

The effects of music on the growth of plants

By Brian Egan, Fall 2010 Intern

Does music affect plant growth? As a musician and composer, I am acutely aware of the effect that music can have on one's consciousness. For ages it has served as the courier of thoughts and emotions sometimes too provocative, complex, or nuanced for expression by verbal communication alone. Music can stimulate the body, evoking movement and dance, and conjure flows of adrenaline and bravery in soldiers gearing up for battle. It can also be used to uplift and heal as is evidenced by its use in religious ceremonies throughout the world and by the ever-expanding field of music therapy. But can music do the same for plants? Can they be moved in the same way? Perhaps not. But there is mounting evidence suggesting that the physical vibratory component inherent in musical sound can provoke measurable responses in plant growth. This brief essay represents a cursory survey of the research done in relation to this phenomena and hopefully will function as the springboard from which to conduct further research and investigation.

Our view of the world at the dawn of the twenty-first century seems vastly different from that of the past. Technology has given us the means by which to examine our surroundings with greater detail and acuity, allowing us to delve into previously unseen worlds. Thanks to the contributions of quantum physics, we are faced with an interactive and interconnected universe made up entirely of fields of energy and vibration. Evidence of the interconnectedness of the universe is all around us, and can be witnessed for example in the breathtaking work of Dr. Masaru Emoto, in which the power of human thought is able to demonstrate discernible effects in the formation of water crystals¹.

Everything from photonic light particles to dense matter is composed of energy vibrating at different speeds or frequencies, and the world that we are able to perceive consciously is but a minute fraction of what vibrationally surrounds us. Audible sound is vibration traveling through matter and is perceivable to the human ear within a frequency range of around 20 to 20,000 cycles per second, or Hertz (HZ). Sounds below this frequency range are called "subsonic" and above this threshold are called "ultrasonic." Music is a composite of audible frequencies, so it is logical to infer that if both matter and music are composed purely of vibration, one could likely affect change in the other. Take, for instance, the work of Swiss doctor and scientist Hans Jenny, whose pioneering experiments in the field of 'cymatics' (the study of visible sound and wave phenomena) have shown that sound vibrations can affect change in matter, and even more importantly, may be the primordial force behind manifest creation². It is also possible that sound may have an effect upon the subtler fields of energy surrounding an organism. This is possibly what is also occurring in the case of plants being exposed to music.

One may ask: if plants are affected by music, how do they hear? Of course they

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posses no discernible ears, but there are other ways that vibrational perception can take place. A recent article in the *American Journal of Botany* describes positive advances in proving the existence of a plant-specific sensory network within plant cells. The article states that this proposed network is responsible for the perception of various mechanical stimuli in a plant's environment and that one of the mechanical signals thought to be perceived through this network is sound³.

Just outside the borders of conventional science lies the idea of plant perception or biocommunication in plant cells. This is the belief that plants are sentient, that they experience pain, pleasure, or emotions such as fear and affection, and that they have the ability to communicate with humans and other forms of life in a recognizable manner. While plants can communicate through chemical signals, and certainly have complex responses to stimuli, the belief that they possess advanced affective or cognitive abilities is not accepted by mainstream science. This is not to say, however, that there isn't evidence to support proponents of the theory.

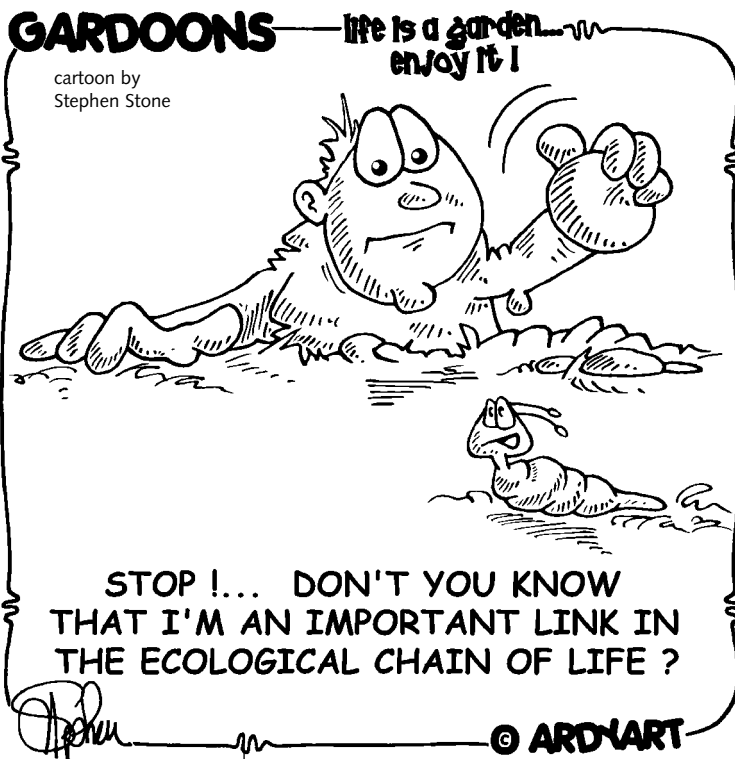
Beginning in the 1960s, Cleve Backster, an interrogation specialist, caused controversy when he found that plants attached to a polygraph machine⁴ would register intense responses when threatened with harm. Termed the "Backster Effect," the outcome of his numerous experiments was the finding that plants could perceive human thoughts and intentions. In addition, he also found that plants could display memory traits, develop bonds with humans, and respond to the death of organic cells within their environment. All of these experiments led to his theory of "primary perception," which is the main topic of his 2003 book of the same name⁵.

Regardless of the precise mode of perception, it seems people have been exposing plants to sound in an

effort to coax a response for quite some time. Indigenous peoples from around the world have for years used the sound of music and chant to provoke bountiful harvests, and Charles Darwin experimented by performing his bassoon for his *Mimosa pudica*, or touch-me-not, in order to see if he could stimulate its pinnae into movement.

In the 1950's, Dr. T.C. Singh, head of the department of botany at Annamalai University in India, conducted experiments in which plants were exposed to specific 'ragas' (melodic modes used in Indian classical music) for periods throughout each day. He reported that the fundamental metabolic processes of the plants were accelerated, sometimes over 200% versus the controls, and stated that he had proven "beyond any shadow of doubt that harmonic sound waves affect the growth, flowering, fruiting, and seed-yields of plants⁶."

In the 1960's, botanist and agricultural researcher George E. Smith played Gershwin's "Rhapsody in Blue" twenty-four hours a day to his soybean and corn fields only to find that his seedlings sprouted earlier, the plants were healthier and more robust, and that his musically exposed plants yielded more bushels to the acre (137) than those belonging to the unexposed plot (117). Perplexed at the overwhelming results, Smith speculated that perhaps the sound energy had increased the molecular activity in the corn. Also of interest was that the temperature was inexplicably two degrees higher in front of the loudspeaker and that the edges of the leaves on the corn



appeared slightly burned⁷.

By the mid-1960s it was discovered that the use of ultrasonic frequencies (those above 20,000 Hz) affected the germination and growth of test plants such as barley, sunflower, spruce, and Jack pine. These extremely high frequency sounds increased the enzyme activity and respiration in the exposed plants and seeds. Following these findings, Mary Measures and Pearl Weinberger at the University of Ottawa conducted research aimed at measuring whether specific audible frequencies would be as effective as music in enhancing the growth of wheat. During their four-year study they found that the plants responded best to a frequency of 5,000 cycles per second (5,000 Hz), producing an acceleration in growth "so striking that it seemed to promise to double wheat harvests⁸." Confused by the results, Measures and Weinberger contemplated that perhaps sound waves might produce a resonant effect in the plant cells, causing energy to accumulate and increase the plant's metabolism. Soon after, researchers at the University of North Carolina at Greensboro validated the work of

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Measures and Weinberger by conducting experiments using 'pink noise,'⁹ within a range of 20 to 20,000 Hz, to sprout turnips. They found that the germination rate seemed to increase at 4,000 Hz; very close to the 5,000 Hz found by Measures and Weinberger.

