Fruit Spotlight

Strawberries – *Fragaria* spp.

Well we finally decided to spotlight a fruit that a Tahoe/Truckee gardener might consider growing – so why not start with strawberries! Strawberries seem to be everyone's favorite, either direct to the mouth, with cream, or in a pie. Strawberries really announce spring has arrived – except in Tahoe/Truckee where homegrown strawberries come into their own in summer, still something to look forward to. There is a lot to explain about with strawberries, and a bit more work to do in the garden to have a good crop each year, which we hope to address.

Strawberries are in the rose family (*Rosaceae*) of plants. There are about 11 "wild" species world-wide, and thousands of varieties, hybrids, intermediates and cultivars derived from these wild stocks. The modern strawberry that we are familiar with involves a series of artificial crosses primarily between two new world species, *F. virginiana* from North America and *F. chiloensis* from the west coasts of South and North America. In the Tahoe basin our native strawberries are possibly *F. virginiana* the mountain strawberry found in moist open areas along forest edges and meadows here and there throughout the mountains and *F. vesca* the wood strawberry. Typically wild berries are few and far between, however in recently disturbed or recently planted areas berries may be abundant. There also may be commercial cultivar (*F. x ananassa*) escapees from gardens, as propagation of strawberries is effective both vegetatively and through pollination and seed development with subsequent dispersal, especially by birds.

Tahoe native strawberries

The wild strawberries found in the Tahoe basin are either *F. vesca*, the wood strawberry (alpine strawberry) or *F. viginiana*, the mountain strawberry. There also undoubtedly a number of escaped cultivars of our commercial berries (*F. x ananassa*) which are essentially impossible to field differentiate from F virginiana. Field identification between *F. vesca* and *F.virginiana* can be problematic, as distinguishing characteristics overlap. For field identification the main differences are in leaf characteristic. *F. vesca* leaves are slightly more serrated (12-21 above and below the middle) and the leaf petiole shorter to the individual leaflets. F. virginiana has fewer serrations above the middle of the leaf (7-13), and a slightly longer petiole to the individual leaflets. Please see the section on genetics to better understand the differentiation in species.

History

The first written records for the strawberry are from Greek and Roman sources, focusing as much on the plant's roots and leaf in teas for medicinal application as the fruit for food. Apparently, then as now the wild plants were rarely prone to profuse fruit production. In the Americas too the strawberry plant was well known to the Indians but its use as a food was of less value than medical aspects of the plant itself. In Europe woodland and/or alpine strawberry started being cultivated in the 14th century, as farmers took plants from the forest and grew them with some success in their gardens. The name strawberry, in a myriad of variations, starts to show up in common usage about the same time, though the etymology of the word strawberry has been variously defined as

either related to where found (adjacent hay/straw fields or meadows), the time of fruit ripening (ripening when hay/straw is harvested), the strewn (straw-like) appearance of strawberry stolons, or that straw was used for mulching around the plants, or how the berries were strung on stems of hay/straw when collected or offered for sale.

Indeed successful fruit production of the European strawberry (*F. visca*) did have a mystical/blessed aspect to it as the symbolism of the fruit was incorporated into gothic/religious art of the 1400's and 1500's with the strawberry being found on manuscript borders or as a central theme (getting weird by the time Hieronymous Bosch painted his Garden of Earthly Delights about 1510). Some of the explanations were in the purity of the white flower, the red ripe small fruit representing a drop of the blood of Christ, and even the pointed edges of the flower's calyx tightly held to the red fruit being interpreted as symbolism for the crown of thorns. There also are the romantic aspects for the rare fruit that includes it being dropped into flutes of champagne shared between lovers.

The symbolism, mysticism, romance and scarcity of the fruit was sure to attract the attention of royalty, who then desired to have such delicacies. The French King Charles V (the Wise, whose son was Charles the Mad) had 1200 strawberries planted into the royal gardens at the Louvre near Paris. The English King, Richard the III had a taste for strawberries – at least as stated in Shakespeare's play about the King. Henry the VIII also purchased the fruit in some quantities.

One of more fascinating stories (and there are many) with strawberries as a theme begins in AD 916, when Charles III, King of West Francia (Charles the Simple, or Carolus Simplex – son of Louis the Stammerer, and cousin of Charles the Fat) meets with Cardinal Clemens de Monte Alto (Italy) in Lyons France to resolve a dispute. Following successful negotiations a feast with entertainment was held at Auvers. At the conclusion of the hullabaloo a local citizen presents the king and guests with dishes of ripe strawberries, which pleased the Cardinal no end, stating that such fine fruit would be a rarity in Rome, especially so early in the season (May). In gratitude, King Charles knights the local, changing his name to Fraise (Strawberry in French) and giving him a coat of arms with two diagonal quadrants containing 3 strawberry flowers, the other two having a variation on the crown. The name change was a bit ironic since the newly knighted Sir Fraise name was Julius de Berry to begin with.

