Dilmun Hill’s McBerry Patch
Production Guide
Kelley McCrudden Class 2010
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Integration Diary
Management Plan for the O’Hara McBerry Patch

The berry patch was designed by Kelley McCrudden and Lindsay O’Hara in the summer of 2008 Sustainable Agriculture Scholars program in the Horticulture department of Cornell. The scholars set out to learn about natural dyes derived by berries, from the growing process (through the development of the garden) through production, through their sales. As the growing season for berries is a long and complex process, the fruit produced in these “unproductive” seasons could be used to create natural dyes. Although the garden was designed by the scholars to produce berries that were capable of producing natural dyes, McCrudden and O’Hara also hoped that fruit could be used one day for consumption.

Given there brief time frame to design the berry patch and begin its implementation, which they plan to continue working on at a later date, they left behind this management plan for Dilmun’s future generation. Outlined here are what they did, what they plan to do, and what should be done to maintain the garden.

Summer 2008:

The berry patch (shown above) was designed with three main criterion; accessibility, proper spacing, and variety. Berries require much maintenance, so accessibility to each individual bed was essential. The main challenge to creating a berry garden was allotting enough space in between each variety without
compromising the others. For example blackberries required at least 6 feet in between rows for an optimal harvest whereas strawberries only required 2 feet. The garden was also designed to be not only practical in terms of use but as an ornamental complementary piece to the barn.

**What was done...**

The pH of the soil was 6, which was ideal for the majority of the berry varieties. However, it was problematic for blueberries. Blueberries require a pH of around 5.5, so to grow blueberries in the O’Hara McBerry Patch the soil required some alteration. The best solution to this pH dilemma was to add sulfur amendments to soil, which come in both pellet and powder form. Although each form has its benefits, the powder form was chosen due to its easy and quick usage, added prior to planting. Although no sulfur was spread during the summer of 2008, steps were taken to order it for a later application.

The main action taken place in order to alter the pH was the execution of a raised bed system. Raised beds are often used in growing berries for many reasons, mainly for their elevation, which provides more sunlight to plants, drainage, and for their accessibility. With the aid of the Dilmun farm managers, the scholars built their beds, composed of an inner layer of cardboard, followed by two feet of compost for the raised beds. Following the creation of the beds, woodchips were placed in the pathway areas.

**What will be done...**

The sulfur amendments will be shipped in the fall, and Lindsay and Kelley plan to work with Melissa Madden, and the two student farm managers (Suzie Konecky and Matt Ball) to add them in late autumn.

Lindsay and Kelley also plan to take an independent study in the spring of 2009 to complete the berry patch. Given the periods of time in which students will be able to enjoy the berries, the scholars chose fall bearing berry varieties, which must be planted in the spring.

**For those responsible in the future...**

Berry plants require a fair amount of maintenance. Irrigation is extremely important to all of the varieties of berries, especially blueberries, which have extremely shallow root systems and virtually no root hairs. Irrigation should take place throughout the various periods of berry blooms, harvest, and post-harvest periods depending on the amount of rain.

Blueberries also require a considerable amount of pruning due to their tendency to overbear, which often results in shorter lifespan. Pruning reduces the ultimate adult size and the crop yield in the following season. By reducing the number of fruit buds on the blueberry bush, there will be an increase in size of the
individual berries. The best time to prune a blueberry plant is during late winter, while the bushes are dormant, and flower buds are easily visible.

Strawberries also require some pruning. Most growers will recommend trimming fruit off during their first season, because they will greatly weaken the plant, and inhibit much future growth. Pick off all the blooms as they form; this will force all of the mother plants energy into producing daughter plants that will give greater yields the following year. Keep up to 5 of daughter plants to each mother.

Strawberries and other berry producing plants are also very vulnerable to cold wind, so to be safe apply a layer of straw or mulch over the plants during winter.

Although raspberry and blackberry plants can benefit from pruning and frost protection, the most important aspect of maintenance for these plants is a proper trellis system. Blackberries and raspberries are brambles, plants that send out long, thorny stems called canes. They are members of the rose family, and contain trailing berries that resemble climbing roses. They must be trained to a trellis or a fence, to enable the plant to grow towards the light, as well as ease of handling. For rows of raspberries and blackberries the best trellises are long and low, which can be accomplished with two posts with wire string between them.

Although there is much more that can be done to maintain a berry patch, by following these basic guidelines the O’Hara McBerry Patch should flourish for years to come.
Raspberry & Blackberry Production

The History of the Raspberry & Blackberry
The first record of the raspberry dates back to the time of Christ at Mount Ida ( ). Greek mythology claims that the gods went berry picking and returned with raspberries, providing the fruit with its scientific name Rubus idaeus. Many records of raspberry domestication appeared from the Romans within the 4th century by agriculturist Palladius. The Romans are believed to be responsible for the spread throughout Europe.

In Medieval Europe, wild berries were used for both medicinal and utilitarian purposes. The juices of berries were used in both paintings and illuminated manuscripts. King Edward I of Britain, a notorious fan of berries, ordered (1272-1307) a large cultivation of raspberries and blackberries for his own enjoyment, which was a critical push for their growth in popularity. The berries can still, till this day, be found in many English Gardens and throughout Europe.

When the settlers from Europe came to America, the Native Americans had already been utilizing the growth of wild berries for hundreds of years. In many cultures, both nomadic and settled, berries were dried for preservation and ease of transportation. The settlers brought over European varieties and began cultivating them along with native species. William Prince started the first commercial raspberry nursery in the United States in 1771.

By the 19th century Native American growers were the leading cultivators in the world. NY State alone harvested more than ten thousand acres of raspberries in 1920. However, the success in the state ended when the systemic mosaic virus wiped out nearly all of the planting stock in NY. The raspberry industry fled to the west coast, where it grew and continues to dominate within the market.

A Deeper Look into the History of the Blackberries
The history of blackberries stays fairly close to their raspberry counterparts starting with the Romans, who collected blackberries from the wild. They too were used medicinally, often used in teas to treat Gout and other illnesses. By the 16th century few varieties were even domesticated, although the majority of blackberry varieties were not commercially used till the 19th and 20th centuries.

The Native Americans had also used wild blackberries for years, and cultivation in the US began sometime between 1850 and 1860. Blackberries were a choice commodity from the very beginning of the colonies. In 1733 General Oglethorpe wrote about blackberries as he was sent to observe various “temperate and subtropical plants” of Georgia and their possibility of expanding farms and orchards up north. The clearing of forests for agriculture was an accelerating factor for the spread and hybridization of blackberry plants. By 1948 production reached forty thousand acres in the U.S.