The most widespread and controversial research regarding the effects of music on plants began in 1968 with the amateur experiments of organist and mezzo-soprano Dorothy Retallack. Inspired by the work of George E. Smith, Mrs. Retallack decided to try something similar for an experiment in her college biology class. Beginning with experiments that employed only a few musical pitches, she soon moved on to exposing groups of test plants to various genres of music. Her first experiment of this nature subjected plants to both classical and rock music. In addition to growing lovingly toward the sound source, the plants listening to the music of Haydn, Mozart, and Beethoven exhibited thicker root growth, more robust tissues, and flowered quicker than the plants listening to the rock music. This latter group had visibly abnormal and stunted growth, and some had died within two weeks of enduring the 'all-rock' diet.

Retallack continued her experiments using various musical sources from Led Zeppelin and Jimi Hendrix to Bach, Ravi Shankar, and Duke Ellington. After plants exposed to a constant diet of hard rock leaned away from the sound source, Retallack would rotate the plants 180° only to find them soon leaning in the opposite direction! She surmised that this had something to do with the harsh, percussive nature of the music, and conducted further experiments that supported this hypothesis.

Overall, the plants seemed to like classical and jazz, leaning 35° and 20° respectively toward their musical sources. Surprisingly, the plants loved the sitar music of Indian musician Ravi Shankar the most, leaning more than

halfway to the horizontal at angles in excess of 60°! This is most interesting in light of the positive responses attained by Dr. Singh, also using traditional Indian music on plants.

In 1970, Retallack along with her professor Francis F. Broman prepared a nine page scientific paper entitled, "Response of Growing Plants to a Manipulation of Their Sonic Environment," and were featured on a CBS news program hosted by Walter Cronkite. The on-air exposure was quite a sensation causing much disdain and backlash from the scientific community. Many had issues with the methodology of Retallack's research and thought that the whole idea that plants responded to music was "an excruciating embarrassment."¹⁰

Much of the controversy surrounding Retallack's research centers on the implication that the data supports sentience in plants, and this is complete anathema to mainstream science. The data however could also be indicative that the proportion of frequency components within the composite musical sound of each individual genre has a distinguishable affect on the physiology of the plants. This is where more detailed research is needed.

After a few decades of silence, there has recently been a slow resurgence of the topic in areas relating to quantum physics and alternative medicine and healing modalities. For instance, in *The Journal of Alternative and Complementary Medicine* a study was published by Katherine Creath and Gary Schwartz detailing the effects of music, noise, and healing energy on the germination of okra and zucchini seeds. The musical sound consisted of a 74-minute CD of mostly improvised music performed on a Native American flute, also incorporating sounds of nature such as birds and echoes. In all five experiments, musical sound had a "highly statistically significant effect on the number of seeds sprouted compared to the untreated control," leading to the conclusion that "sound vibrations directly affect living biologic systems, and

that a seed germination bioassay has the sensitivity to enable detection of effects caused by various applied energetic conditions."¹¹

So do your plants prefer Haydn to Mozart, or The Stones over the Beatles? For now, the jury is still out. However, there is most definitely viable evidence that, unlike a sentient, aesthetic response to music, plants do respond to the physical components of musical sound in a scientifically repeatable way and this should open the door to further research into the exact properties to which they respond. But who knows, we also may find in the near future that, like us, our plants have their own tastes in music, and so we should all be prepared to start making them mix tapes.

Footnotes

¹ Emoto, Masaru. *The Secret Life of Water*. Translated by David A. Thayne. Hillsboro, OR: Beyond Words Publishing, 2005.

² Jenny, Hans. *Cymatics: A Study of Wave Phenomena and Vibration*. Newmarket, NH: MACROmedia Publishing, 2001.

³ Telewski, Frank W. "A Unified Hypothesis of Mechanoperception in Plants." *American Journal of Botany* 93/10 (2006) : 1466-1476.

⁴ Specifically, Backster used the part of a polygraph machine called a galvanometer. This device measures the electrical resistance within the body of a human subject and registers the fluctuation of energy caused by the stimulus of thought and emotion.

⁵ Peter Tompkins and Christopher Bird, *The Secret Life of Plants*. (New York: Harper & Row, 1973), 3-16.

⁶ Tompkins, *The Secret Life of Plants*, 147.

⁷ Ibid, 148-150.

⁸ Tompkins, *The Secret Life of Plants*, 151.

⁹ 'Pink noise' has a power spectrum similar to 'white noise,' with the lowest frequencies rolling up and the highest frequencies rolling off.

¹⁰ Tompkins, *The Secret Life of Plants*, 159.

¹¹ Katherine Creath and Gary E. Schwartz, "Measuring Effects of Music, Noise, and Healing Energy Using a Seed Germination Bioassay," *The Journal of Alternative and Complementary Medicine* 10/1 (2004) :

Bibliography omitted because of lack of space.

Hybridizing bearded irises

By Pamela Windsor, Fall 2010 Intern

Who can resist the allure and beauty of irises with their incredible, breathtaking colors—each one more vibrant and/or more luscious than the last, spanning the whole color spectrum? Even the magical name “Iris” comes from the Greek word for rainbow. The amazing forms, standing tall and erect like confident beauty queen contestants reaching for the sky, provide the awestruck onlooker with a vision of spectacular splendor. It is no wonder that irises have been depicted in various art forms for many centuries, going back as far as the walls of Egyptian temples.

Tall bearded iris, one of the world's oldest cultivated flowers, date back many centuries to Europe where they were used for medicinal and perfumery purposes. It was not until around the 1820's that the French, Germans, and Belgians started to introduce hybrids with the British joining in the latter part of the nineteenth century (Austin 28).

Sir Michael Foster (1836-1907), a British physiology professor at Cambridge, considered one of the pioneers and founders of the modern cult and cultivation of irises became one of the first hybridizers to use scientific knowledge in his crosses.



'Caterina' Introduced in 1909

Photo provided by Heritage Iris

“Unfortunately, he did not record the parentage of his plants” (Austin 29). However, some of his iris can still be

obtained today, i.e., **'Caterina,'** pictured in column 1, was used as a cross by many of the renowned breeders. Prior to Foster, all bearded iris had been diploids (two sets of chromosomes), but he discovered a new species that produced larger flowers with thick, velvety petals, and strong stems (Austin). “It was one of the first tetraploid hybrids, and proved to be invaluable for introducing plant size, vigour, plants with taller well-branched stems, and larger flowers to the world of tall bearded iris breeding” (Heritage Irises). He provided the impetus for successor breeders to cultivate the tall bearded iris toward the fabulous hybrids of today.

William R. Dykes (1877-1925), for whom the prestigious Dykes Medal is named, is considered the foremost authority on irises at the time he lived. In addition to hybridizing twenty-four irises, he was a prolific author, with his monograph, *The Genus Iris*, a tribute to Foster, being his most famous. He had access to Foster's notes and he collaborated with Arthur Bliss to test his theory that many of the bearded species were hybrids (Austin).



'Dominion' 1917

Photo provided by AIS

Melba Hamblen, co-author of *The World of Irises*, considered Arthur J. Bliss (1860-1931), another famous British hybridizer, to be the greatest hybridizer of the transitional period

of iris breeding (Austin). **'Dominion'** was the result of an amazing cross between an asiatica and a tall bearded hybrid by Bliss. “The petals of this hybrid were more velvety and thicker than those of any hybrid previously introduced” (Austin).

The Americans contributed the most improvements to the tall bearded irises in the early years of the 20th century. Some of the star breeders were: Bertrand Farr, the Sass brothers (Jacob and Hans), and Clara Rees. During that same period, some of today's most famous iris nurseries were established. Schreiner's in Minnesota imported a number of the newer European varieties to the United States.

