growers, on the other hand, have to contend with weed pressure throughout the establishment year, and black plastic is not really an option because it prevents runner rooting. Annual plasticulture systems are often higher yielding and earlier to fruit than the same cultivar grown in matted rows. Harvesting is easier with annual raised beds because the fruit is more visible, and disease pressure can be less.

With these advantages, why hasn't annual plasticulture production completely displaced matted row production? Does the matted row have a future? I contend that the answer is yes, particularly if modifications to the matted row are implemented. But even without modifications, the matted row does have certain advantages. First, planting costs are low since mother plants produce daughters throughout the first growing season. Beds are replanted every 4 or 5 years, rather than every year. Secondly, with high numbers of well-established plants, the risk of significant loss from winter injury (or other problems) is low. Little "goes wrong" with the matted row so long as pests are attended to and plants are protected from frost. It is a very dependable and forgiving system. Third, the number of varieties that perform consistently in the matted row is large, and obtaining plant material is relatively easy and inexpensive. Fourth, one does not have to dispose of large amounts of plastic every year, and varieties perform well without annual fumigation. Fifth, dormant plants require less water to establish than fresh dug or plug plants that are components of annual systems. Furthermore, perennial strawberry roots are much more efficient users of nitrogen, so fewer inputs are required per unit of fruit produced than with annual systems. These latter two advantages are important for growers who wish to adopt sustainable agricultural practices.

I believe the challenge for cold climate strawberry growers is to develop a system having many of the advantages of annual plasticulture while retaining the advantages of the matted row. There are several such adaptations that might be considered.

1) *Plant later in the season and at a higher density to minimize the amount of time that weeds have to be controlled.* The earlier mother plants are set, the more runners that they will produce. Later planting results in fewer runners and higher plant costs (to establish the proper density), but weeds are easier to control because the initial spring flush can be turned under prior to planting, and because the growing season for the strawberries is shorter. Labor costs are increasing at a much faster rate than plant costs, so it makes economic sense to plant at higher densities if weed removal costs are significantly decreased.

2) *Use newer cultivation tools and herbicides to manage weeds.* Several new herbicides are awaiting labeling for strawberries. These include some very good, selective materials that are effective at low rates. For example, Select was just labeled and is a very good grass herbicide. Others awaiting approval through the IR-4 process include fenamiphos, flumioxazin (Strike), oxyfluorfen (Goal), and pendimethalin (Prowl). In addition, newer cultivation equipment holds much promise for reducing weed pressure in strawberries. These tools include brush hoes, flex-tine, and finger weeders - all of which minimize deep soil disturbance while killing seedlings.

3) *Make better use of mulches for weed suppression.* Biodegradable and organic mulches can be used to supplement herbicide use, particularly at higher planting densities where runnering may not be desirable. Plant-based mulches do not necessarily have to be placed by hand around plants, rather it is possible to plant strawberries directly into mulches that have been grown in place. Again, this is most successful with high density plantings.

4) *New plant material may have herbicide resistance.* With today's technology, it is possible to produce strawberry plants that are

resistant to Roundup herbicide. In theory, strawberry plants can be directly treated with Roundup herbicide and be unaffected. Weeds, on the other hand, are killed. A few strawberry varieties have already been engineered to have resistance, although these are not available commercially. Plants with herbicide tolerance are being developed at Cornell University with standard breeding techniques. Herbicide tolerance can potentially reduce labor costs significantly for matted row growers. Of course, there are many other issues surrounding the use of genetically-engineered strawberries which could make their use unacceptable. The point is, however, that newer technologies can help identify and develop varieties with resistance to broad-spectrum herbicides. Their use can potentially benefit matted row growers much more so than annual plasticulture growers, or growers of most other crops for that matter.

5) *New varieties may be selected that establish quickly and are more competitive with weeds.* Strawberry breeders have not paid much attention to how quickly strawberry plants establish roots and compete with weeds. We have developed an assay that identifies rapidly-rooting genotypes in the field. We hypothesize that these genotypes will be more competitive with weeds. If matted row growers had available to them varieties that were deliberately bred for rapid rooting and competitive ability, then their success should increase.

6) *Select varieties that produce large fruit and are high-yielding.* New varieties are continually being introduced that have increased fruit size and higher yields. Consumers may not want fruit larger than what is currently in the marketplace from annual systems, so there may be an upper limit on acceptability. The fruit size of matted row varieties (e.g. Cavendish, Cabot, Annapolis) is approaching that of annual varieties. Cavendish, Jewel and Honeoye can produce in excess of 20,000 lb/A under matted row management. This is comparable to yields for annual plasticulture systems.

7) *Plant on raised beds.* Annual plasticulture strawberries are almost always grown on raised beds. This allows for easier

harvest and earlier fruiting. However, matted row strawberries also can be grown on raised beds. Although the effect of the raised bed on earliness is not as great as when black plastic is also used, it is measurable. Row covers also can be used to further accelerate flowering and fruiting in matted row strawberries. The challenge with using raised beds is incorporating some of the other modifications suggested above. Many of the cultivation tools, for example, work best on flat beds.

Many of these modifications can be made to the matted row without sacrificing its advantages. These modifications move the matted row towards the plasticulture model without requiring large amounts of plastic mulch or specialized plant production procedures. Of course, if plug plants of cold-hardy varieties could be made available to northern growers, and the plants could be "conditioned" prior to planting, it may be possible to establish them very late in the season to achieve an even shorter period of weed management.