Basic Botany: What is a Bramble?
A bramble is defined as the fruit of a plant with in the genus Rubus, such as the raspberry or blackberry. These berries are aggregate fruits, a classification denoting their unique reproductive cycle. Aggregate fruits develop from blossoms containing multiple pistils. As the pistils mature they gradually merge into one another forming the aggregate
fruit. However, before getting into the more complex aspects of the bramble’s development we should start by explaining the standard blossom.

For those who cannot recall their basic elementary botany, first note that the flower is the site of reproduction for many plants. A flower consists of a few key parts. The first part of the flower worth noting is the pistil, the female reproductive structure in the plant. The pistil includes the ovary; a part containing the embryo seed or ovules of the plant, responsible for producing gametes. The upper portion of the pistil is known as the stigma; the part of the flower that catches pollen from various other plants or from itself.

Pollen is produced within the male reproductive structures called the stamen, which contains two parts; the anther (creates the pollen) and the filament (supports the anther). Generally various natural phenomenons are responsible for the transport of pollen from the anther of one plant (or itself) to the stigma, including wind and insects. When pollen moves from the stigma down into the ovary fertilization occurs, plants can either fertilize themselves (self-fertilization) or by others (cross fertilization). When the ovules are fertilized a seed will form, thus the basis for another plant.

![Diagram of a Flower](image)

The reproductive cycle is just one of many complex ecological elements that must be considered while producing such fruit. There are several hundred species that have been identified, but only a few dozen are edible and can be grown commercially. Some brambles are low-lying herbs, others are woody bushes, and many are vines. Brambles typically grow best in cleared or disturbed land, and can be found in the wild. Brambles appear in temperate forests and tropic highlands, some species prefer cool, high altitudes, while others thrive in boggy, tundra areas.

The root systems of brambles tend to be fibrous and relatively shallow in comparison to other berry plants. Brambles are woody shrubs that have perennial root systems (come back every year) and canes (also emerge every year), typically producing fruit for two years. Stepping back for a moment, its important for every berry grower to
have a keen understanding to what a cane is. New canes emerge every year are called primocanes, and second year canes are called floricanes.

The canes of bramble plants also come in many forms; sturdy and upright, freestanding and semi-erect, or trailing over the ground. Once brambles become established roots are very tolerant to damage through cultivation. These roots will also act as a sink for carbon, and may benefit from higher levels of carbon through their initial growth. The majority of the root system can be found within the top few inches of soil. Raspberry and blackberry plants differ in that their root systems slightly, raspberries grow farther away from their parent plants, whereas blackberries remain in the location where their parent once grew.

In early spring canes form from either crown buds or adventitious root buds, eventually growing into a new primocane cane. The primocanes of last year are now floricanes. While floricanes are flowering in the second year new primocanes are also growing. Primocanes will produce fruit at the top of first year canes in late summer or early fall, and produce on the lower portion of the cane in early summer the second year. Second year canes (floricanes) will remain intact throughout the winter and will bear fruit in this second year, and die. Some of these will replace the floricanes the next season, and compete with the floricanes for sun and water. The first crop will occur the year after planting and will be in full production by the third year.

When the temperature drops flower buds begin to form in the axils of leaves, but they do not break. Eventually with enough cold weather (temperatures between 25°F and 40°F) the canes will stop growing, and the plant will enter dormancy, an important period of time for the plants development. If these temperatures are reached the buds will break when conditions will become favorable in the spring with sufficient chilling. If this chilling period does not last long enough the buds will stay dormant in the spring. Cold weather unlike most plants is critical for the bramble growth and harvest.

Maintenance of a bramble crop continues far after planting and is crucial to the development of a successful berry operation. Lateral shoots must be managed to ensure optimal harvest, in most cases the most fruitful lateral shoots are those in the middle
three-fifths of the cane. After the fruiting the entire cane dies. As the second-year canes (floricanes) are flowering, the first-year canes (primocanes) are growing from the crown or roots. When primocanes grow too large they often interfere with the growth of floricanes by blocking light. Pruning and other cultural practices can be used to keep this natural process from occurring.

Use
In the US over 173 million pounds of fresh brambles are sold a year, with an industry worth over $112 million dollars a year. Raspberries and blackberries have a number of uses in addition to being a delicious fresh fruit. They are also sold commercially dried, in purees, juices, jams, preserves and many other food products.

Raspberries and blackberries have a number of medical uses and are healthy foods. They are high in Vitamin C, and naturally have no fat, sodium, or cholesterol making them a healthy snack choice. The berries are also good sources of iron and folate for those that anemic or have particularly low red blood cells. Studies have shown that raspberries and blackberries have been able lower high blood cholesterol levels and slow the release of carbohydrates into the bloodstreams of diabetics. They also contain elegiac acid, a known anti-carcinogen that many berries contain. The fiber in one pound of raspberries or blackberries is from twenty to thirty grams. The berries are also a low caloric option; the USDA says that 1-cup is only 64 calories.

The major raspberry producers include Russia, Europe, and the Pacific Coast of North America. Although majority of these producers harvest then process the berries, although in American berries have most commonly been sold to fresh markets. Currently the Pacific Coast states are the main growing areas for blackberry and blackberry hybrids, and the Southeast region of the US is a key area of production. A major challenge for both Europe and North America is limited greenhouse production to supply the local markets. In the winter the fresh market shifts to other producers in areas such as Chile, New Zealand, and Australia. However, this may soon change as high tunnel production has become widely used in Europe and is becoming increasingly common in the United States.

Genetics
While red raspberries are most commonly grown, black raspberries are most popular in certain regions of the United States. Red raspberry species include Liberty, Heritage, Autumn Bliss, Canby and Festival. Allen, Jewel, Huron, and Bristol are popular black raspberry varieties. The progeny of red and black raspberries make a more purple fruit that are also growing in popularity, these cultivars called Brandywine and Royalty. Fall Gold, a yellow- fruited raspberry variety is caused by a recessive mutation.

There is an interest in thornless varieties of blackberries and raspberries throughout the United States. The difficulty with these varieties lie in their hardiness, most plants will not survive the journey from the west to east coast. There has been considerable advances in production, size of fruit, color, flavor, shelf life, and disease resistance. Tissue culture has been a positive factor in the improvement of propagation, and technological innovation continues to enhance the berry industry.