Bertrand Farr (1863–1924) has the distinction of being the first important iris hybridizer in the United States. He introduced about 40 irises during his lifetime and several of his creations were introduced after his death. **'Quaker Lady'** is still popular and available today (Lowe).



'Quaker Lady' introduced in 1909

Photo provided by AIS

Hans Sass (1868-1949) won many awards throughout his career as a hybridizer, including the Gold Medal for Hybridizing from the American Iris Society, and the Foster Memorial Plaque by the Iris Society of England. “In 1925 he introduced **'King Tut,'** which he later considered his most important iris for breeding, but it never received any awards” (Whiting). However, a seedling from it, **'Rameses,'** won the Dykes

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Medal in 1932. When you look at pictures of them together, they appear to be very similar and to the untrained eye, it is difficult to discern why the one is greater deserving of awards than the other.



'Rameses' 1932 Dykes Medal Winner

Photo courtesy AIS

Hybridizer of twenty-six other irises, in 1938 Clara B. Rees made international history when she developed **'Snow Flurry'**, the first ruffled, tall bearded iris. Of particular interest is the fact that there was only one seed pod that produced two seeds with one of them being shriveled, so it had to be discarded. That one seed has parented many, many of the tall bearded irises of modern day. She actually sold all but one rhizome to Carl Salbach, a hybridizer and nurseryman, who introduced **'Snow Flurry'** (Randall).



'Snow Flurry'

Photo provided by Historic Iris Preservation Society

During the mid part of the 20th century, Americans made even more advances. Individual breeders focused on specific aspects of

tall bearded iris hybridization they were interested in, i.e., size, substance, color. Some of the successful breeders included Paul Cook, whose hybrids provided parentage of many of the modern hybrids; Orville Fay, who worked on white irises; and David Hall, who worked on pink irises. All of these men produced Dykes Medal winners: Cook (1955 **'Sable Night,'** 1962 **'Whole Cloth,'** and 1964 **'Allegiance'');** Fay (1953 **'Truly Yours,'** 1954 **'Mary Randall,'** and 1966 **'Rippling Waters'');** and Hall (1951 **'Cherie'**). This is the period in which many of the hybridizers shared their ideas and exchanged pollen for hybridizing (Austin).



'Truly Yours' 1953 Dykes Medal Winner

Photo provided by AIS

Paul Cook (1891-1963) introduced **'Whole Cloth,'** a blue and white amoena, in 1958, and it won an honorable mention; an Award of Merit two years later; and the coveted Dykes Medal in 1962 (Unser).

In addition to producing three Dykes Medal winners, Orville Fay was



'Whole Cloth'

Photo provided by Historic Iris Preservation Society

presented with the Foster Memorial Plaque, which is presented in recognition of Sir Michael Foster's "achievements and assiduous effort in collecting and hybridizing irises." The plaque is reserved for special personal awards to those contributing to the advance of the genus (Randall). Fay was obviously a genius, given that he is also famous for the hybridizing work he has done with daffodils, peonies, and daylilies. In all my research, I could not find out much about him personally; not even his birth date or if he is still alive.



'Cherie' 1951 Dykes Medal Winner

Photo provided by AIS

David F. Hall (1875-1968) was a Canadian living in the United States when he did his hybridizing. **'Cherie'** is considered the most famous of all the Hall flamingo pinks. It is a self of bright medium pink with large ruffled blooms. **'Wine and Roses'** was the first iris with the color pattern of clear rose pink standards and deep wine falls, and is a superb specimen (Heritage).

Great strides were made in the world of irises in the late 20th century, as well. Together the hybridizers produced incredible specimens that the earlier breeders would have imagined only in their fantasies. It is not as easy to get information on these later hybridizers, so I had some difficulty getting dates of birth or death. Of course, I know that some of them are still alive.

Monty Byers, whose breeding interests centered around two classes

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of irises not altogether at the top of general popularity, i.e., the space-age and rebloomers indicated that breeders began moving in new directions. Byers promoted them through his Moonshine Gardens catalog (Hager). He managed to hybridize three Dykes Medal winners. I have one of his iris in my garden—‘**Thornbird**.’



‘Thornbird’ 1997 Dykes Medal Winner

Photo provided by AIS

Joe Ghio (1938), a highly respected hybridizer, has been breeding irises since he was 16 years old. He has won many awards in America and several Canadian awards, too. ‘**Mystique**’ won the 1980 Dykes Medal.



‘Mystique’ 1980 Dykes Medal Winner

Photo provided by AIS

“Ben Hager was known primarily as a hybridizer of bearded irises, but worked with many different species including daylilies. Most iris growers identify him with his famous award-winning pinks, ‘Vanity’ and ‘Beverly Sills’ . . .” (Caillet). My personal favorite



‘Edith Wolford’ 1993 Dykes Medal Winner

Photo provided by AIS

is ‘**Edith Wolford**’ pictured above.

Keith Keppel started growing irises as long ago as 1953 when he discovered them in a neighbor’s yard. Three of his hybrids have won the Dykes Medal, i.e., ‘**Babbling Brook**,’ 1972; ‘**Crowned Heads**,’ 2004; and ‘**Sea Power**,’ 2006.



‘Crowned Heads’ 2004 Dykes Medal Winner

Photo provided by AIS

The Schreiner dynasty began in Minnesota when Francis Xavier Schreiner started to garden as a hobby during WWI. After his death in 1931, the family moved to Oregon where the famous gardens remain today. Bernard (Gus) Schreiner, Francis’ son died in 1981, and his son Ray, who had worked on hybridizing iris with him for about ten years, took over where his father left off. Today, Ray and his cousin Dave are the primary hybridizers in the family. Their family has a record of 11 Dykes Medal winners! I am fortunate to have ‘**Celebration Song**’ in my garden.



‘Celebration Song’ 2003 Dykes Medal Winner

Photo Provided by AIS

Bearded irises have been my favorite flower as long as I can remember, back to my grandmother’s garden when I was a little girl, but I have been collecting hybrids only since the early 1990’s. When I started collecting them, I gave no thought to how those cultivars came into being. I am totally fascinated by the endless varieties and cultivars available in today’s market, and I fear I am becoming fixated with possessing new varieties; working on this paper only fueled my desire for more irises. The one thing that saves me from becoming a hoarder is the limited space available on my property.

It has been only the last year or so that I became enchanted with the idea of trying my hand at hybridizing irises, while at the same time I believe it is the height of arrogance to think I can improve on something already magnificent. There are a couple of hybridizers (Jim Hedgecock and Mitch Jameson) in the Pony Express Iris Society, of which I am a member. They have had great success with hybridizing tall bearded irises, and I am fortunate to have some of their hybrids in my garden. After endless discussions with them, and much research on the subject, I have determined that it may not be beyond my abilities even though botany and patience are not my strengths. I prefer to think that passion sometimes overrides other weaknesses, particularly if one is dedicated and steadfast.

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Aster cousins

by Becky Peck, Class of 2003

When Southwest Airlines posted a huge airfare sale, my girlfriend said we couldn't let that pass us by. "Where do you want to go?" I asked. "Somewhere warm," she replied. So, the first weekend in December we flew to Houston where it was 80 degrees. I visited Bayou Bend on my last visit there. This time, we found Mercer Botanical Gardens not far from George Bush Airport on the Northeast side of Houston. It was a glorious woodland garden with butterflies still basking in the sun. I learned a lesson at Mercer: Do not skip the long paths angling off to the back, in favor of the more centralized gardens near the entrance. It was a brief walk down one such road that we found Storey Lake, with many turtles crawling out on the logs to bask in the Texas sun. The only thing we were missing was a good book and a glass of chai tea.