A hundred years later members of the Strawberry Clan immigrated to Scotland at the request of the French King, Henry I (who was pivotal in securing William the Conqueror's ascendancy in Normandy prior to his excursion to England), to assist the Scottish King Malcolm III to subdue a renegade noble – Macbeth (yep we are back to Shakespeare). The Fraise name was anglicized (or the Scottish equivalent) to Frazer and their new coat of arms retained the strawberry flower but now had three crowns at the opposite diagonal (France, Scotland and England). Fast forward a couple hundred years and the politics in Scotland (think Robert Bruce) get too hot and there is a movement of the Frasers back to France and but now having the French version of Frazer - the name Frézier (Whew! We're close to the end). Enter one Amédée François Frézier born in 1682 to a prominent lawyer father, he studied both theology and science – and was keen on architecture and fortifications. He also liked to dabble with pyrotechnics, writing the first book on the subject. This odd combination of interests and skills won him a commission to the French Military intelligence Corp and an assignment as a spy to investigate the fortifications and defenses along the west coast of South America. (Still with us?) During this assignment he also found time to investigate the situation with the natives, geology and botany of the area. So on a tour of the beaches he encountered large fields planted in the beach strawberry (*F. chiloensis*), where he collected a few plants to take with him back to France. His spying was a success, so much so that his Journal was translated into several languages – each a possible enemy of Spain. His five beach strawberry plants became the basis of a number of experimental crosses with European and other

strawberries from the New World including *F. virginiana*, which directly led to the modern strawberry we know today. ***You just cannot make up some of this stuff.***

Many of the early hybrids attempted were between the large fruiting *F. chiloensis* and the European *F.vesca*, which never quite met expectations. However when *F. chiloensis* was pollenated by the American *F. virginiana* the progeny (termed *F. ananassa*, or *F. x ananassa*) did have both size and some flavor – though perhaps not to the standards of the *F. vesca*. Still it was a start. Why pollen from *F. virginiana* and not the other way around? Well the few plants brought to France by Frézier were fruiting (female) plants, of a dioecious species. Antoine Nicolas Duchesne was the first to notice the separation between sexes in both *F. chiloensis* and in the European Musk Strawberry *F. moschata*, a species having a distinct flavor but difficult to produce fruit – until it was understood that while only female plants produce fruit, it is essential that the male plants be present to enable fertilization.

Attempts to commercially grow *F. chiloensis* in Europe were only successful along the coast of France near Brest, in the most western coastal France, and only after it was recognized that male plants were required. Before male *F. chiloensis* were brought to France from the new world, males of the Musk Strawberry were used as a substitute. The other outcome of these crosses was that the daughter plants often were hermaphroditic and capable of self-pollination. Duchesne was the first to publish a book (1766) devoted to the taxonomy, physiology, and cultivation of the strawberry. Somewhat interestingly, the French approach was more academic in their attempts, while the British were driven to commercialization of promising cultivars. As a consequence English varieties were the common market berries in England, the continent and eventually the United States.

<u>American cultivation</u>

Early commercial cultivation of strawberries in the United States began about 1800 and was based on small sized plots that used *F. virginiana* transplanted from nearby forests. Selection of the more productive individuals led to development of a few named cultivars (New Jersey Scarlet). The Hovey strawberry was introduced in 1834 and was a planned hybrid cross (though with parentage coming from earlier European crosses of *F.virginiana* and *F. chileoenis*), often was planted along-side locally collected indigenous plants. The Wilson strawberry, derived from the Hovey and introduced just before the Civil War was more forgiving in a wide variety of soil or climatic situations and was the direct reason for strawberry acreage to increase significantly to over 100,000 acres. The Wilson had a perfect (fertile) flower so secondary pollinator plantings were not required and productivity per acre increased accordingly. The Wilson was supplanted as the leading planted cultivar by the Howard 17 around 1910. The Howard 17 was significantly more resistant to leaf scorch and viruses and is found in the ancestry of nearly all current cultivars. Beginning in the late 1920's and accelerating through the depression (and beyond) was work undertaken not by growers but by state supported universities and the federal government (*MG Note: The USDA began strawberry research at the Beltsville, MD facility in 1910*). The proliferation of named cultivars were being developed specifically to have high productivity, disease resistance, larger size, better shipping qualities and for growing well in certain regional soil and climatic conditions – often with a loss of the taste and texture of the older varieties. From the 1920's to World War II, the Marshall and Klondike were the dominant cultivars grown in California. The Marshall was well known for size, color and flavor. After WWII there begins a change to the strawberry markets with production expanding to areas of cheap labor and moderate temperatures. This shift was in part due to better transportation methods, including refrigeration from fields to store, but also in the development of varieties that shipped well, such as Shasta, Lassen and Fresno that were developed (Davis) and grown almost exclusively in California.