Lastly, the further north one attempts to use annual plasticulture systems, the riskier the outcome. In colder areas, planting dates become more critical and the already short autumn presents challenges for annual plant establishment. Some of these challenges can be overcome with row covers and plastic tunnels, but these are expensive. The risk of cold-temperature injury to recently-established plants on raised beds is also increased. It is my observation that only the very best managers are successful with annual systems in the north. Many growers have tried the annual plasticulture system of production, but have not continued. Most northern strawberry growers have mixed fruit and vegetable operations, and few have the focus or time, or can devote the attention to detail, that is required to successfully grow annual plasticulture strawberries. The matted row offers these growers a low risk system for producing strawberries that will likely be used for years to come.

Sheltered Workshops

by Tammy Bruckerhoff

My church sends out over 1,200 newsletters, which I sometimes get the fun job of stapling, labeling and sorting by zip code. I recently contacted our local Sheltered Workshop about doing this job for us, and they gave us a phenomenally low bid of 3 cents per newsletter! Wow!

I also looked into some of the other services that Sheltered Workshops offer throughout the state, and found that some even deal in corrugated boxes. One even made 50,000 crates that they put jars of honey in!

And, many of you are familiar with our Missouri-shaped baskets. Those are made by the Sheltered Workshop in Neosho, Missouri.

So, perhaps you have something around your farm that these wonderful people could do. 70% of the revenue at a SW, comes from their contracted work. Please be thinking of them....folding boxes? making crates? sending out your newsletter? Building palettes? Possibilities are endless!

Please find below the contact information for Larry Young, Director of Division of Special Education, along with their website. I think you'll be surprised at some of the services they can provide.

Larry Young

lyoung@mail.dese.state.mo.us

<http://www.dese.state.mo.us/divspeced/shelteredworkshops/swindex.html>

Spring Horticulture Conference Contacts

by Marilyn Odneal

There were so many interesting topics presented at the Spring Horticulture Conference held on April 6 in Mountain Grove, that it was difficult to decide which of the concurrent sessions to attend. Subjects included organic lawn care, greenhouses, beginning and advanced water gardening, backyard berries, advanced vegetable gardening, pruning fruit plants, plant propagation, bonsai, shade gardening and railroad gardening. I was able to gather contact information for some of the presenters who are either involved in horticulture related groups or wish to organize one in our area.



Geoffrey Chambers considers the shape of the pot in relation to the shape of the tree when creating bonsai.

Garden Railroading.

Garden Railroading is model railroading in the outdoors. The miniature railways are usually built in specially prepared gardens (some include bonsai). The trains are large and the engine is about the size of a loaf of bread. The track is large and usually made of brass so it can remain outdoors year-round. Buildings and other accessories can be built to stay outside all year or brought indoors during winter. While the trains should be stored indoors, they are designed to operate in the elements, even rain and snow. The engines can be powered by electricity, battery or even live steam. For further information, contact Joe Levanti.

Ozark Garden Railway Society

Joe Levanti, President

417-461-0454

levanti@mntvernon.net

www.geocities.com/ozarkgrs

Bonsai.

The art of bonsai (creating miniature trees) was presented by Geoffrey Chambers. He demonstrated this technique on a low growing juniper or "cedar" tree, *Juniperus procumbens*, and suggested that beginners start out with a container plant of this type. Geoffrey is interested in organizing a group of people interested in bonsai in the southwest Missouri area. If you are interested in becoming a part of this group or would like to request a brochure or information on techniques and tools, his contact information is listed as follows:

Geoffrey Chambers

P. O. Box 4872

Springfield, MO 65808

417-823-8565

Water Gardening.

Connie (Blankenship) Ausema is a Master Gardener who specializes in water gardens. She presented both beginning and advanced water gardening. Her experience and knowledge of plants to use in our area is invaluable and she offers some water garden plants for sale. She recommends "The Pond Doctor" by Helen Nash as a reference book. Her contact information is:

Connie Blankenship

P. O. Box 435

Mammoth Spring, AR 72554

Phone: 417-256-9655

E-mail: conniesgate@yahoo.com.

Web: <http://groups.yahoo.com/group/awatergarden/>

The Spring Horticulture Conference is alternately held at Mount Vernon and Mountain Grove and is sponsored by University of Missouri Extension and Southwest Missouri State University.



Connie describes a close encounter with a snake in her water garden. Photo by John Wall - SMSU.

Classifieds

Livingstons Berry Patch has the following equipment for sale.

8X10 walk-in cooler/freezer

One row Strawberry Mulcher

1.5 Acre irrigation system. Layflat tube with 1 gal. per minute wobbler heads. Works for frost protection also.

2 row cultivator.

2 row cultivator extended to 3 row with 42" wide rows. Has 16" shovels for making ridges.

2-250 gal plastic liquid storage tanks with valves.

3 Pt. hitch seeder/fertilizer spreader.

1 lot of 2" valves and misc. irrigation supplies for plastic layflat and T-Tape irrigation systems.

1 roll of 2" layflat pipe.

1 movable fruitstand.

Good selection of specialized fruit growing equipment.

Call 573-686-1605 after 5:00 pm for details and prices.

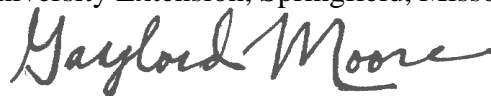
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