Specifically located at 22306 Aldine Westfield Road in Humble, Texas, you can find online information at www.hcp4.net/mercer. Mercer Arboretum and Botanic Garden is a 325-acre treasure that showcases the Gulf Coast Region's native and cultivated plants. Over a quarter of a million visitors come to Mercer annually. Situated next to a library, it is owned by the county. As such, there is no admission fee. Located in a flood plain has had its challenges, but the gardens are carrying out the wishes of Thelma and Charles Mercer. From Mercer's visitor map, I share this little history:

"Thelma and Charles Mercer had a dream of sharing their small, private garden with the community. Their personal oasis along Cypress Creek was preserved as a Harris County Precinct 4 park in 1974. Through community support and volunteer commitment, Mercer has grown to be a nationally recognized arboretum and botanic garden.

Over 325 acres of east Texas piney woods showcase the region's largest collection of native and cultivated plants. This living museum stimulates the senses with texture, color, and fragrance. Visitors enjoy the gardens for their aesthetic value, appreciate the critical role of plants in environmental and quality of life issues and learn about the economic significance of the plant kingdom. From lowly ferns to majestic oaks, all plants have a story to tell. Mercer shares these stories with the world—through children, visitors, and community programs. A major goal at Mercer is to connect people with plants to link the understanding of horticulture with its benefits to society."

The Mercers were married 59 years. Lt. Colonel Mercer passed away in 2001, only months after Thelma. An engineer by trade, Thelma said "There is not much he can't do." When they bought 14.5 acres in 1949, Thelma called it "a wild, wooded, burned out area." Their first home is now the Volunteer Cottage. The goldfish pool near the Staff Building was dug by Charles Mercer for a garden focal point. As the land was cleared, dogwoods, rusty blackhaw Viburnums and hawthorns were planted. Thelma planted large Camellias in the Central Garden and introduced several exotic tree species that are still in the garden such as: Gingko, Bauhinia, orchid trees, azaleas, camphor, and Philadelphus. In 1973, the Mercers



Above: Ligularia. Below: Storey Lake



decided to retire to Zapata in the Rio Grande Valley. In the Visitor's Center, you will see the framed letter that Thelma wrote to the county recommending that they purchase the site. They then offered the property at far below market value to ensure the land would be a garden and horticultural education facility.

Through various additional purchases, the garden grew to just over 300 acres. The gardens are divided by Aldine Westfield Road. On the east side of the road are the gardens. On the west, you will find two playgrounds, a picnic area with 58 picnic tables, boardwalk, cypress swamp, maple collection and many miles of walking trails winding through the woods.

There were several garden areas that were unique at Mercer, to

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ALONG THE ALLEY

by Joanne Couture, Class of 1991

Play Garden Jeopardy: Named for a vaudeville song-and-dance man, this grafted shrub is esteemed for its cork-screw branches that show off in the winter. What is...? (Solution at end of article)

A special HUZDAH for **SARA SCHEIL**'s funny/clever first-prize bumper sticker: "So Mulch to Grow... So Little Thyme." Sara also won Bridging the Gap's Environmental Excellence Award for Individuals for "environmental conscientiousness" but considers her foremost achievement creating and coordinating a community organic garden at St. Paul's Church, 36th and Sterling, Independence. Sara is also a "Heartland Tree Keeper" (sponsored by Bridging the Gap) and serves on the executive board of "Missouri Master Naturalist" (sponsored by Missouri Extension and Dept. of Conservation). Like the MGs, both require extensive training and expect volunteer service hours. "I grew up on a farm in Iowa," Sara said, and my ancestors were mostly engaged in farming. I have always enjoyed nature and feel happiest when I am outdoors."

What grows best in **DEVONA MARTIN**'s five acres near Lee's Summit? "Most anything I can keep the groundhogs and deer away from." Devona and husband Gary came home one night "to 25 deer in our front yard. That winter they stripped our yew hedge down to twigs." Deer repellent? "When you're spraying such a large area, the entire neighborhood stunk worse than the skunks that roam the area." (Note: they're putting up 6' fencing!) And as for last

summer's 30 cantaloupe, "We got one, the groundhogs got the rest"—plus most of the squash and pumpkins. The Martins' acreage is divided into "blackberry and raspberry patches, two large vegetable gardens, a small orchard, and a barnyard where we raise a small flock of chickens and turkeys. In 2010, Devona planted eight varieties of tomatoes. Successes: 'Kellogg's Breakfast,' a huge meaty slicer recently named one of the best heirlooms by *Sunset magazine*. 'Master Sandwich,' another good red slicer. 'Legend Extra Early' lived up to its no-blight reputation and "produced lots of 3"-4" fruit . . . smaller than I anticipated, but they did very well." Also 'Viva Italian,' a determinate, disease-resistant paste type, and 'Sugar Snack,' Devona's "favorite pop-in-your-mouth" cherry variety. Disappointments: the heirloom 'Chianti Rose,' whose rose-pink thin skin "cracked and rotted easily," and 'Brandywine': "Terrible this year for blight and fungal diseases . . . though I love the flavor and will always try to grow at least one somewhere." As for favorite zucchini, Devona can't find any more 'Italiano Largo' seeds, so she'll try 'Italian Harvest' this year.

CHRIS HERSHEY also has a critter problem in Parkville. Raccoons are probably the culprits who got "more of my sweet corn than I did," plus groundhogs (those guys again!) who hit Chris's melons, greens, and tomatoes. But Chris is philosophical: "They have to bulk up for that long winter sleep." Though deer snacked on some of his 18 blueberry plants, "I did get just enough to taste." Chris also enjoyed raspberries from the canes he planted last year as well as the wild variety around his property. Successful veggies include potatoes, 'Clemson Spineless' okra, and beans; he usually plants 'Blue Lake' green beans, black-eyed peas, and black beans. Now he's perusing the seed catalogs for new green beans, plus fava and limas. "I've added a new bed or two each year, and like using the beans as a first crop to shade weeds and improve

the soil." What he won't plant again? "Tomatillos. Their growth was unruly and I didn't really enjoy cooking with them." His new venture for 2011? Wine grapes. (I can recruit some MG stompers at harvest time, Chris!) Now let's switch from sunny open spaces to the city's tree-lined neighborhoods.

Like many of us urbanites, in **TEEDE STIPICH**'s yard "shade is the operative word. The only thing that really comes back with a flourish, with no care, is my 'Annabelle' hydrangeas." The brilliant white *Hydrangea arborescens*, unlike the pink and blue varieties, blooms faithfully every year even after severe pruning or an arctic winter. She also "relandscaped my backyard three years ago. Pulled all the lawn out and have beds and pathways. One bed is cool colors (blue, purple and pink), such as plumbago and plumaria. The other is warm colors: red, yellow, peach and orange." Teede ("my name started as a childhood nickname and I had it legally changed") is an artist specializing in jewelry on sale at area stores and galleries and designed the necklace won by Sara Scheil in the MG bumper sticker contest. She also does yard art and will be a presenter at March's spring seminar. Topic: "Eco-Frugal Art."

KATHY VEDDER (a familiar name to us—she recently retired as Volunteer Hours co-chair for the last 12 years). Heard the old saying, "Down the rabbit hole"? In December Kathy was walking in her back yard when her right leg "just disappeared into the earth"—no rabbit hole but a deep, 3' wide crater from a rotting tree stump! The lawn company took "about 400 lbs of dirt to fill it." A hardy MG, Kathy suffered only "a bruised knee and a headache." However, like some of us, Kathy is slowing down: "In my heyday, I overwintered 80 plants in my basement and garage under eight fluorescent fixtures. This winter I brought in only 25." (Slacker!) They include tropical hibiscus, coleus, ferns, rosemary,

Alley continued on page 9

a winter-blooming white heliotrope, and a 'Meyers Improved' lemon tree. "I keep it short and even at 2' tall, it still has 10 lemons on it at one time." Though the fruit takes 6-7 months to ripen, it blooms and produces the year 'round "stimulated by regular feedings of fish emulsion." Kathy's beloved 'Shasta' viburnum survived the Easter freeze of 2007, and is showing signs of middle age, but is still "active." It is classified as a "doublefile" viburnum for double rows of spectacular white fragrant flowers along the flattened stems with red/ purple fruit in late summer. So it attracts the "Three B's": birds, bees, and butterflies. Other favorite shrubs are itea 'Little Henry,' hydrangea 'Limelight,' and buckthorn 'Fine Line.' Especially interesting is Kathy's buddleia 'Lo and Behold Blue Chip.' Rated "A Proven Winner" by horticulturist P. Allen Smith, 'Blue Chip' "stays under 3' tall, and blooms continuously from midsummer to frost without deadheading."