<u>Odd</u>

Before we leave the strawberry history section one last odd (?) story. Two words to start. Nazi Germany. Strawberries were well known in what is now Germany for centuries, however the type grown during the middle ages through to the early 1800's was primarily the dioecious musk strawberry (also called the hautbois strawberry), *F. moschata*. The center for musk strawberry production today remains in and around Germany. The *F. x ananassa* was introduced to Germany by George II in 1751. George II was king of Hanover (Germany) but was also King of England and Ireland (George II was the last British monarch not born in England and also the last British king to lead troops on the battlefield - Battle of Dettingen – 1743). Acceptance and development of new cultivars from the New World hybrid, *F. x ananassa*, did not take hold, with most commercial production shifting towards growing English (he was King of England) cultivars with a very few French varieties. Beginning about 1870 the Goescke father and son team (Gottlieb and Franz) introduced successful German cultivars derived from *F. x ananassa* to the marketplace. Franz was the Royal Horticultural Director at Proskau until about 1912. Their work was followed by Otto Schindler who continued breeding and cultivar introductions until the Nationalist Socialist Party comes to power in 1933.

Hitler, a vegetarian, and a number of high ranking associates really, really did like their strawberries, an expensive luxury – even more so after the self-sustainment policy know as Autarky became the norm with the Nazi build-up to conflict. With Autarky, crop management and research moved to a great degree to the Kaiser-Wilhelm Institute for Plant Breeding Research, which while government funded maintained some degree of independence. One researcher, Reinhold Oskar Kurt von Sengbusch, took up the evaluations related to strawberries, with emphasis on finding cultivars suitable for flash freezing. (*MG Note: The quick or flash freezing process developed and patented by US businessman Clarence Birdseye was licensed to many companies in Europe, including companies in Nazi Germany. During the late 1920's through the 1940's there was great interest in finding or developing fruits and vegetables compatible with the fresh-frozen process*). Sengbush a talented botanist, though ambitious, somewhat arrogant, and a difficult person to work with, soon was at odds with his Kaiser-Wilhelm Institute superiors, leaving in 1937 to start a private institute, funded by a tobacco company (through a subsidiary) H.f. & Ph. F. Reemtsma GmbH which had extremely close ties to the Nazi elite. Throughout the war years strawberries were grown and cultivars developed at the Sengbusch's institute fields in Luckenwalde. Even as late as 1944-5 strawberry production and research continued with 10,000 seedlings grown and evaluated for both fresh and frozen applications. The selection of Luckenwalde for field growing was either good planning or luck because a POW prison and an internment camp were there so labor was never an issue for Sengbusch. Even after the Soviets occupied Luckewalde, Sengbush continued his work- but now with oversight by curious Russians who wondered why such importance was given to growing strawberries during a war.

After the war Sengbush's work continued but now in Hamburg, still supported by the tobacco company subsidiary Andersen & Company. He claimed that much of his research during the war was censored, not allowing publication or giving him rights to his work – as a consequence he asked for (and received) appointment to the Max Plank Institute of Plant Research (*MG Note: Yes! The new name for the Kaiser-Wilhelm Institute*) where he continued work on Strawberries, very quickly developing one of the most famous European cultivars, the Senga Sengana – all based on his war time research. It was introduced and copyrighted (patented) by Sengbush in 1954. The same year Sengbusch founded the Sengana GmbH to manage the commercial production and promotion of this cultivar – all while employed at the Max Plank Institute, where he retired from in 1968 (the Max Plank Institute for Plant Breeding closed about the same time).

An excellent and detailed history of the human/strawberry interactions through to the beginning of the modern breeding and tissue culture programs that start in the 1970s can be found in Darrow's treatise, Strawberry – History Breeding and Cultivation listed in the reference section. It is online as noted below.

Our Strawberry sources

The alpine strawberries, *F. vesca* come from Michael Wellik's Strawberry Store. Michael has a degree in biology and a Masters in entomology. His operation grew out of trying to find a greenhouse crop to grow during the winter. Michael's operation has evolved since he started with strawberry production, but seemingly has always had a penchant towards the alpine cultivars with seeds a mainstay and plants offered regularly more recently. Michael always responds to inquiries and e-mail.