A grower selecting varieties must consider conditions such as hardiness, ripening season, and disease resistance. In colder climates raspberries tend to have superior
hardiness and survival rates than both blackberry and black raspberry varieties. It is possible for growers to harvest berries continuously from early summer to the first frost if the appropriate varieties are chosen. For example planting an early, middle, and late ripening floricance-fruiting variety to be harvested over the summer, and a primocane-fruiting variety for the fall. Choosing the right variety can also decrease the crop’s susceptibility to disease. Raspberries are extremely susceptible to disease, where as blackberries and black raspberries tend to be less susceptible.

Although variety may play a substantial role in the success of a raspberry or blackberry plot, the productivity is mainly determined by its maintenance. Keeping the ground protected from excess water and from the invasion of pests is crucial for any berry crop. It is also key to ensure that the berry varieties chosen are healthy. It is important to look certified virus-indexed material; this indicates that plants have tested negative for common viruses that may decrease productivity.

Cultural Practices

Successful raspberry and blackberry plants can be grown from 18 months to 15 years depending on the variety of plant chosen and the grower’s management plan. There is much that can be done in order to maintain a raspberry or blackberry garden, in most cases time and funding tend to be the deciding factor to which cultural practices are used. However, there are some key practices that must be considered in order to have a successful and enduring crop.

Although high tunnels and greenhouse production is commonly used to protect bramble plants, field plantings has historically dominated the production arena. Rows are commonly used to organize plots and ease harvest. Raised beds are additionally used often to protect plants from wet conditions, and receive optimal sunlight. However, raised bed systems do risk the chance of drying out the roots of brambles, it is key to water plants regularly. Generally raspberries are spaced, 2 to 3 feet apart in a row, as mentioned earlier raspberries tend to produce many new shoots. Blackberries, who do not spread far from their original plant like raspberries, still require 3 to 4 feet in order to grow strong lateral branches. Many gardeners also place flowering plants in close proximity to their bramble crops to attract beneficial insects, which can facilitate growth and organization of beds.

The majority of plants ordered from nurseries come in a dormant state or as tissue-cultured. Red raspberries and black berry suckers should be planted in early spring. It is ideal to plant brambles while still dormant, if the plot is not ready it is suggested to keep them in 35°F, where they may survive for several weeks. When ready the plants should be transported, being careful to place them into the ground as vertically as possible (if plants are at an angle their development may be threatened). The plants should be placed at the depth of their nursery soil, while spreading roots laterally and a bit deeper. For blackberry plants the crown should be placed about 3 inches below the soil, so bud tips are about 2 ½ inches deep. If buds begin to grow before planting, their tips should be closer to the surface. Water should also be provided immediately, and a light layer of straw to retain moisture as the plant becomes established. If weed suppression is a concern applying mulch is suggested. This will have to be removed the following year to allow the new primocanes to grow.
Pruning is required to keep plants vigorous and to develop the appropriate growth habitat for harvesting. Through pruning a gardener may ensure that next year’s crop will grow to abundance, as primocanes overabundance and overgrowth will keep light from reaching the floricanes, thus inhibiting their development for the following season. Pruning tends to be a bit of an art form, and gardeners make decisions about which primocanes to cut depending on various factors: including the variety of crop, trellising, fertility of site. It is a general guideline to prune the dormant raspberry transplants to a height of 5 inches immediately after planting, and then removing the woody covering once new shoots emerge from the soil. In the case of blackberry transplants, the portion of the stem above the surface should be cut once new shoots emerge from the soil. The next opportunity to prune will come the following winter.

Since most first year growth occurs under ground establishing root systems, they rarely will provide a harvest. Most growers opt to grow single late-summer primocane crops, this eliminates cane thinning, complex pruning systems, pest and disease damage, and cold injury. To do this primocane fruiting raspberries must be cut to the ground each year from December to February. Blackberry canes do not need to be completely removed from sight, it is suggested they be cut to a few inches from the ground, leaving 4 to 8 canes. It is important to wait till these times to cut, for the carbohydrates absorbed from the soil reach the crown of the plant in late autumn.

The next step in creating a bramble garden is developing a trellis system to be used just before harvest. Trellising can aid in manipulation of cane growth, increase plant growth rate, fruit quantity and size, increase sugars, decrease disease, and ease harvest. A temporary trellis is ideal in keeping the top-heavy canes from falling over and making harvest simpler. A simple T-trellis (look below) can be made by using two T-shaped posts (wood or metal) around 7 feet tall, 2 cross arms around 3 feet in length, and 2 pieces of twine. The trellis should be placed in the center of each row, in holes around 2 feet deep. Many suggest that a piece of PVC pipe be placed immediately into the holes.
after dug to keep posts in place. The balling twine is strung from pole to pole and laced through raspberry and blackberry canes to lift canes upright. A temporary trellis could be beneficial during each season to assist primocane fruiters, but a permanent trellis system will be needed for the floricane fruiters.

After planting a bramble crop should be maintained throughout the first year when plants are most vulnerable. Raspberry and blackberry plants require a good drainage system, once established brambles will suffer in soils that are too wet. Even short-term oversaturation could lead to issues such as poor cane growth, increased incidence of soil-borne diseases, and plant death. Fungal diseases such as Phytophthora root-rot, are common problems in poorly drained soils. In small patches hand weeding should be done throughout the warmer months. In the fall of the first year one MUST remove straw or plastic mulch, this will leave excessive moisture that may increase the incidence of Phytophthora root rot. If the soil is excessively dry other mulch materials, such as wood chips, may be applied 4-6 inches to retain moisture and prevent weed seed germination.

Raspberries are nearly always harvested by hand as individual berry ripeness is not uniform. Keeping the berries cool will keep them preserved for the longest periods of time.
Blueberry Production Guide

Basic Blueberry Botany

The Blueberry is one of the few commercially grown endemic fruit crops of the United States, which has various positive implications for growers. Blueberries are an ideal crop for many small and large farms as there are few major insect or disease pests that harm the plants and they tend to thrive in Northern America with little maintenance. Before getting into the cultural practices one must have a firm grasp on the basic growth and development of the blueberry.

There are 3 main species of blueberries; the highbush blueberry, the lowbush blueberry, and the rabbiteye blueberry. Although we will focus on the highbush blueberry, the most widely commercially variety, the lowbush and rabbiteye blueberry are still produced on a smaller scale in the US. The location and soils type of a blueberry garden often plays a key role in its development; all blueberry varieties grow best in sandy loams or acidic sands rich in organic matter. The cultivated berry is a deciduous, long living, woody- shrub that ranges in height from 6 to 8 feet tall.