Cuttings

Drum roll, please! **First place in 2010's Too-Good-to-Be-True Plant Award:** the "Miracle 50-Year Resurrection Plant" huckstered in many home and garden magazines last year: "Keeps Coming Back to Life for 50 Years, No Matter How Dry You Leave It! No Soil! No Mess! From Dry and Lifeless to Lovely and Lush IN JUST 3 HOURS!" think I'm hallucinating? Check out www.DreamProductsCatalog.com Winterstuff to do when not dreaming over those garden catalogs: Buy a calendar to keep handy by your garden tools and note important dates: when you fertilized, sprayed, seeded, planted . . . first blooms, ripe veggies and fruit (and what variety). Keep a garden journal—plans/ideas for 2011, what works well—and what didn't. File those miscellaneous seed packets we all pick up (who can pass a display?) Old seeds? Check germi-

As with most things, there are differing opinions on exactly how to facilitate the actual mechanics of hybridization. According to William Shear, author of *The Gardener's Iris Book*, "With their large, simple flowers, irises are very easy for even a beginner to hybridize." With this being said, he cautions the would-be hybridizer to be particularly selective when choosing the parents for your seedlings. After mentioning how easy it is to hybridize irises, he then discusses how complex the genetics of irises are.

Only a few simple supplies are needed to perform the actual process: tweezers, envelopes, some type of labeling or tagging system, a notebook, and a pen. All the research indicates that keeping copious notes is imperative to the documentation for posterity.

The actual mechanics of hybridizing are fairly straightforward, but it is approximately a four year commitment from pollination to introduction. There are some rules to remember related to cross pollination, but mostly it is a creative endeavor to make a different plant to achieve the goals you have set. Simply put: there is a "pollen parent" that is the pollen donor and the "pod parent," which is the one where the pollen is distributed. Tweezers are used to remove the stamen from the pollen parent and then the pollen is gently brushed across the stigma of the pod parent. Hopefully, the pollen will then fertilize the ovules. In a couple of weeks, if there is successful fertilization, the flower will dry up and fall off and the ovary will swell up and form a pod. When the seeds mature, the pod will turn brown and begin to split. That indicates it is time to harvest the seeds. Record keeping is extremely important. It is critical to tag the crosses and to keep copious notes about the progress.

In addition to personal gratification for hybridizing a spectacular specimen, as alluded to throughout the document, the American Iris Society (AIS) has a medal award system beginning with the High Commendation (HC), which is the first award an iris can win. If an iris wins the HC, then it can move to the next tier only after it has been considered for introduction, which is the Honorable Mention (HM). It is then eligible for the Award of Merit. The highest award any Iris can ever receive is the Dykes Memorial Medal. An eligible Iris must have won the highest award in its class, as well as proving itself to be an excellent all-around performer. The award is the equivalent of the Pulitzer Prize or the Super Bowl for the Iris world. (Shear 158).

Bibliography omitted because of lack of space.

nation by sow a few in soilless mix or between moist paper towels.

GARDEN JEOPARDY solution: What is Harry Lauder's Walking Stick? (Scotsman Lauder's trademark was a bizarrely gnarled cane.) *Corylus avellana* 'Contorta' is even more twisted than the similar corkscrew willow. Its spring flowers resemble pussy willow's catkins. Though in the hazelnut family, the 8'-10' shrub produces no nuts. Zone 4. (Taylor's Guide to Shrubs) Alan Branhagen invites MGs to view Powell Gardens' specimens: "We have 2 large, 20 year-old plants in the Perennial Gardens, one just left of the entrance to the lakeside arbor, the other on the curved wall along the

ramp down to the arbor. We also have a smaller plant in the Heartland Harvest Garden just past the vineyard. They are sure beautiful in the winter and spring, but look disheveled with warped-wrinkled leaves all summer until leaf drop."



Photo courtesy of Missouri Botanical Garden

A history of sunflowers

by Terrence Thompson, Class of 2006

Gaze at all the fun new ornamental sunflowers as you browse garden catalogs this winter. Sunflowers have morphed from ten-foot, back-of-the-garden, yellow-flowering giants down to a manageable four foot range with some growing no higher than two feet tall. New flower colors from bright red and dark orange down to pale yellow have been developed. A new color called chocolate burgundy pleases the eye.

This shows the amazing versatility of a plant that has been cultivated on the American continent for many thousands of years. Sunflower seeds found in archeological excavations of Native American settlements in the Tennessee River valley have been dated back 4,200 years ago. Seeds in preserved human fecal remains found in Arkansas caves go back 3,000 years.

There is also strong evidence that early Native Americans cultivated sunflowers so they could harvest their seeds to supplement a diet that at that time probably mostly depended on hunting. Archeological clues show Native Americans long ago hybridized sunflowers to improve them for domestic use.

“Across the continent Native Americans were discovering and domesticating sunflowers, creating breeding programs that tailored the plant to perform a dizzying array of jobs,” writes Joe Pappalardo in his book *Sunflowers (The Secret History)*. Sunflower seeds were eaten raw, roasted, or ground into meal, the author writes. Other parts of the plant were also eaten, including the flower buds.

“From the Apache to the Choctaw, from the Anasazi to the Algonquin, Native Americans used sunflowers as more than just food,” Pappalardo continued. “They embraced the flowers as ceremonial objects and as cosmetics, as a cure for kidney infections and for

battle jitters, as a wart remover and as a ward against prenatal infections...”

The book is a fascinating read and is worth a trip to the library. I first spotted the book on the Internet while researching another garden subject. A blurb caught my eye that claimed the book explained how Adolph Hitler’s lust for sunflowers helped influence the course of World War Two. More about that fascinating tidbit later.

First I need to explain how sunflowers migrated to Europe. And then I will explain how they returned to America from Europe, specifically Russia, improved by breeding there to make sunflower the agricultural giant it is today.

The first mention of sunflowers in Europe appeared in 1568 in an early book on ornamental flowers titled *Florem* published in Antwerp. Sunflower seeds most likely were transported to Europe by early explorers returning from the Americas. Pappalardo said *Florem* was one of the first books published strictly about ornamental garden plants and undoubtedly helped spread sunflowers across Europe. The author of the book, Rembert Dodoens, later became the personal doctor to the Emperor in Vienna. With that connection the imperial gardener introduced sunflowers to Austrian gardens. Over the years sunflowers slowly conquered the gardens of Europe.

In the meantime colonists in America were discovering the virtues of the sunflower with the help of Native Americans. They learned that the seed made a tasty supplement to their Spartan diet. One species of Sunflower grown for its tuberous edi-



Sunflowers sold as a snack in China

ble roots was dubbed the “Artichoke of Jerusalem” in 1622 after it made its way to England. The roots were eaten with butter, vinegar and pepper and used in other ways Pappalardo reported. The plant was later better known as the Jerusalem artichoke.

By the mid 1700s sunflower seeds grew into a food source in Europe. However it wasn’t until the sunflower conquered Russia did its full agriculture potential start to unfold. The Russians discovered that sunflower seeds were an excellent source of oil that could be used for cooking. Although a patent filed in 1716 in London showed how to squeeze oil out of seeds, the Russians took sunflower seeds to their bosoms as a superior source for cooking oil and for eating. In 1779 detail of how to make a sunflower oil press was released in Russia. “Soon enough hand-cranked oil presses sprang up in homes,” Pappalardo said.