The majority of our *F. x ananassa* come from Nourse Farms in Massachusetts. The Nourse family farm is one of the 10 oldest continually operated family farms in the United States, being started in 1722 by William and Ebenezer Nurse. Shortly after setting up the farm in what is now Westborough, Massachusetts, the family name started being spelled as Nourse, though still somewhat pronounced Nurse with the New England accent. The name change may have had something to do with the family leaving Salem following the hanging of Rebecca Nurse (the grandmother of William and Ebenezer) as a witch! Think Arthur Miller's *The Crucible*. The Nourse family contributed to American farming in development of a patented plow, as well as farm record keeping.

A Note on strawberry genetics

The species of strawberries can be grouped based on chromosomal numbers, which to a certain extent also defines the degree of success for hybridization. The group of diploid species (2N=14) includes the *F.vesca* assemblage that is circumpolar in distribution plus 4 other species found in Eurasia. From a commercial agricultural perspective only *F.vesca* has any importance. There are two western Asiatic tetrapod strawberry species (2N-28), also of little or no agricultural importance. The musk strawberry, *F. moschata, is a hexaploid* (2N=42), and has been cultivated in small plots and occasionally offered for sale in Germany/Austria and northern Italy. The American species *F.virginiana* and *F. chileoenis* are true octoploids (2N=56). The multiplying of the chromosomes is called polyploidy and is fairly common in plants, with any number of examples found in the *Rosacea* family. What causes polyploidy has been greatly discussed, with a number of environmental, chemical, and hybridization opportunities as contributing factors.

Propagation

Strawberries can be grown from seeds, plant plugs, bare root, crown divisions, or from stoloniferous daughter plants. The most common methods are starting with plant plugs or bare root plants. On a cost per adult plant basis the bare root plants are usually the most economical way to get started in the strawberry garden business, but after a season or so, use of the daughter plants is a no cost option – of course this assumes that you are growing cultivars that have runners (stolons). The actual cultivation considerations are relatively simple – soil having good tilth and drainage, plenty of sunlight and adequate watering. Sounds simple, and it kind of is – well maybe.

Seeds can be used to get started with your strawberry production, and are not too difficult to start indoors 4-6 weeks before the last frost. The seed germination rate is usually around 80% (minimum standard is 60%) so putting at least a couple of seeds into each pot is a good idea. If using seeds other than from *F. vesca* or *F. moschata* cultivars you need to remember that *F. x ananassa* cultivars are hybrids so the seedlings may have greater variability in the individual plants – even when a specific cross was made to obtain the seeds. You can also obtain seeds from store or farmer's market bought strawberries, simply pick a few of the larger and mature seeds (seeds usually mature first from the calyx towards the center of the berry, and usually one side of the

berry more so than the other). Mature seeds are tan or brown in color- not green or yellow. Use a knife to cut out and flick the seed from the berry. An overly ripe berry is a good source of seeds.

Seed germination occurs more quickly and at slightly higher germination rates if the seeds have undergone a conditioning process where the seeds are frozen for 2-4 weeks, and then allowed to return to room temperature prior to sowing. Conditioned seeds should start to sprout in 6-14 days. Raw seeds may take up to 36 days for germination to occur. Many of the strawberry seeds offered for sale have been conditioned – check to make sure. If you need to condition your seeds place in an airtight container so they do not dry out in your frost free freezer. Seed conditioning requirements are more variable and may not be needed for many of the warm weather, short day cultivars.

Place the conditioned seeds on the surface of a potting soil filled container and press the seeds into the soils so there is good seed to soil contact. Dust with a little potting soil, water (and keep soil moist but not overly wet). Soil temperatures 65^0F - 75^0F are optimum for germination. Germination is enhanced if the planted seeds remain in a well-lit area or under grow lights. It is important to keep the soil moist, but not overly wet while waiting for germination, and as the seedlings emerge. The seedlings are ready for repotting or hardening off (if planting outside) after the third leaf has expanded. Hardening off in the Tahoe/Truckee area can take a week or more, of increasing time outdoors. When 4-6 leaves are out, the plant is plug size.

Plugs or immature plants can be purchased from suppliers or grown from seed. Commercial growers usually use plant plugs in their plantings. By the time the 4-6 leaves are out and expanded direct planting to the field, plot or permanent container is recommended (after the prerequisite hardening off). If however you still expect snow or extended periods of freezing temperature, you can repot and hold until ready to plant. For the home gardener the issue with plant plugs is the limited varieties available, but if you find the type you want this planting method is a good option.