Blueberry growth occurs all year, but root growth is most rapid in the fall and in the spring. Dormant buds (picture 1) are produced on shoots in the late summer or early fall, and begin growth in late fall when temperatures reach the plant’s chilling requirement, a period of around 1,000 hours above freezing but below 45°F. Buds will grow throughout winter and will begin to swell as the weather becomes warmer (pictures 3 and 4). In spring the buds continue to develop and leaves emerge from their respective bud-tips. When leaf tissue grows to about ¼ inch the buds will burst into flowers (pictures 4 to 7). The flowers will continue to grow into summer, open, and eventually fall off the buds revealing small green fruit (pictures 8 and 9). The leaves will fall off during the course of the summer as fruit develops. As fruit growth begins root growth slows, as water and nutrients will be demanded by the new fruit.
New canes develop from the crown of the plant in early spring, much like the blackberry, staying fairly localized. Roots continue to grow throughout the season and each may grow to be between 6 to 10 inches with adequate moisture and nutrition. Growth stops during the summer months, generally around the time that flowers begin to form from buds. Once the harvest has passed roots begin to rapidly grow again, where they do the majority of their developing, till temperatures drop past 43 F. The root system of the blueberry is composed of fine, fibrous, roots on the surface, and a small number of larger roots underground. Roots tend to stay close to the surface in the top 8 to 12 inches of soil.

Blueberries rely on their beneficial association with endomycorrhizal fungi. Unlike many other fruit varieties blueberry roots are not very absorptive, and require the aid of fungi within the soil to grow. The fibrous root structure prevents blueberries from surviving in highly compacted soil, as well as excessively wet or dry soils. Blueberry roots harbor the fungus in their outer root cells, which help uptake nutrients and water from the soil. High organic matter can also help to improve the root penetration and maintain soil moisture and nutrients for the plant.

Blueberries tend to ripen 2 to 3 months after they bloom, which is when sugar content is the highest in the fruit. By waiting to harvest several days following the fruit turning blue, growers ensure peak sugar levels. Fruit size will also increase by as much as 35% following the change in color, due to water movement into the fruit. The ripen blueberry is nearly 85% water. Drastic changes in color demonstrate changes in cell walls as a result of fruit softening, which is desirable but can also lead to vulnerability during this period. Drought during ripening will reduce fruit size and fruit flavor, which is why it is essential to keep soils moist during these days.

It is ideal to allow berries to fully ripen on the plant; however, these fruits will not survive very long once picked. Keeping berries cold will keep the ripening process slow and reduce rot.
History of the Blueberry

Blueberries have been a part of the American diet dating back far before European settlers arrived in North America. Native Americans would often collect and consume wild blueberries, and dried the fruit for use in winter. The Europeans were discovered the berries fairly late in the 1800s where it was first found in fields and backyards. The blueberry is one of the most recently cultivated fruit crops, domesticated entirely within the 20th century.

Various individuals throughout history are responsible for the growth in popularity of the blueberry and for their domestication. Elizabeth White of my home state, New Jersey, was a commercial cranberry grower who paid her employees to search for exceptional bushes in the wild and then transplanted them on her farm. These bushes would be used for the breeding programs in the future. Dr. Fredrick Coville established the first breeding program in 1908 and performed the first successful hybridization of the blueberry. He alone produced over 30 varieties, which are still widely grown. In the 1930’s Stanley Johnston, a professor at Michigan Agricultural College started a movement towards growing blueberries along the eastern shore of Lake Michigan, where soils were too acidic for most other agricultural productions. The Michigan Blueberry Growers’ Association was formed in 1936 for the purpose of shipping berries to each of the major American cities.

The blueberry market would then travel south to North Carolina, which continues to produce the majority of fruit in the East for the month of May. In the 1940s blueberries began to be produced in Oregon and Washington, which also continues to grow a large portion of berries going to local markets and to California. The berries now have been planted throughout the world where the soils are acidic and climate is suitable. The acreage planted to blueberries has increased faster than for any other temperate fruit crop. Today more than 40,000 acres of Highbush blueberries are cultivated in North America, an industry worth over $600 million as Americans consume nearly 200 million pounds of blueberries a year.

Genetics

Blueberries have only few pest issues offering an advantage to organic production. Insects and disease can be controlled through cultural practices and using the proper cultivar. Deciding which variety to use tends to be based on weather fluctuations and geographic seasonal advantages. Popular varieties include Earliblue, Duke, BlueRay, Patriot, Berkley, Bluecrop, Herbert, Darrow, Jersey, Coville, Lateblue, and Elliot

Blueberries in the genus Vaccinium and are members of the Rhododendron family (Ericaceae). The Vaccinium genus contains several species capable of cultivation, most commonly the highbush blueberry and the lowbush (wild) blueberry. The highbush blueberry (Vaccinium corymbosum) is the most popular variety of cultivated species grown from the Mid-Atlantic to California, mainly in Oregon, Washington. The lowbush blueberry (Vaccinium angustifolium) originates from Northeastern North America, in Eastern Canada, Maine, New Hampshire, Massachusetts, Michigan, and Wisconsin. Although North America produces the majority of the world’s supply of blueberries, the
market has expanded to Europe, now growing in Germany, France, Poland, England, South Africa, New Zealand, Australia, and Chile.

Scientists at land-grant universities have been interested in blueberry production for quite some time, with breeding programs expanding throughout the country. Major breeding goals include sweetness, intensified flavor, large fruit size, small fruit scar, light blue color, winter hardiness, drought resistance, wide climate adaptation, erect habit, and late flowering with early ripening.

It is highly recommended that state inspected plants be purchased and that season ripening, yield, fruit quality, hardiness, chilling requirement, vigor, and local adaption also be considered when choosing blueberry plants. One should also note that varieties with successive ripening periods extend the harvest season.

Uses

The blueberry has many desirable traits, which have contributed to their growing popularity. Blueberries have small edible seeds that often go unnoticed when consumed, they have a long shelf life, and a unique flavor. Blueberries are commonly used in a variety of different ways, they can be eaten fresh or used for jelly, jam, syrup, pies, pastries, and made into juice.

Blueberries also have various medicinal uses, containing compounds that protect the urinary tract, cholesterol-depleting chemical pectin, and cancer-inhibiting ellagic acid. The berry also contains vitamins C and E two key antioxidants from the prevention of disease. In only 3.5 ounces of blueberries, an amount barely enough to cover a bowl of cereal, contains the antioxidant capacity of 1,773 International Units of vitamin E.