“Over the ensuing years, Russians increasingly accepted sunflower oil as a source of cooking oil,” he continued. “It also became the snack food for the peasants. The desperately poor began their long tradition of snacking on sunflower seeds and selling them to travelers from the roadsides.”

This Russian love to sunflowers leads us to sunflowers’ influence on the course of World War

Sunflowers continued on page 11

Photos courtesy of Wikipedia

Sunflowers *continued from page 10*

II. Food was scarce in pre-war Nazi Germany. When it invaded Russia in 1941, breaking a pact with Russian, Germany desperately needed to feed its people. A shortage of fat needed for cooking food along with other food scarcities plagued Germany. Invading Russia with its huge fields of agriculturally grown sunflowers potentially would allow Germany to provide its people a significant source of fat--oil from the seeds of sunflowers. Of course that never happened. Stalin's army eventually drove the Nazi army back into Germany. One of the rallying cries of Stalin had been that Germany wanted to steal food out of the mouths of Russians.

After the war sunflower growing prospered in Russia and far outstripped sunflower growing in the United States. Russia also advanced in research into the breeding of sunflowers to make the plants produce more seed oil, Pappalardo said. From 1956 to 1964 the percentage of oil in the seed was increased by more than 10 percent by Russian researchers. By 1966 Soviet farmers harvested 5.6 million tons of sunflower oil. The Soviet Union exported great quantities of oil seed which competed directly with the United States production of soy bean oil. That helped warm up what was known as the Cold War at that time. Pappalardo called it the "sunflower gap".

In the late 19th century Russian sunflower seed found its way to the United States, probably with the help of Russian immigrants. The first commercial production of sunflowers came in 1926 in Missouri with the production of sunflower oil, says the National Sunflower Association. However, it wasn't until after the Soviet Union started exporting large quantities of sunflower oil that farmers and agricultural officials here got serious about growing sunflowers. Delegations from the United States visited Russia to learn of its growing and breeding practices.

One American scientist on such a trip was incredulous that the Soviet hybridizers had increased the sunflower seed oil content to more than 50 percent. He asked for a sample to bring back to the United States to test. The Soviets guarded their sunflower hybridization success so jealously that they denied the request. However, when it was time for the American to return home, he asked for some sunflowers seeds to snack on as he flew back. The Russian guide got him some seeds to eat. After he returned to the United State he tested the seeds and found that the Soviet scientists were not exaggerating. The seed oil content was more than 50 percent. This "sunflower gap" helped push American hybridizers to improve the sunflower for agricultural use here.

"The native North American sunflower plant has come back home after a very circuitous route," the association explains. "It is the Native Americans and the Russians who completed the early plant genetics and the North Americans who put the finishing touches on it in the form of hybridization."

A profile on sunflowers by Kansas State University reported that the United States' sunflower crop totaled three billion pounds last year and was valued at \$444.8 million. Sunflowers are primarily grown in North and South Dakota, Kansas and Texas. However, the largest production of sunflower seeds and meal still remains in Europe. The Ukraine of the former Soviet Union tops all countries.

As pretty as the new ornamental sunflowers are I can't grow any in my garden. It's too shady. They aren't called sunflowers for nothing. Next summer when I spot sunflowers growing in other gardens or turning crop fields into dazzling lakes of yellow, I will have a new appreciation for the long companionship mankind has had with the sunflower over the centuries and how each has influenced the other.

Aster *continued from page 9*

include an Endangered Species Garden, Prehistoric Garden, Ginger Garden, Azalea Berms, Bald Cypress Pond, Hickory Bog, and Bamboo Garden. Like all botanical gardens, they have their share of weddings. While at Mercer, the bride walked by with her gown gathered up to avoid tripping, exposing pink and brown cowboy boots!

When I think of crepe myrtles, I think of shrubs. However, 'Miami' is a cultivar that grows into a 20 foot tree very quickly. Devoid of blooms during our visit, it was the bark that caught my eye. It was various shades of brown and beige. The leaves, I am told, turned brilliant orange before dropping. When spring comes the dark pink blooms will appear to be red. In the fall, berry clusters remain for the birds. Considered to be a late-blooming cultivar, it can grow in Zone 5. An online search reveals that miniature crepe myrtles are available and I have added that to my wish list.



'Miami' Crepe Myrtle

I noted some plants that I was not familiar with and when I subsequently researched them, found that I had picked two from the aster family:

Aster continued on page 16

Preserving blackberry memories: The four P's

by Gwen Martin, Fall 2010 Intern

Growing up in an urban area, my only experience of country and gardens were the treks to visit relatives in the Ozarks each year. The incredible amount of space, trees, wildlife and farm animals that made up these rural farms were foreign to my everyday world. And, the food! Oh, the amazingly delicious food that we ate! It was either fresh picked from an enormous garden, trees and bushes or from jars neatly lined on thin shelves that reached from the dirt-floor to nearly the ceiling in a shed that was dark and cool even on the hottest days. My favorite food was blackberry cobbler; a dessert I got often because it seemed to be everyone's favorite!

Picking blackberries was never a chore because the scratches and sore back melted away as soon as I took that first bite of cobbler. Now, these many decades later, I can still see, smell and taste those blackberries. Recreating those memories began in earnest when I bought a house with a little acreage. My immediate purchases included four blackberry bushes, three fruit trees—apple, peach, pear and many flower bulbs. Planted in the ground and mulched for winter, I looked forward to the following summer enjoying my very own blackberries. Much to my horror, the berries (along with the peach and apple trees as well as the tulips) were broken, dug up and/or eaten during the winter and spring.

Round two: a couple years later I planted more blackberry bushes into one of the raised beds that had become my vegetable and flower garden. The bushes yielded a few berries the following summer. Most were eaten by the birds and the bushes were a mass of tangles and the space (3 x 3) was impossible to weed. The canes were branching out into the other garden boxes and the rock aisles

separating the boxes. The blackberries were definitely out of control. Not at all how I remembered the blackberry bushes on my Grandma's farm.

Round three: the following year I cut the canes back and put netting around them in the box. I managed to get a few more berries but still the plants were not producing what the literature reported. It was still impossible to weed and the canes continued to go beyond their rightful place.

Frustrated and annoyed, I had a choice to make: either give up the dream of picking blackberries from my garden or figure out how to do it right! What I discovered was that I had done very little right in my blackberry attempts. Gilbertie and Sheehan (2010) "... propose a kind of three-year plan for becoming a full-fledged home gardener" and I certainly wish I had read their suggestions years ago! Lots of reading and learning from the Master Gardener classes has helped me develop the four P's for growing blackberries: Plan, Prepare, Plant, Preserve.

Plan!

- Blackberry plants can live 15-20 years⁷, so think about the fact that it's permanent. Survey your space and select a sunny site that will provide the right location for the number of plants desired. Blackberries need full sun. In my case I need a plot about 8 feet long and 8 feet wide to accommodate 6 plants set up in two rows. Smith⁵ suggests siting the plants where you'll be able to work them from both sides, rows should run north and south so they don't shade themselves (339).
- Do a soil test. Blackberries need a pH of 5.5-7 to do their best.

- Select your blackberry plants. There are many varieties. Choose wisely the plants with characteristics that will ensure success. These include:
 - > cold-hardiness: Kansas City is Zone 5
 - > disease-resistance: Arapahoe, Apache, Kiowa, Prime-Jim and



Photo courtesy of Wikipedia

- Prime-Jan are a few of the varieties available
 - > thorny or thornless
 - > harvest time: different plants ripen in June, July and August
 - > erect or trailing canes: erect canes have greater success in Missouri³.
- Order your selection from a reputable nursery. I chose award-winning Prime-Jim and Prime-Jan varieties from Stark Bros. Co. located in Louisiana, Missouri. While blackberries are perennials, the canes are biennial which means the canes grow the first year and produce the next year. Prime-Jim and Prime-Jan are unique in that they bear fruit on both the primocanes and floricanes thus ensuring good production especially in our unpredictable winter weather.
- Order a good bramble fertilizer. Stark Bros. suggests a 12-10-10 blend. Swenson⁷ recommends using a 10-20-20 blend. Results from your soil test will help you make the right decision with regard to your fertilizer choice.
- Become familiar with the differences between row and raised bed

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Blackberries *continued from page 12*

planting and which will work best for your site.