Bare root plants as mentioned above is probably the best option for most of us. Typically the plants are sold in 25 plant bundles, which sounds like a lot but when planted with one foot spacings does not take a lot of room, but by the time you buy a couple of different varieties, suddenly you need to start sharing with a fellow gardener. The bare root plants are one year old plants that have been trimmed and are ready to plant when received.

Live one year plants can be purchased, usually from the nursery or garden center. This is the most expensive way to get going but is an option if time or space is an issue, and you only want one or two plants. The potted plants usually are bare roots the nursery has potted and grown for a couple of weeks before being offered for sale. You still should harden off before planting or repotting.

Stoloniferous varieties of strawberries will send out runners (stolons). Along the stolon at each node a daughter plant will begin to form. The daughter in this case is a clone of the parent. The daughter plant will have leaves and may even flower, without having any significant root development, getting nourishment from the parent plant via the stolon. Eventually roots do develop and the stolon dries and eventually breaks. The sooner the daughter plant can become self-sufficient the less strain there is on the parent which means more fruit. You can pin the daughter plants down using a bobby pin that's been slightly splayed. Pin close to the daughter plant so there is good soil contact with the base area of the daughter. Pinning the daughter plants also keeps the row neat and fills in open areas.

Crown division is a propagation method for those varieties that are not stoloniferous. This requires the excavation of the mature plant and separating or cutting the crown heads (some varieties will have a cluster of tightly adjacent crowns that can, with some difficulty, be separated. Other varieties you just cut the crown length-wise into 2-4 sections and replant.) It is best to do

crown divisions in early spring just prior to plant growth starting. Some care is needed, and it may take a year for the segments to fully rebound.

Cultivation

As mentioned elsewhere in this article strawberries can be grown in containers, raised beds, field planted, and even grown hydroponically. Except for the latter method (which we will ignore) planting is pretty straight forward – well sort of. There are a couple of critical items to consider when planting strawberries. First and foremost is the site selection. While not as important as for asparagus, rhubarb, fruit trees, or brambles you need to be aware that once established a strawberry plot can be maintained at the same location for a number of years, so plan accordingly. The more sun the better for these low growing plants. Six to 8 hours sun is a minimum for good production. Another aspect relating to productivity is that fruit seems to be more frequent along the edges and sides of the planting area and less productive in the center. Consequently narrow rows are typically more productive than area plots. There are many specialized containers and structures for growing strawberries that increase the edge effects, and increase fruit production.

The next consideration is the methods of planting. Containers work well, and look attractive, especially with the alpine strawberries. Those cultivars that have runners soon outgrow the container, but you can put out secondary pots to establish the daughter plants.

If you are planting to the garden, narrow raised beds work well, as you can pin the daughter plants and remove older less productive plants. If planting into the garden proper, consider mounding soil along the planting row to elevate the plantings. As with containers and raised beds you can pin the daughter plants into open areas along the mounded row, removing older plants that are less productive.

You can and should consider covering the mounded row with a ground cover or plastic and planting through the covering. This can help elevate soil temperatures and keeps the fruit from being in contact with the soil. If this method of plasticulture is used, consideration on watering method need to be made concurrently, to either use drip systems below the fabric or use a permeable fabric. Most commercial operations use drip systems beneath the plastic.

Strawberries like moderately fertile well drained soils that have are neither water logged or too dry. The plants once established are pretty drought tolerant, but fruit production requires moist soil. Soil pH is usually not a concern, unless very acidic or alkaline. The soil characteristics are claimed to impart flavor aspects to the ripe fruit.

Planting care is needed to place the crown of the plant (The crown is actually a truncated stem.) at the proper height above the soil. Placed too deep and the crown is covered and growth is slowed with the plant more susceptible to crown mold or rot. Placed to shallow and the roots are partially exposed, leading to the plant drying out. If planting into containers or freshly prepared raised beds make sure of proper depth of the crown as soils often compact somewhat with watering.

Prior to planting an addition of a phosphorus fertilizer incorporated into the planting bed is recommended to help with root development. Bone meal, at ½ pound per 100 square feet of planting area is a good alternative if going organic.

Preparing for winter

Strawberries are hardy plants that usually can survive our Tahoe/Truckee winters. It is important that following the end of harvest and before the first snows that some care be given to assure a good crop next summer. If you're using plastic ground cover with drip irrigation below the plastic you need to make sure the drip system will make it through the winter, if not then removal will be required with some disturbance to the plants, and possible loss of most of the protective fabric.