The blueberry has grown to popularity throughout the world, and the industry continues to expand. North America produces nearly 90% of all the blueberries sold commercially in the world. In the US the blueberry is the second most popular berry variety, next to the strawberry, with over 200 pounds produced each year. The top blueberry producing states are Michigan and New Jersey.

Cultural Practices

As blueberries have few pests or diseases their management primarily relies upon their early development. It is essential to prepare the area to which the blueberry plants will go well in advance; modifying soils where needed, mulching, and creating an appropriate design for the site.

Since blueberries have a shallow root system it is essential to prepare in advance the soil structure of the plot, keeping plants away from areas with risk of erosion and flooding. Ideally the water table should be around 15 to 40 inches below the surface even after dry periods. Raised beds of 8 inches of soil or more can help to maintain the soil structure as well as providing a way to ensure the roots will not drown. However it is important to keep plants hydrated during warmer months, a common recommendation is to water 2-4 gallons per plant a day during peak evaporation. Having high amounts of
organic matter can also keep soil structure intact when sandy soils are unavailable, which also play a role in retaining water.

Having the appropriate pH for a blueberry garden is key; they require an acidic (low pH) soil, between 4.5 and 5.5 pH range. With higher pH the blueberries become at risk for chlorosis, and when it becomes too low manganese toxicity may occur. Although the plants do not require much nitrogen, having an appropriate pH will help maintain the proper level. Neutral and high-pH soils favor nitrification (the conversion of ammonium nitrogen to nitrate through microorganisms). However, in acidic soils the ammonium from of nitrogen predominates is much more readily available for the plant. The most common way to lower soil pH is by applying sulfur, during the winter or early spring. It is generally recommended to check pH every year to see if amendments are needed. Powdered sulfur generally takes 4 months to oxidize and reduce soil pH. Sulfur can be quite detrimental to soil biology of the plot and to reduce the amounts needed many growers will apply peat moss close to growing time to acidify their soils. Vinegar and citric acid solutions can also provide an alternative to using sulfur, used through irrigation. To protect other growing areas sawdust and woodchip mulch can be applied to easily buffer soil pH.

Blueberry plants should be planted in the spring, as soon as soil can be worked in April or May. Generally vigorous 2 to 3 year old plants are preferred over rooted cuttings, and container-grown stock tends to transplant easier than bare-root. However, these plants tend to be expensive and roots may become bound in pots, requiring some pruning. Highbush blueberries are typically spaced 4 to 4 ½ feet in the row, with 4 to 5 feet in between rows. Holes should be more wide than deep to accommodate for the spread of the root system, and as deep as the nursery the plants came from. Many growers also incorporate peat into their planting, which helps to facilitate the root penetration and improve nutrient holding capacity by improving soil texture. The piece of peat should be soaked for several days and placed into the hole. The grower should then water the plant, it is generally recommended to fill the hole up to with at least 1 inch of water.

Although blueberries do not require nearly as much pruning as bramble fruits, pruning the plant immediately after planting should be done to reduce stress the root system, as well as annual clean up. As the plant ages pruning needs tend to vary. In the first two years only flower buds should be removed, promoting the establishment of vegetative growth. This can be done by rubbing off the fruit buds in March or April or but pruning the shoots where buds form. Pruning should be done in early spring, when winter-injured wood is most easily identifiable. Many growers will prune immediately after harvest, but this tends to make plants more susceptible to injury and often reduces long-term productivity. One should aim to have plant grow upright with an open canopy to allow light penetration. First remove any winter-injured, diseased, and broken branches. Next cut away any cane that rubs against another, and short canes that will not receive much light. If left attached these branches would compete for nutrients with other branches that have the potential to produce fruit. From ages 3 to 8, in addition to removing the diseased and destructive branches all but 2 canes produced the previous year should be removed.

At age 8 canes begin to loose their productivity, requiring more leaves to produce enough energy for fruit. Removing the 8-year old-canes will help to ensure productivity in future years, although their removal may initially reduce yield. In general, 20% of
older wood can be removed from the bush without interfering with productivity. Many larger growers will suggest removing the plants entirely and restarting the process following the 8th years of growth, but for small growers, blueberries yields may be maintained through yearly pruning.

Blueberries do not have an extensive root system, and incorporating cover crops or bedcovers is often less damaging to them than to bramble fruits. In row weeding once or twice a year is often sufficient to keeping blueberry plants healthy. It is also strongly suggested that blueberry plants be covered with 3 to 5 inches of mulch; blueberry roots grow in the margin between the mulch and the soil. If the mulch decomposes the roots will be exposed, thus it is key to replace the mulch every 2 to 3 years.

All blueberry flowers have the potential to open and fruit, however, to achieve a high set insect pollinators are needed. Planting beneficial plants within the vicinity of the blueberry plants is another important element of blueberry gardens that do not have access to hives. Deer damage can also be an issue for some blueberry gardens, and fences should also be incorporated as a physical protective barrier to the plants.

As was discussed in the “Basic Blueberry Botany” section, fruit will ripen from 2 to 3 months after their flowers bloom. It is important to allow berries to fully ripen on the plant, to ensure peak sugar levels within the fruit. One should also keep plants hydrated during this period of ripening, which influences fruit size and flavor. Blueberries will not survive very long once picked, but by keeping berries cold will keep the ripening process slow and reduce rot.
Strawberry Production Guide

History of the Strawberry

The history of the strawberry begins in ancient Rome, although there has been some speculation that the berries date back to the year 234 BC in Italy. Discussions of strawberries can be cited in works by Virgil, Ovid, and Pliny the Elder. They were often used in the Roman culture, where they were used in festivals and with grapes ornamentaly. The plant then went through a period of relative hiatus after the fall of Rome, but reemerged during the medieval times. During this period the strawberry was used for medicinal purposes, in contrast to its previous culinary value. Many believe the strawberry was avoided as food because of its poor taste in the wild, and growth so close to the ground.