- What critters share your outdoor space? Birds, rabbits, deer, woodchucks and others might also like your blackberries. Read materials from MU Extension and other experts on the best ways to defeat their attempts.

Prepare!

- Read and understand the soil test results; amend your soil as needed.
- Mark off the area and till up the soil to a depth of at least 10-12 inches if using rows.
- If using boxes, till the soil up at least 6 inches and preferably deeper.
 - > Build bottom-less boxes from scrap wood or purchase garden box kits from a garden supplier. Put the boxes in place. Because of the heavy clay soil and abundance of rock in the site chosen in my yard, I will use raised beds. The boxes will permit me to easily attain the required soil ph as well as provide a structure to deter all the critters.
- If needed, purchase weed-free garden soil and work it into the soil or raised beds along with compost.
- Erect posts that are at least 6 foot above ground and place at both ends and in the middle of each row (or boxes). String wire at approximately 15, 30 and 45 inches for your canes to grow up. Even though not mandatory for erect blackberries, it will make future pruning easier.
- Arrange tall metal stakes along the length of the aisles. These stakes will allow the netting to cover the blackberries completely while giving you access and not becoming entangled in the canes.
- Mark off a working aisle—about 2 foot wide around the entire perimeter. Place cardboard and then mulch the aisle with a suitable material such as large wood chunks, pea gravel or chad.

- Purchase netting to cover your plants in the spring.

Plant!

- Blackberries can be planted in fall or spring. Usually the plants are potted, not bare root⁶. Plant the berries in early November for fall or in early spring. Be sure to follow any instructions from the nursery. Swenson⁷ suggests “After positioning the plant and carefully arranging the roots, fill the hole half full of soil. Tamp down the soil to eliminate air pockets, and water again. After the water soaks in, add soil to fill the hole, firm it well, then water. Always leave a saucer-shaped depression around each berry plant to catch rain and direct it to the new plant.”
- Mulch the new plants. Mulch will keep weeds to a minimum and preserve the moisture in the soil for the plant’s use³.
- Fertilize around the plants at a rate of about 5 pounds per 100 feet in early spring.
- If you planted in the fall, carefully inspect the plants the following spring.

Preserve!

- Water as necessary. Blackberries require at least one inch of water per week or two gallons per square foot of root area⁵. Drip irrigation is preferred.
- Weed. Do this on a weekly basis.
- Tie the canes to the wires as they grow up.
- If you purchase Prime-Jim and Prime-Jan brambles and believe the marketing materials, you will be able to pick some berries the first year. However, patience may make the plants stronger. Thus, removing the flowers and tipping the primocanes when they reach about 3 feet tall will enable the nutrients to go to building the plant instead of the fruit^{3,5,7}.
- After the first year, monitor the plants and the soil ph. Blackberries require fertilization each year.

Check your soil ph every two years. Call the experts or check appropriate Extension publications and web site if you see any sign of disease or experience pest problems.

- Prune appropriately and at the right time. The floricanes will die after fruiting and you should remove them just above the soil line in the early fall. Thin and tip the remaining primocanes in late winter. Retie to the wires if necessary^{4,5}.
- Apply compost and keep your plants mulched throughout the year.
- June, Year 2 should bring on loads of berries for eating out of your hand, in a bowl, for a cobbler and even preserved in a mason jar!

Following the four P’s—Plan, Prepare, Plant, Preserve—makes it possible to have great tasting blackberries in a relatively small space and minimal investment of time if you consider being able to pick those berries for years to come! Enjoying and preserving your own blackberries will take your taste buds to a new level and, indeed, creates wonderful memories!

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Diseases of pine trees

by Ron McMickle, Fall 2010 Intern

This essay describes three prominent diseases of pine trees in Missouri and Kansas. My purpose is to identify the disease, its cause, the treatment recommended and provide suggestions for replacement trees if removal is necessary.

My experience and interest on this subject began 3 years ago after buying a house in the Brookside/Waldo area in Kansas City in December, 2007. At that time, it appeared I had inherited a lovely back yard with three mature, healthy looking Austrian Pines (*Pinus nigra*). The following link provides a brief description and photo of the Austrian Pine. <http://www.arborday.org/tree-guide/TreeDetail.cfm?id=40>

In the following years however, I became suspicious of what I thought was more than the usual number of needles turning brown and dropping to the ground. It is normal for healthy pines to go through a process known as natural needle drop, which is a dropping of brown needles that are 2 to 4 years old in the fall. At this point, I thought that this was a natural process. At the end of the 2nd year I called a reputable tree care company and they assured me there was nothing abnormal with my Austrian pines. That assessment proved incorrect. At the end of the 3rd season, I researched this extensively as I was determined to find the cause of the brown needles and excessive needle drop. By this time, about one-third of the trees contained brown needles and what appeared to be dead or dying limbs.

Potential causes

My research showed the first potential cause to be pine wilt, a fatal disease caused by the parasitic pinewood Nematode *Bursaphelenchus xylophilus*. In general, nematodes (or roundworms as they are sometimes known as) are the most numerous multi-cellular animals on earth, estimated to be in the 10¹⁸ to

10²¹ range. Their numbers and diversity are amazing: over 20,000 have been identified with 16,000 being parasitic. They range in size from 1/100 of an inch to 28 feet long, which was discovered in the intestine of a sperm whale. They can exist in the most severe environments, from the Antarctica to the bottom of the ocean, where they comprise 90% of all animal life there.

The pinewood nematode however is microscopic, about 1/100 of an inch in length. While they cannot move freely from tree to tree, they do migrate via the pine sawyer beetle *Monochamus carolinensis*, also known as the long-horned borer. The females of this species lay their eggs just under the bark of susceptible pine trees, usually in the summer. The resulting grubs hatch and feed under the bark then tunnel into the tree. There the grubs develop first into pupae and later into adult beetles, 3/4 to 1 1/2 inches in length. The nematode larvae invade the newly formed beetles just as they are emerging from their pupal shells, a vulnerable time. They attach themselves to the beetle's breathing tubes (*tracheae*) and stay for the winter. About the 1st of May the adult sawyer beetle exits the tree from the tunnel they made in their grub stage. The nematodes are still present and go to the next tree, thanks to the sawyer beetle. So the sawyer beetle has now become an insect vector, moving the nematode to its next host, a healthy pine tree. The beetle's damage doesn't stop there however, because they feed on pine tree twigs. While this maturation feeding doesn't cause severe damage to the twig, it does create entry points for the nematodes, which then leave the beetle and move to the resin canals of the tree. There they molt to adults and begin feeding on the cells within the resin canals. Once the cells are destroyed by the feeding process, the canals become clogged, slowing first then stopping the resin flow, which

is the water-moving method the tree needs for its life to be sustained.

It is at this time that wilt symptoms begin to develop and the tree dies. In the warm summer months, this process becomes aggressive, with the nematodes multiplying rapidly and spreading throughout the tree.

Another beetle variety adds to the nematode attack as well; the bark beetle. Bark beetles host the blue-stain fungi, which leaves the beetle after it bores into diseased or dying pine trees and spreads rapidly. This fungus is a favorite food of the nematodes, so the nematodes multiply even faster, bringing on an even more rapid decline of the tree. Therefore, it is this interaction between the pine sawyer beetle and the pinewood nematode that bring about the rapid destruc-



Japanese black pine with needle blight

tion of pine trees, in a time period of a few months to a matter of weeks.