For the mature plants it is recommended that that the plants be trimmed to remove the majority of the old leaves and flower stalks, this improves field sanitation and also will stimulate new leaf and flower buds for next spring. Be careful when you "mow" the plants not to damage the terminal portion of the crown. Fall is also the time to remove any older nonproductive plants that you should have noted during the summer, and hopefully pinned a daughter plant close by as a replacement.

Mulching with weed free straw (strawberries after all), or pine needles helps, but also provides suitable habitat for overwintering earwigs or sow bugs. With container grown plants make sure that the plants do not dry out. If possible move to a protected area.

Diseases and pests

Strawberries are pretty hardy plants, but they are susceptible to a variety of diseases and are chomped on by just about every variety of critter. For home gardeners, diseases fall into two categories, those that you have little control to prevent or manage and those where garden practices contribute to the situation, often leading to recurrence every year. Those diseases over which the gardener has little control, such as red stele, planting resistant cultivars is the best or only option. Other diseases like powdery mildew are best controlled through changes in garden practices. Still other diseases such as crown rots may be a function of how the strawberry crowns were planted. The occurrence of certain diseases such as verticillium wilt may be a function of what was planted prior to the strawberries (Solanaceous plants). Since strawberries are perennials, it is important to maintain good field sanitation, by removing dead or diseased plants, keeping weeds to a minimum and removal of old leaves and flower stems prior to winter. For strawberries one big issue to avoid is lengthy periods where the leaves and especially the fruit remain wet, usually related to watering cycles or method of watering.

There are a number of insect pests that can quickly infest your plants. Infestations can occur more quickly in area growing methods (strawberry patch), and less quickly if you are growing in rows. Aphids (of course) can affect the plant or the fruit. Using a stream of water or soapy water as you might with fruit trees can lead to disease problems. If ants are managing the aphids it may be best to set ant bait to control the ants which will lead to more aphid predation by beneficial insects.

Sow bugs and earwigs often damage fruit and are more easily controlled through good field sanitation and elimination of excessive mulch or other hiding spaces. Traps are effective for earwigs. Just about every bird, mouse, squirrel, skunk, raccoon, and bear will be glad to have strawberries for a late night snack. The only solution is in excluding them from getting to the berries. Deer will munch on the plant leaves, and will lift whole plants from the garden, eating to below the crown, killing the plant.

Planting Strawberries Summary

Strawberries can be grown in raised beds, raised rows, mounds and containers.

A typical plant needs about 1/4 cubic foot of soil (6"x 6" x 12").

Site selection (other than containers) is important as a strawberry bed can last for several years.

The site selected should have:

- Do not select a site where potato, tomatoes or peppers have been grown the prior year
- A minimum of 6 hours direct sun.
- Moderately fertile soil – pH 6.5 – 8.0
- Well drained soil, that can be well watered

Site Preparation:

Prior to planting, incorporate a phosphorus based fertilizer (bone meal or equivalent) ½ pound/100 square ft. of bed.

Fertilize with a balanced fertilizer (10-10-10)
1 pound / 100 sq. ft. spring
½ pound / 100 sq. ft. after harvest.

Planting
Consider planting through plastic or fabric to control weeds and keep fruit off soil
Planting depth to mid-point of crown after being watered.
Good soil contact with roots (important to set crown depth).

Plant Care and maintenance **year one**
For June Bearing varieties remove all flowers and runners the **first year**.
For Everbearing/Day Neutral varieties remove the first set of flowers and runners.
Consistent moisture, especially during berry development is important.
Mow or remove old leaves and flowers after first hard frost (sanitation)
Consider mulching with straw for winter.

Plant Care and maintenance **year two**
Remove mulch from around plants
Fertilize with a balanced fertilizer (10-10-10)
1 pound / 100 sq. ft. spring
½ pound / 100 sq. ft. after harvest.
Pin or place one or two runners per mother plant at desired location
Remove excess runners
Do not water late in day if possible.
Harvest fruit in morning if stored.
Harvest in afternoon if eaten immediately.
Consistent moisture, especially during berry development is important.
Mow or remove old leaves and flowers after first hard frost (sanitation)
Consider mulching with straw for winter.

Plant Care and maintenance **year three**
Remove mulch from around plants
Fertilize with a balanced fertilizer (10-10-10)
1 pound / 100 sq. ft. spring
½ pound / 100 sq. ft. after harvest.
Pin or place one or two runners per daughter plants to desired locations
Remove excess runners
Remove any non-productive mother plants
Do not water late in day if possible.
Consistent moisture, especially during berry development is important.
Mow or remove old leaves and flowers after first hard frost (sanitation)
Consider mulching with straw for winter.