The name “strawberry” comes from the Anglo-Saxons who named them after the way in which the plant strew or spread along the ground. The strawberry regained culinary popularity in the 18th century, when tastier varieties were discovered. In the Americas different varieties of wild strawberries had grown throughout the continents and had been consumed by native communities for generations. When the settlers arrived to North America they sent back a variety of strawberry from Virginia. Then in 1700, the French botanist Amédée-François Frézie introduced the Chilean strawberry now commonly known as the Beach Strawberry. English horticulturalist, Thomas Andrew Knight, was the first person to practice large-scale strawberry breeding, and perfected the commercial strawberry. He crossbred the two North American species in 1714, to create the large fruited strawberry that is most commonly grown today, *Fragaria x ananassa*.

Although strawberries had been gathered in the wild for many years, it was not until the 1820’s that they were commercialized. The strawberry industry flourished in the US, starting with the earliest breeder Charles M. Covey of Massachusetts. In NY in 1851, James Wilson produced a strawberry variety that caused commercial production to expand from a few hundred acres to over 100,000 acres within 20 years. Today, strawberries are the most popular and most sold cultivated berry in the country!

Basic Strawberry Botany

The strawberry is a low creeping, perennial herb that can sometimes be grown as an annual. Contrary to popular belief, and its deceptive name, the strawberry is NOT a berry, and many will argue furthermore it is not a fruit. The actual strawberry is the enlarged end of the plant receptacle and it is sometimes classified as an aggregate fruit (see Basic Bramble Botany). The strawberry plant also has seeds on its skin rather than the skin around the seed, like most fruit. To grow a successful garden one must understand the plant’s full life cycle, the basic strawberry botany.

All strawberry plants require full exposure to the sun, good air and drainage, and
protection against early frost. Although most strawberries varieties produce fruit in late spring and mid-summer, everbearer varieties produce lightly in the summer and heavy in the early fall. These varieties are ideal for those who aim to have fruit grown throughout the season, in addition to growing the largest bounty at the beginning of the fall. We will focus on the lifecycle of this variety.

Just as our other berry plants, the strawberry will die over winter and begin growing again in the spring. Strawberries are usually planted in early April or May, depending on the length of the growing season. Like raspberry plants the strawberry plant grows from a central stem, from which it grows outwards. Around 6 weeks after planting the mother strawberry plant will begin producing runners. Runners are the intermediary part of the plant, to which the mother plant will feed its daughter plants. The number of runners produced by each plant depends upon the variety, but when the runner reaches 8-10 inches in length it will shoot upwards and form a daughter plant. The same runner will then continue to grow outwards and set several more daughter plants if allowed for several years.

The plants each have a short stem, called a rootstock, from which a group of thin leaves form above ground, the scale leaves. The foliage and flowers sprout from the buds in the axils of the scale leaves. The buds also may produce shoots that grow over the surface of the ground and bear scale leaves and more buds. The terminal buds of these runners turn up and become the daughter plants that will provide most of next season’s strawberry crop. After the season ends, the new plants will develop deeper roots, and the runner connections will shrivel away.
It will take an entire season before the patch is in full production. Strawberry flowers will grow the first year, but the majority of the energy spent by the plant is used to produce its daughters. During the second year the parent plant becomes longer and woodier, and the older roots will become less functional. A new parent plant will develop, and the runner-reproductive cycle will continue. Around 30 days after strawberry blossoms are seen the berries will be ripe and ready for harvest. The best yielding gardens usually require a new batch of plants each year and the removal of old plants, but they can be managed to grow for longer periods of time. The productivity of the plant will decrease rapidly after one to three years.

**Genetics**

Strawberries are the most widely grown fruit crop in the world, and are growing in every continent and in nearly every country of the world. More than 1 billion pounds of strawberries are produced in North America each year, and are grown in every state and province. The United States is the top strawberry producer in the world, and is also the top consumer of strawberries. This growth in demand has led to production in California, the leading grower of strawberries, Oregon, Michigan, Washington, Florida, and North Carolina. The number of cultivars has changed rapidly over the last few years, but the market has grown mainly where strawberries can grow nearly all year round (Childers, x).

Although wild strawberries had been consumed throughout the world for years before modern plant breeding, the strawberry that is most commonly eaten today is a hybrid variety. The commercial strawberry comes from the cross of two wild American strawberries; the Eastern Meadow Strawberry and the Beach Strawberry (Chilean variety). Strawberries descend from the large fruits of *Fragaria chiloensis* and *Fragaria virginiana*, two species of wild strawberry. *Fragaria chilo*, also know as the Beach Strawberry is a Chilean variety that can still be found on the western shores of North and South America. *Fragaria virginiana*, the Eastern Meadow Strawberry is a species that is distributed along the Eastern US and Canada. Together they create the Frangaria x ananassa, the common strawberry, to which other commercial varieties stem from.

When choosing the appropriate variety of strawberry species one should take into consideration many key characteristics; adaption, disease or insect resistance, seasonal growth/ripening, and hardiness. In the Northeast varieties that are often seen include Jewel, Seascape, Earliglow, Northeaster, Sable, and Allstar.

**Use**

The strawberry has become a significant part of the American diet, with over 94%
of all US households consuming the berries. It is also the most commonly consumed variety of berry in the United States. The average American eats up to 7 pounds of fresh strawberries each year, up from 2 pounds just 20 years ago.

Strawberries offer a number of nutrition and health benefits in addition to being sweet and delicious. Strawberries contain high ratios of Vitamin C, a much greater percentage than that of oranges. They are a rich source of antioxidants that help to protect the cell structures in the body and prevent oxygen damage in all of the organ systems. The phenol content in the strawberry makes them a heart-protective fruit. Strawberries have been linked with reducing unwanted inflammation, such as that which is involved with rheumatoid and osteoarthritis, asthma, atherosclerosis, and cancer. Despite their sweet flavor and high sugar content berries are quite low in calories, one cup of strawberries (144 grams) contains approximately 45 calories. They are an ideal food for those looking to change their diet to loose weight and to eat healthier. Strawberries are even known to whiten teeth!

The strawberry not only contributes to healthier Americans, but healthier American economies. In California alone, the sale of strawberries will provide the state with over $1.2 billion. Strawberries are often consumed fresh, but are sold in a wide variety of ways. They are often sold frozen, made into preserves, cereal bars, used for flavoring, and can be found many other commercial goods. They are also quite popular additions to dairy products, such as strawberry flavored ice creams, smoothies, and yogurts. Strawberries, like many other berries, are often used in baked goods and dressings. One cannot discuss the success of the strawberry without mentioning the incredible popularity of the fruit both as a dish and cultural symbol in the strawberry shortcake.

**Cultural Practices**

Strawberries are tolerant of a wide range of habitats all over the world, providing that the growing season is long enough for the fruit to ripen. This provides growers with some flexibility in creating their strawberry garden, but planning is still key to achieving healthy and high-yielding plants.