After this research, I was convinced that pine wilt was not the cause of my Austrian pine tree problem. So what tree varieties are most susceptible? I found it is the Scots pine, *Pinus sylvestris*. Although it can rarely occur in Austrian pines and even more rarely in white pines, it has been known to occur in jack pines, mugo and red pines. In the Midwest however, 90+% of the pine wilt tree fatalities have occurred in the Scots pine. Eastern Kansas has been severely hit by pine wilt. You don't have to travel far into Overland Park to see the extent of the damage. And it doesn't seem to appear much in trees that are less than 10 years old, which is evident in the

Photos courtesy of Wikipedia

Christmas tree farms, which is because most of the trees are harvested before the 10 years of age. It seems limited to the Midwest: Missouri, Eastern Kansas, Iowa, Illinois, southeastern Nebraska and Kentucky. Minnesota, Indiana and Ohio report few pine wilt cases. Perhaps the extreme weather seasons in the Midwest invite more invasions of beetles that begin the pine wilt disease. Hot, dry summers coupled with high winds are the leading stress makers, along with cold, dry winters.

There is no known cure for pine wilt. Injections may decrease the likelihood of an infection occurring, but offer no cure if the tree is infected. The injections must be administered by a trained tree care professional. To reduce the risk of pine wilt, it is best to not plant the

10+ years with pine wilt. Early symptoms occur in late May or early June when newly developing shoots, called candles, fail to grow fully. These stunted shoots, along with stunted needles start to first yellow and then tan. The fungus usually progresses from the bottom branches and moves upward, but untreated trees with recurring yearly attacks can suffer damage throughout the crown. Also, when acting as a canker, the disease can attack older tissue as well, causing extensive branch die-back. Black fungal specks can appear at the needle base and on cone scales. The fungus is treatable with some of the copper-based chemicals. It can be applied only when the buds are just beginning to swell (about the 3rd week in April). Apply twice again at ten day

spots may enlarge as the disease progresses becoming red bands that may be bordered by a light yellow area. *Dothistroma* is uniquely identifiable by the tip of the needle turning brown, but the base of the needle remaining green for up to several months. Infected trees will appear bare in the lower interior part of the tree. As with tip blight, these fungi can be controlled with copper-based fungicides. Two applications in mid-May and two more in mid to late June should provide sufficient control. Proper sanitation procedures should be followed by removing diseased needles on the ground, although successfully removing all diseased needles on the tree would be impractical.

As for my Austrian pines, the confirmed disease is tip blight. Due to the costly treatment and the environmental concern of using chemicals, I have decided to remove these three trees. This is a painful decision, but one I have made after much research and thought. My hope for the future is a beautiful landscape with a variety of healthy, well maintained trees that are more resistant to disease.

As for recommendations provided to me, here are some suggestions for replacement varieties that are more resistant to fungi and blight:

Giant Arborvitae: A fast growing evergreen, but susceptible to ice storm damage. <http://www.seedlingsrus.com/GreenGiant.html>

Eastern White Pine: Another fast grower, slight risk to fungus invasion. <http://plants.usda.gov/java/profile?symbol=PIST>

Serbian Spruce: A beautiful evergreen, slower growth rate. <http://www.arborday.org/treeguide/treeDetail.cfm?ID=136>

Southern Magnolia or Brackens Brown Magnolia: An evergreen tree as opposed to the deciduous bush. <http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=A345>

Lace Bark Pine. http://www.cirrusimage.com/tree_lacebark_pine.htm

Japanese White Pine. http://www.cirrusimage.com/tree_japanese_white_pine.htm



Austrian pine with needle blight

susceptible Scots pines. If these trees are present, proper management is mandatory to prevent the spread of pine wilt. Remove dead pines immediately to prevent beetle infestation. Provide water during hot, dry stress times. If infestation is suspected, provide a wood sample to a State Extension service that can test for presence of the pinewood nematode and remove the trees if the test is positive.

My search continued. Next on my list to investigate was the Tip Blight, *Diplodia pinea* or *Sphacopsis sapinea*. This is a fungal disease affecting Austrian, ponderosa, mugo and Scots, as if the Scots didn't already have enough problems. As with pine wilt, this disease mainly affects mature trees, but usually 20+ years instead of



Spotted pine sawyer beetle

intervals. Professional tree personnel are recommended due to the fact that a high-pressure sprayer is required to reach the tops of the trees. Chances are that this process will have to be repeated every spring for the life of the tree. Weighing the cost of treatment and success risk versus the cost of replacement with more disease resistant trees should be considered.

The third disease my research discovered was the *Dothistroma* needle blight. This disease affects pine trees in this region too. This is a fungus that attacks Austrian, ponderosa and mugo pines, but the Scots are resistant. Infected needles are noticeable in late summer to early fall, with dark bands or scattered yellow or tan spots. The



Southern Yew

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Aster *continued from page 9*

the ligularia and the cardoon plant. The Ligularia is sometimes called the Leopard Plant, or Ragwort. They are hardy in our zone, and prefer moist soil. They like to be placed in sun to filtered shade, making them ideal for a stream or pond bank. These plants grow fast to about three by three feet. They are good as a specimen plant or to plant in large masses. Native to China, the name comes from ligula, meaning little tongue. The florets are ray-shaped, reminding you of tongues. Usually, they are propagated by division. What caught my eye was that the butterflies were mobbing them! The main species is called *dentate*. Flowers are usually orange ('Dark Beauty,' 'Desdemona,' 'Gregynog Gold', and 'Othello'), but some cultivars are yellow ('Little Rocket' and 'The Rocket').

Also from the aster family, is the cardoon (*Cynara cardunculus*). Related to the artichoke, it is grown for its stem. The main root can also be boiled and served cold. Sometimes called the artichoke thistle, cardone, cardoni, caruni or cardi, it is native to the Mediterranean. It requires a long, cool growing season and is frost-sensitive. Like the artichoke, the plant takes up much room when growing. Highly invasive, it is considered a major weed in the pampas of Argentina and California, and is considered a weed in Australia. It is also covered in little hard-to-see spines that like to slip into your skin like splinters. Chef Mario Batali of the Food Network calls the cardoon one of his favorite vegetables. It is an ingredient in one of the national dishes of Spain, the Cocido Madrilen0, a one-pot, slowly-cooked, meat and vegetable dinner simmered in broth.

The Southern Yew was more impressive than its northern cousin. It is only hardy in Zones 7-9, where it likes rich, slightly acidic, well-drained soils in full sun to part shade. Although it tolerates shade, it does not

like wet soil. Coming to us from the mountain areas of China and Japan, this evergreen is a narrow-conical tree that can reach 50 feet tall or it can be grown as a large shrub. Bruising the foliage produces a pleasant fragrance. Its toleration of shade makes it usable as a potted plant in Kansas City, that can be moved indoors for winter.

With gardening seems to come the knowledge of where good food can be found. When we asked about local eateries for dinner like Pappasito's Cantina, the lady in the Visitor's Center said we needed to go less than a mile up the road to the White Flamingo in a strip mall. Major score. I had my first pecan cobbler. Imagine the insides of a pecan pie, only larger, with a scoop of vanilla bean ice cream on top!

Before leaving Texas, we took a trip to Kemah, which has a great boardwalk with shopping, rides, good food, and some nice landscaping. This little red plant was everywhere and quite festive looking. No one around that day seemed to know what it was. I sent a copy to Logees and they promptly replied that the plant was *Calistemon viminalis* 'Little John' (below). This miniature bottlebrush



would make an excellent potted plant. It has some degree of tolerance for cold weather and I am thinking it might make it through the winter in the garage. Numerous online postings have noted that in areas that got unexpected freezing temps in the teens, the plant would turn brown and die back to the ground, only to return even better when the weather warmed up. I am up for an experiment are you?