Trials

Our planned trials look at different varieties and types of strawberries, in an effort to determine which grow and produce best in the Tahoe/Truckee area. We will be planting early, mid-season and late June bearing cultivars. We also will be looking at ever bearing strawberries and two alpine cultivar types. The details are:

2016

S1 Earliglow – This is an outstanding early season June bearing cultivar that is popular with home gardeners and is often recommended for beginners. The cultivar was developed by the USDA and released in 1975. The berry is of medium size with good flavor. The calyx, often lifts from the fruit surface when ripe making eating and preparation (capping) for use easier. Later berries will be smaller. Earliglow is resistant to red stele and somewhat resistant to verticillium wilt. There is some susceptibility to powdery mildew, especially post-harvest. Our plants are from Nourse Farms.

S2 Allstar – This is considered one of the best tasting mid-season cultivars, and is often recommended for beginners and home gardeners (*MG Note: this cultivar was originally listed by the USDA as being a late variety, that growers reported as being a mid-season variety*). The knock against Allstar is the light coloring often in orange hues that may be disquieting to the uninitiated. This is another release from the USDA out of Beltsville, MD. Our plants are from Nourse Farms.

S3 Sparkle – This cultivar is considered a late mid-season to late season cultivar, which does well with cooler temperatures. Sparkle is an old standby maybe even an heirloom variety that was released in 1942 by Rutgers University from the New Jersey Agricultural Experimental Station, and is recommended for beginners. This cultivar has good flavor and high yields, but the berry size by today's standards is considered to be small. This is a good cultivar for freezing some of your crop for use in the fall and winter months. Productive even in cold climates. Our plants are from Nourse Farms.

S4 Seascape – This is a Day Neutral or ever bearing variety. Developed by the University of California for commercial growers. The berries are large, firm and have good flavor. It does not produce runners. Overwintering without protection (mulch) may be an issue for the Truckee/Tahoe region. Taste, size and firmness are the noted qualities for this cultivar. Does freeze well. May be susceptible to verticillium wilt. Our plants are from Nourse Farms.

S5 Fort Laramie – This ever-bearing cultivar's habits are pretty much the exact opposite of Seascape. Released by the USDA's Cheyenne Wyoming Research Center in 1973, Fort Laramie is extremely cold hardy. It is very vigorous, producing many runners and daughter plants. Fruit is on the large size, bright red with pink to red interior and very aromatic. A proven producer in Tahoe for one or two years.

<u>Alpines</u> do not generally develop outstanding flavor and aroma until fully ripe (For fullest flavor, try slightly crushing the berries, sprinkling them with a touch sugar, then covering and leaving them for several hours at or near Tahoe room temperature). You can also drop one of these prepared treats into your flute of Champaign.

Alpine strawberries are a very good consideration for growing in containers, and planters. The Alpines being evaluated are both ever bearing cultivars of *F. vesca semperflorens*. One of the first named ever-bearing varieties from the 1700s was Quatre Saisons – Four Seasons. Those cultivars that do not produce stolons (like the two we have) were sometimes called bush alpine strawberries.

S6 Reine des Vallees (Queen of the Valleys) – An extremely old cultivar of the European *F. vesca semperflorens* known for famous taste and color. This plant has small berries that are held aloft often above the leaves. The plant is fairly long lived forming a dense cushion of leaves. No runners are produced from this ever bearing variety. The plant can be dug up every few years and then crown divided. Seeds are viable and true to the cultivar, another option for propagation. Plants are from Michael Wellik's Strawberry Store.

S7 Mignonette – Another old cultivar of *F. vesca semperflorens* perhaps more widely known and available than other alpine varieties. The berries are small with little taste until fully ripe.

Growth habit similar to Reine des Vallees. Runners are not produced by this ever bearing strawberry. You can propagate from seed or dig up after a few seasons and replant the divided crowns. Plants are from Michael Wellik's Strawberry Store.

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S8 Brunswick – US Patent #16,859 A cultivar that originated in Nova Scotia at the Kentville Research Center. This cool weather specialist is an early mid-season variety. It is not expected that these plants will produce fruit the first year. This variety is an especially good choice for home gardeners. These bare root plants are from Nourse Farms.

S9 Flavorfest **–** A recent addition to commercial strawberry varieties. This mid-season berry was recently commercially released through the USDA Beltsville research Station. The berries maintain size throughout the production season having a good flavor balance. The supplier has asked for feedback on this cultivar's performance. These bare root plants are from Nourse Farms

S10 Malwina – US Patent # 23,246 This is considered one of the best tasting late-season June bearing cultivars that was developed in Germany. The fruit are medium sized glossy with high sugar content. These bare root plants are from Nourse Farms.