The first step to creating a successful strawberry garden is to establish one’s site. Ideally the garden would be located in a woodland clearing, where the plants would receive the appropriate level of sun exposure. Early producing varieties require maximum sunlight, whereas late producing varieties can thrive in semi-shaded areas. Strawberries also grow best in slightly acidic soil, the pH of a strawberry garden should be around 6.2. Amendments can be applied to the soil when necessary, but there are varieties one can use that are more accommodating of soil pH. All strawberry varieties, however, require free drainage and retentive soils. Contrary to popular belief, strawberries are not heavy feeders and do not require large quantities of nutrients, their main nutrient. Both nutrient
and drainage concerns can be achieved by providing organic mater. It is generally suggested that the strawberry plants be provided with a minimum of 3 top inches of compost or manure. After this is complete, the garden should be left to settle for a few weeks before planting.

Strawberries should be planted in the spring during the months of April and May, depending on the projected last freeze. It is suggested that plants be purchased dormant, and virus-indexed from a reliable nursery. It is important to avoid plants that have signs of winter injury, mold, and root rot. These problems will lead to plants dying when the weather turns warm. Plants can be kept in refrigerators until you are ready to plant. If the ground is still frozen when plants arrive keep the plants in refrigerators until it is ready. Planting days should be cool and cloudy so that the plants are not exposed to sun and wind. Dig a hole large enough so that roots can extend vertically, than cover the plant with soil to just below the crown or scale leaves. You may need to cut the roots back to 4 inches before planting to avoid the J-shaped root systems. Keep the strawberries well watered for the first few weeks following planting.

There are 2 different raised bed systems for growing strawberries that are both used on a commercial and garden scale; the matted-row system and the ribbon-row system. The matted row system is least labor intensive and requires the least number of plants, but does not provide fruit the first year of growth. Strawberries are produced the first year using the ribbon row system, is much more labor intensive and requires many more plants. Most gardeners suggest the matted-row system, thus this method will be our primary focus.

The matted row system places rows 48 inches apart and plants 12 to 24 inches apart. Flowers are usually plucked the first season, eliminating a potential harvest, but encouraging vegetative growth. Runners will be restricted to 6 per plant, but it is the goal to fill a strip of 12 to 15 inches wide. Fruit will be harvested from these 12 to 15 inch rows for subsequent years. If there are too many runners, the planting will be overcrowded, and will reduce yields and put the plants at risk of disease. To remove runners from undesired areas growers suggest the use of a rototiller or hoe. Although clipping runners requires much time and energy it is essential to reducing rotting, increasing fruit size, and making harvest easier.

Several weeks after planting the strawberry will begin to flower from buds formed within the crown the preceding fall. In a matted-row system the first year, these flowers should be cut to prevent fruiting and encourage the runners. First-year berry production deprives the plant from energy necessary to establish in the new garden, for runners to produce, and for winter survival. Some strawberries only produce one flower cluster per plant, but other may produce several times throughout the season. This is why you will need to check on the planting multiple times to remove the flowers.

In addition to pruning the strawberry garden should be maintained throughout the growing season by daily watering and weekly weeding. Strawberries have a shallow root system, and need to be well watered in order to keep the roots well hydrated. The plants
need about 1 inch of water each week, either by rainfall or irrigation. One should avoid watering in the early morning or late evening so that plants do not stay wet for long periods of time. If there is ever a risk of overnight frost, cover the plants with row covers or mist the plants. The ice that forms on the plant actually helps prevent the flowers from freezing. Row covers can also help to keep the plants from freezing. Strawberry plants can be crippled by weeds competition and it is important to weed frequently in the first few months as runners are establishing in the beds. It is a general guideline that if soil is well prepared and beds are weeded early there will be less weed problems throughout the season.

In the fall the strawberry plants should be covered with mulch to prepare for low temperatures that may injure plants. Traditionally, straw has been the mulch of choice, and should be applied after temperatures reach 20°F. The mulch should cover the plants 3 to 4 inches deep. In the spring the mulch should be removed around in late March or early April when the threat of cold temperatures has past. Since strawberries are evergreen they will have green leaves and will begin photosynthesis as soon as the mulch is removed. The mulch can then be placed in the rows to help smother out weeds.

Immediately following your harvest in the fall, the beds should be renovated to help reduce disease, stimulate new growth, and prolong the life of the plant. Each plant should be mown or clipped to a height of 3 inches, making sure to remove the scraps away from the garden, to prevent disease. If capable, rototill the area between the rows, reducing the width of the matted rows to about 12 inches. Rake the excess soil to cover the plants left in the row about 1 inch deep.

Northeastern strawberries typically flower in May and produce fruit in early June through early July, depending on the variety planted. There should be expected a 2 to 3 week harvest, fruit will ripen about 30 days after the flowers open. One should avoid picking green tipped berries that are not fully ripened, and should remove all remnants to prevent disease. The strawberry plant’s lifecycle in a garden generally extends to 3 years of harvest before the plants rapidly decline. As the plant’s age, they will become increasingly more woody, and less productive. Weeds will become more difficult to control and diseases often become a more serious problem. After the third harvest season, it is strongly suggested that the plants be removed in entirety, and new fresh runners should be purchased.
Manager Cliff Notes

**Raspberries + Blackberries:**

**Everbearing Varieties:** Brandywine and Royalty

**General Information:**

- Successful raspberry and blackberry plants can be grown for 6 years before new plants should be purchased.

- In the first year plants are establishing and do not produce a harvest.

- Raspberries grow outward, and blackberries stay fairly stationary. Raspberry plants require more pruning.

- Raised bed systems should be used to eliminate risk of wet conditions and for optimum sun exposure. Raspberry should be spaced 2 to 3 feet apart, blackberry should be 3 to 4 feet apart.

- Flower plants should be grown around patch that attracts beneficial insects. Suggest growing Tansy, Alyssum, and Dill. These plants attract Hoverflies, these insects not only aid in pollination but also in killing Aphids (pests).

- Hand weeding should take place throughout warmer months.

- If soil is dry, mulch or woodchips should be applied to retain moisture and prevent weed seed germination.

**Planting:**

- Plant when temperature is stable at 35°F or higher in April or May. May keep new plants refrigerated at 35°F until temperature is consistently warm.

- Plants should be placed into ground at the same depth as the nursery soil, and the roots should be spread laterally and deep. Blackberries crowns should be placed at least 3 inches below the soil, so tips are 2 ½ inched deep.