S11 Mara des bois – - Developed by Jacques Marionnet a French horticulturalist, and patented in the United States in 1993. Mara Des Bois produces small to medium fruit, and contains the highest flavor and fragrance of any everbearer. Berries have an attractive red color with a high gloss. Planted in the spring, Mara Des Bois will produce fruit 10-12 weeks after planting, continuing into the fall. The following spring it also produces a good spring crop

S5 Fort Laramie – This ever-bearing cultivar's habits are pretty much the exact opposite of Seascape. Released by the USDA's Cheyenne Wyoming Research Center in 1973, Fort Laramie is extremely cold hardy. It is very vigorous, producing many runners and daughter plants. Fruit is on the large size, bright red with pink to red interior and very aromatic. A proven producer in Tahoe for one or two years.

Alpines Strawberries do not generally develop outstanding flavor and aroma until fully ripe. Alpine strawberries are a very good consideration for growing in containers, and planters. These are cultivars that do not produce stolons were sometimes called bush alpine strawberries. These are a *F. vesca* species of strawberries.

S12 Yellow Wonder **-** We are pleased to be including in our trials a yellow woodland variety that may be easier to keep the birds at bay. This interesting cultivar is well known among strawberry aficionados for fabulous taste when fully ripe. Seedling plants are from Michael Wellik's Strawberry Store.

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Recipe

Strawberry Pie Trifle
Donna Elick
The Slow Roasted Italian
(Modified slightly from original)

Ingredients:

- 2 pounds fresh strawberries, washed, hulled and halved
- 3/4 pound fresh strawberries, pureed
- 1 1/2 cups sugar
- 3 tablespoons cornstarch
- 3/4 cup water
- Ready-made pie crust roll

1 tablespoon butter (melted)
2 cups heavy whipping cream
1/4 cup powdered sugar
2 teaspoons vanilla extract

Preparation:
Preheat oven to 475°
Rollout ready-made pie crust on slightly greased baking sheet. Roll edges over to create a decorative look. Brush crust with butter. Prick pie crust thoroughly with fork. Bake 8 to 10 minutes or until golden brown. Cool on cooling rack. Cut into 16 slices and set aside.

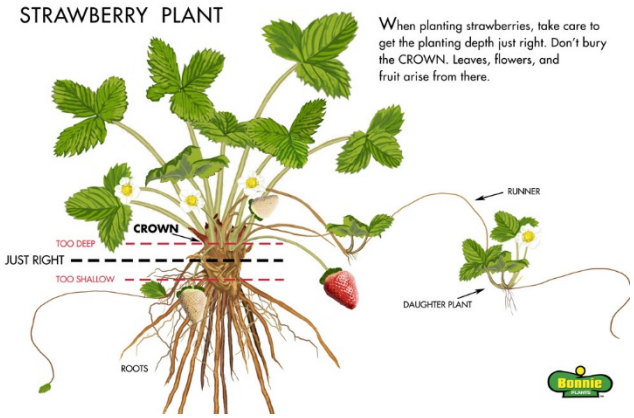
In a tall mixing bowl whip heavy cream until peaks form. Slowly add powdered sugar until stiff peaks form, add vanilla and mix until combined. Fill a piping bag or resealable 1 gallon bag with whipped cream. Place in refrigerator until needed.

In small saucepan, combine sugar and cornstarch. Whisk until well combined. Slowly pour in water and pureed strawberries, whisk constantly. Cook over medium heat, whisking constantly, until mixture thickens and comes to a boil. Boil and stir 1 minute; remove from heat and bring to room temperature (You can use a water bath to speed this up).

In 8 individual trifle dishes (or large wine glasses) add strawberry halves, then pour cooled strawberry syrup on top of the strawberries. Pipe or spoon a layer of whipped cream and crumble 1 slice of baked pie crust over top. Form a second layer of strawberry halves and then pour cooled strawberry syrup on top of the strawberries. Garnish with a slice of pie crust, a dollop of whipped cream and a slice of strawberry. Refrigerate until set, about 2-3 hours.


Earliglow June Bearing – Nourse Farm Photo


Allstar June Bearing – Nourse Farm Photo



Strawberry plant – Bonnie Plant Photo


Bare Root Plants – DML Photo


Queen of the Valley (*F. vesca*) Michael Wellik Photo


Pinning Strawberry stolon A – DML Photo

Pinning Strawberry stolon B – DML Photo