- Straw should be applied after planting to retain moisture.

- Water plants more heavily in the beginning of the growing season.
- Straw MUST be removed in the fall of the first year of growth.

**Year 1:**

- Prune dormant RASPBERRY transplant to height of 5 inches immediately after planting. When new shoots emerge in the coming weeks, remove the woody covering from the soil.

- Prune dormant BLACKBERRY transport when new shoots emerge from the soil, and cut to the portion just above the stem above the surface.

- The next opportunity to prune will occur the following year.

**Establishing Trellis Systems- Year 2:**

- A simple T-shaped (look below) can be made by using two T-shaped posts (wood or metal) around 7 feet tall, 2 cross arms around 3 feet in length, and 2 pieces of twine.

- The trellis should be placed in the center of each row, in holes around 2 feet deep.

- Suggest that a piece of PVC pipe be place immediately into the holes after dug to keep posts in place.

- The balling twine is strung from pole to pole and laced through raspberry and blackberry canes to lift canes upright.

- After harvest the T-trellis can be removed and stored till next harvest

**Year-Year 2: December or February**

- During these months RASPBERRY **primocanes** (new canes that emerge over the course of the season) must be cut to the ground, in order to ensure next years crop in the early fall.

- BLACKBERRY primocanes do NOT need to be cut to the ground, but only a few inches from the ground, it is suggested that 4 to 8 canes be left each year.

**Harvest:**

- Should done by hand.

- Keeping berries cool will preserve them for longer periods of time.
Blueberries

Varieties: Earliblue, Duke, Blueray, Patriot, Berkley, Bluecrop, Herbert, Darrow, Jersey, Coville, Lateblue, and Elliot

General Information:

- Blueberry plants will produce fruit successfully for 8 years

- The pH of a blueberry garden must be between 4.5 and 5.5. Sulfur amendments can be applied, I suggest using powder sulfur, which takes 4 months to reduce soil pH (oxidizes).

- Mulch or woodchips can be placed in between rows to help buffer pH change from other plots.

- Blueberry plants should be planted in spring during the months of April or May.

- Highbush Blueberries should have 8 to 10 feet between rows, and should be spaced 4 to 4 ½ feet in their rows.

- Blueberries have a shallow root system, incorporating a cover crop or bedcover could help alleviate this, I suggest using fine-leaf fescues.

- Like raspberries and blackberries, they too can benefit from having plants grown that attract beneficial insects.

Planting:

- Holes should be wide enough to accommodate for the spread of the root system, and as deep as their nursery plantings.

- Suggest incorporating peat into planting to help facilitate root penetration and nutrient holding capacity. To do, soak peat for days before planting and place in hole with an additional 1 inch of water.

Year-Year 1:

- Blueberry plants should be pruned immediately after planting like blackberry plant, few inches from ground.

Years-Years 2 and 3:

- For the first 2 years the flower buds should be rubbed off in April and May.
-Injured, diseased, or rubbing shoots should also be removed in the early spring.

**Years-Years 3 to 8:**

-In addition to removing the diseased and destructive branches (those that rub each other), all but 2 canes produced over the previous year must be removed.

**Pruning- Year 8:**

-Suggest removing the 8-year old canes and purchasing new replacement canes, to restart the process.

**Additional Maintenance:**

-Must keep the soils from becoming too wet, as the root systems of blueberries are quite shallow and may erode. Providing high organic matter can help alleviate this issue as well.

-Must water in warmer months, as the fruit has little water-holding capacity, it is recommended 2 to 4 gallons a day during peak evaporation.

-Plants should be covered with 3 to 5 inches of mulch, which should be reapplied every 2 to 3 years.

**Harvest:**

-Blueberry fruit will ripen 2 to 3 months after their flowers bloom.

-Suggest keeping berries on branches until fully ripe to ensure peak sugar levels.

-Water more intensely during ripening period.
Strawberries

Varieties: Jewel, Seascape, Earliglow, Northeaster, Sable, Allstar

General Information:

- Strawberry plants generally survive for 3 years before they become unproductive.

- It will take an entire season before the strawberry plant is established.

- Later bearing strawberry varieties tend to require semi-shaded environments that are rich in organic matter. Suggest incorporating a 4-inch cover of compost or manure on the top of strawberry beds.

- Raised beds should utilize the Matted-Row system—rows 48 inches apart and plants 12 to 24 inches apart.

Planting:

- Strawberries should be planted in the spring during April or May.

- Dig a hole large enough so that the roots can extend vertically, avoid J-shaped root systems, and cover the plant up with soil just below the crown or scale leaves (see Basic Strawberry Botany).

- Keep plants well watered in first initial weeks.

Year-Year 1:

- Pluck flowers to eliminate the potential harvest, allowing the plant to establish and vegetative growth. One may have to check for flower growth throughout the season.

- Runners should be restricted to 6 per plant, but it is the goal to fill a strip of 12 to 15 inches wide. (Fruit will be harvested from these 12 to 15 inch rows for subsequent years.)

- If there are too many runners, remove runners from undesired areas growers suggest the use of a rototiller or hoe.

Years-Years 2 and 3:

- Immediately following harvest in the early fall clip plants to 3 inches, making sure to eliminate the scraps (prevents disease).
-Reduce the width of the matted rows to about 12 inches and then spread additional soil over plants to cover them about 1 inch deep.

**Additional Maintenance:**

- Water daily during summer months, suggest 1-inch of water a day, avoiding watering in morning and late evening.

- Weed weekly.

- As soon as there is a risk of overnight frost (20°F or lower) cover the plants with straw 2 inches deep, this can be removed in April or May the following spring.

**Harvest:**

- Flowers grow in late May or June and fruit is produced in July and August, it will take around 30 days for the fruit to ripen from this point.

- There should be an expected 2 to 3 weeks of harvest.

- Avoid picking green tipped fruit, and remove all scraps from picked fruit.

- After the third harvest season it is strongly suggested that the plants be removed, and new plants be purchased in the following spring.
Additional Projects: What further research can be done? What else should be considered in the future?

1) Research on berry pests.
2) Research on berry diseases.
3) Research on cover crops.
4) Research concerning lead arsenic and raised bed system (of berry garden).
5) Research on beneficial plants and insects.
6) Research or implementation of a living fence. I (Kelley) have had dreams of implementing a pear tree fence. Talk to Marvin Pritts for further explanation.

References:


