

# Home Garden Strawberry Production in New Mexico

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Strawberries are one of the easiest and most popular small fruit grown in the home garden. Attractive and flavorful, the strawberry is also nutritious. A cup of strawberries will supply more than the recommended human daily requirement of vitamin C with only 55 calories. A bed of 25–50 strawberry plants will produce enough berries for an average-sized family.

## Botany

The strawberry (*Fragaria ananassa*) is an aggregate fruit with seeds or achenes embedded on the surface of a swollen receptacle. The number of cells in a strawberry is determined at the time of flower-bud initiation (previous fall for June-bearers). Size of the berry, however, is mostly influenced by irrigation, which affects the enlargement of the cells.

The perennial, herbaceous, low-growing strawberry plant is composed of leaves, a crown (a compressed, modified stem), and roots. Roots tend to be either semi-permanent (lasting more than one season) or temporary (lasting only days or weeks). Most occur in the upper 3–6 inches of soil, but can reach depths of 12 inches or more in lighter soils. As roots and leaves tend to develop at a higher level on the crown each year, root contact with the soil tends to decrease with time. The elevated plant tends to push itself out of the ground.

Inflorescences (flowers) develop from terminal buds on the plant. Plants with branched crowns (induced by short-days) may form multiple inflorescences. Lower temperatures (below 60°F) will also induce flower bud formation. Flower bud formation is generally inhibited when day/night temperatures exceed 72°/70°F.

Strawberries generally propagate vegetatively by producing runners (stolons). Runners arise from buds at the base (axils) of the leaves, in response to longer-days (more than 12 hours of sunlight) in June-bearing strawberries. Longer days occur from June through

August. Day-neutral varieties generally produce fewer runners, so they should be planted closer together in the bed.

## Strawberry Types and Cultivars

There are basically three types of strawberries: June-bearers, everbearers, and day-neutrals. They differ primarily in their response to day length, which affects both berry and runner production.

### June-Bearers

June-bearers develop flowers in the early spring from buds initiated the previous fall under short-day conditions (less than 10 hours of light per day). It is essential during the fall (September–November) that the plants have a full, well-developed leaf canopy to produce sufficient energy for flowers to bud. June-bearers tend to outproduce other types of strawberries, but the crops are often lost due to late frosts in the spring. June-bearers are better adapted to warmer growing areas of the state.

### Cultivars

‘**Guardian**’—large, conic, glossy, light red fruit; good yields; excellent flavor; good for desserts, preserves, and canning; resistant to *Verticillium* wilt and five races of red stele.

‘**Robinson**’—large, conic, blunt-ended berries; good producer; fair flavor; fair to good quality for desserts, canning, and freezing; resistant to *Verticillium* wilt, but susceptible to red stele; good in warm weather.

‘**Sequoia**’—large, dark red berries; good producer over relatively long time; fair dessert and freezing quality; susceptible to red stele; good in warm weather.

‘**Surecrop**’—medium to large wedge-shaped berries; secondary berries tend to be more conic; excellent, slightly tart flavor; excellent for desserts and freezing; resistant to *Verticillium* wilt, red stele, and drought.

‘**Tioga**’—medium to large, wedge-shaped berries; very good flavor; good dessert and freezing quality; no resistance to red stele; good in warm weather.

‘**Tufts**’—large, long, wedged-shaped fruit; high yields; fair dessert but good freezing quality; susceptible to red stele.

### Everbearers

Everbearers initiate flower buds under long-day conditions (more than 12 hours of sunlight). They will generally produce two main crops (spring and fall), but yield less than a single spring crop from a June-bearer. Everbearers, however, that lose a spring crop to frost will still produce a fall crop. Everbearers produce fewer runners and tend to form multiple crowns. Everbearers do not tolerate heat well, so they should be grown in the northern part of the state.

#### *Cultivars*

‘**Fort Laramie**’—large, bright red fruit; very aromatic; good dessert, freezing, and preserving qualities.

‘**Gem Everbearing**’ (‘Superfection’)—dark red fruit; good dessert qualities.

‘**Ogallala**’—large, plump fruit; excellent for preserves; very hardy; good drought and disease resistance.

‘**Ozark Beauty**’—large, firm, wedge-shaped, long-necked berries; excellent flavor; excellent for desserts, canning, freezing, and preserves; susceptible to Verticillium wilt and red stele.

‘**Quinault**’—large berry; good yields; good for desserts and preserves.

‘**Streamliner**’—large, bright red fruit; excellent flavor; good yields.

### Day-Neutrals

Day-neutral strawberries have the unique ability to flower and fruit under any day-length conditions. They will produce fruit from spring through fall with several peaks throughout the season. Temperatures above 70°F, however, will inhibit flower bud formation. Day-neutrals produce fruit and runners simul-

taneously, although runner production is generally less than that of June-bearers. Day-neutral runners often flower before initiating roots, which makes them excellent container plants, especially as hanging house plants in the winter.

#### *Cultivars*

‘**Fern**’—large, very firm, sweet berries; high yields.

‘**Selva**’—large bright red fruit; excellent flavor; heavy yields.

‘**Tribute**’—medium-large, short, cone- to wedge-shaped, bright red berries; pleasant flavor; good dessert and processing qualities; resistant to red stele.

‘**Tristar**’—medium size, symmetrical, short, conic, deep red fruit; good dessert and freezing qualities; resistant to Verticillium wilt and red stele.

### Site Selection

Strawberry blossoms are susceptible to late spring frosts, which can kill early flowers. Since early blossoms produce the largest berries, this can be a serious problem. Locating strawberry beds on elevated areas of the garden with gentle slopes will allow heavy cold air to drain away from the bed, helping to reduce frost damage. A northern exposure may help delay bloom in the spring if late frosts are a problem. Earlier production can be achieved by selecting a southern exposure that warms earlier in the spring. Plants may have to be covered with a straw mulch or blanket at night to protect them if frost becomes a problem. Locations next to a house are often warmer due to heat generated from the home.

Strawberries prefer full sun, although afternoon shade may be needed in warmer areas of the state. However, shady locations can cause more vegetative plants with fewer berries and cause more disease problems.

Avoid planting strawberries after peppers, tomatoes, potatoes, eggplant, or okra, all of which are susceptible to Verticillium wilt. Sites planted to strawberries following sod may have to be treated to control white grub. Sites should also be free of noxious weeds.

## Soil Preparation

Strawberries prefer well-drained, sandy loam soils high in organic matter and fertility. Soils should be neutral to slightly acidic (pH 6.5) in nature. Plants established on more alkaline soils (pH of 7.5 or greater) tend to exhibit signs of iron deficiency (interveinal chlorosis of younger leaves). In severe cases, pale leaves become white, turn brown around the edges, and then die. Strawberry plants are also highly sensitive to salt. High total salt levels will cause stunting, marginal leaf scorch, and severe yield reduction. Enough water should be applied to ensure that salts are leached below the root zone.

The soil should be prepared well in advance of planting. Incorporate organic matter (2–3 inches of garden compost) in the bed to a depth of at least 12 inches. Organic matter will help improve nutrient availability as well as the structure and water-holding capacity of the soil.

Soil drainage can be improved by planting on raised beds (36 inches wide and 3–4 inches high). Raised beds will warm sooner in the spring than flat ground. However, planting on flat ground may be preferred where salts are a problem, making it necessary to flood the beds occasionally to move salts down through the soil profile.

## Fertilization

Before planting, approximately 1.0 pounds/100 square feet of 12-24-12 fertilizer should be incorporated into the planting bed to a depth of 6–8 inches. The rate will depend on the results of a soil analysis. Additional nitrogen may be necessary once new growth begins in the spring and again 3–4 months later at a rate of 1/2 pound/100 square feet of ammonium sulfate (21-0-0) per application. Scatter the fertilizer evenly across the bed and work it into the soil. Wash fertilizer off plant leaves to prevent leaf burn. Irrigate the bed after application. Fertilization is important the first year to encourage good growth.

During the second and following growing seasons, plants should not be fertilized until after harvest in the spring. A balanced fertilizer (10-10-10) can then be applied at a rate of 1-1/2 pound/100 square feet. Applying nitrogen fertilizers before harvest can result in soft, tasteless berries that easily rot. Plants can also

become too leafy, more susceptible to disease, and tend to shed blossoms. Additional fertilizer probably will not be necessary if plants remain dark green. Applying too much nitrogen in the fall to established beds can make plants more susceptible to winter kill problems.

Iron chlorosis problems can be corrected with a foliar application of either iron sulfate or an iron chelate. Foliar applications should be made in the spring before flowering or between flowering periods (everbearing and day-neutral types). Foliar applications during flowering can damage flowers. For longer lasting results, use soil applications of iron chelates. Follow label directions for best results.

## Planting

Plants should be ordered early in the winter before spring planting to ensure the availability of appropriate cultivars. Buy only certified virus-free plants that have been inspected for pests and bred for disease resistance. Beds should be prepared well in advance of your scheduled planting date.

Planting in the spring (after danger of hard frost) ensures greater plant survival because the weather is cool. Plants should be dormant and healthy upon arrival. Crowns should be solid with light-colored roots. If new plants arrive early, plants can be stored at 29–30°F and 85–90 percent relative humidity (wrapped in moist packing materials). This should prevent the growth of mold. Plants can also be “healed-in” in the garden for temporary storage. To heal in the plants, place them in a shallow trench, cover the roots with soil, then water them.

Do not allow the plant roots to dry out during planting operations. Roots can be placed in water for up to 1/2 hour before planting. Keeping plants in the shade will also reduce stress.

Trim roots to 4–6 inches long. Prune off older damaged leaves, leaving one or two good leaves. Spread the remaining roots evenly in the planting hole. The crown (where leaves are attached) should be level with the surface of the soil. If planted too shallow, the roots will dry out. When planted too deep, the plants will rot. Firm the soil over the roots and around the base of the crown so no air pockets occur. Water plants immediately. One pint of fertilizer starter solution around each plant will help promote early growth. A

starter solution can be made of one cup of 12-12-12 or 12-24-0 per 10 gallons of water.

## Training

Strawberries can be trained to either a matted row system or a hill system. Choice of training system is generally dependent upon the type of strawberry and personal preference.

In a matted row system, plants are generally spaced 18–24 inches apart in rows with 36- to 42-inch centers. Runners are allowed to develop to fill the empty spaces between plants until the rows are 12–18 inches wide. The middles between rows are kept free of plants. Four to six runners per plant are allowed to develop. The runners are arranged along the row and spaced 8–10 inches apart. Runners are placed in the desired location and gently pressed into the soil (1/2 inch deep) where daughter plants form. Runners can also be held in place by placing a carpenter's staple over the runner near the base of the daughter plant. Do not sever the daughter plant from the mother plant. After sufficient runner plants have formed, pinch off any new runners that develop. During the following growing season, all new runners should be removed.

The matted row system is generally used for June-bearers. During the first growing season, remove (pinch out) flower stalks before the blossoms appear. Allowing blossoms and fruit to form will reduce the vigor of the new plants. Blossoms and fruit can be allowed to form the following spring. The biggest problem with the matted row system is that too many plants can form, which can result in smaller berries and poor yields.

The hill system is generally used for both everbearing and day-neutral types of strawberries. Plants are generally spaced 12–15 inches apart in the row. The runners are removed as they form and the plants remain distinct units. With age, plants are allowed to form runners that can be selectively placed in an alternate fashion to replace older plants. Rows are generally spaced 2 feet apart. During the first growing season, the flowers are generally removed in the spring but can be allowed to set berries in the fall. Hill-trained strawberries generally produce larger berries than the matted row system.

## Management

Mulches are often used in strawberry production to reduce soil moisture evaporation, reduce weed growth, prevent mud from splashing on berries, reduce fruit rots, protect plants from freezing, and to control soil temperatures. Choice of mulch depends on the type of strawberry you're growing, growing season characteristics, and management objectives.

Organic mulches are often used with June-bearing strawberries (matted row system) in warmer areas of the state to help cool the soil. Clean straw (free of weed seed) and pine needles tend to keep berries clean and dry. Do not use lawn clippings, which tend to mat and attract pests such as snails, slugs, and sow-bugs. Runners can be easily manipulated to root down through the mulch.

White plastic (nontranslucent) mulches can be used with everbearing and day-neutral varieties that form fewer runners and are planted closer together. White plastic, like organic mulches, tends to cool the soil in warmer areas of the state.

Black plastic or black woven plastic fabric (weed barriers) can be used in colder areas of the state to help warm the soil (for earlier harvest) and to keep plants from freezing. Woven fabrics are preferred, as they allow the soil to "breathe" and water to penetrate. Drip irrigation can be used under either plastic or fabric for optimum irrigation efficiency.

When using plastic or fabrics, a hill system planted with everbearing and day-neutral cultivars is preferable because runners are discouraged.

Straw mulch can also be used in northern New Mexico to protect plants from freezing in the winter. A 3–4 inch straw mulch should be applied after frost in early winter and should not be removed until after new growth (2 inches) begins in the spring. The new growth will be yellow-green. Removing the mulch earlier than this could result in frost damage to the blossoms. Approximately half the mulch can be pulled down along the sides of the beds, allowing the plants to grow up through the remaining mulch.

Strawberries grown in warmer areas of the state will require some shade in the afternoon during the summer. This will reduce heat and water stress to both plants and fruit. Erect a shade cloth (65 percent shade) over the bed, or plant on the east side of a fence or wall.

Due to the shallow root system of the strawberry plant, irrigation should be relatively frequent. Irrigation water containing more than 640 parts per million total salts can cause salt burn on the leaves if it is allowed to accumulate in the soil. This can be a problem when drip irrigation is used. Flooding the bed occasionally will help move salts down through the soil profile below feeder roots. Whatever irrigation technique is used, enough water should be applied with each irrigation to wet the soil to a depth of at least 12 inches.

Strawberries require bees for pollination. No insecticides should be applied during bloom because they can kill bees. Catfacing or irregularly shaped fruit is often the result of poor pollination from either poor bee populations or damage from cold weather.

After harvest in the spring, June-bearing strawberry beds should be renovated. The main objectives of renovation are to replace old leaves with new foliage, improve sunlight penetration, fertilize for berry enlargement, control weeds, and to topdress with soil over crowns for improved root production.

Renovation of strawberry beds can be accomplished with a rotary mower, removing old foliage just above the crowns. Be careful not to damage crowns. Do not renovate after July 15, as there may not be enough time for new leaf production. Older, less productive plants can be replaced with new runners. Row width should be maintained at 12–18 inches, with an optimum plant density of 5–6 plants/square feet. Topdress beds with 1/2–1 inch of soil and a balanced fertilizer (refer to fertilizer section). Most plantings will last 3–4 years using this technique.

## Harvest and Storage

Pick berries in the morning when it's cool to prolong shelf life. The surface of the berry should be dry to prevent fruit rot. As berries will not continue to ripen after harvest, pick them when fully ripe (dark red). Be sure to remove any overripe, diseased, or insect-damaged fruit to keep plants producing. The time from bloom to harvest will vary from 18–45 days depending on variety, temperature, and exposure to sunlight.

Berries should be harvested every other day to maintain quality. Most June-bearers will yield berries for 10–15 days. Harvest by cupping the berry between your fingers and snapping both the berry and hull cleanly off the plant. Keep berries out of the sun, and

refrigerate unwashed until needed. Strawberries can be stored 2–6 days at 33–34°F (high humidity). Berries can be hulled and cleaned when ready to eat, freeze, or process.

## Pests

White grubs, spider mites, slugs, snails, and sowbugs can be major problems on strawberries. White grubs (June beetle larva) are 3/4-inch long, with brown heads and white, C-shaped bodies. They generally feed on roots of weaker plants. Grubs are generally a bigger problem when strawberries follow a sod crop.

Spider mites are very tiny, light-colored bugs that can build up on the leaves, making them dirty and gritty. Spraying the plants with a strong jet of water tends to discourage them.

Slugs, snails, and sowbugs tend to build up in beds with organic mulches. Using synthetic plastic mulches and baits that attract these pests away from the bed can be effective controls.

Plant diseases are generally the biggest problems most home gardeners encounter in growing strawberries. Major diseases include nematodes, Verticillium wilt, Botrytis gray mold, black root rot, red stele, and various viruses.

Generally more abundant in sandy soils, nematodes, particularly the dagger nematode (*Xiphinema americanum*), can cause stunted plants. As the roots do not swell (a typical symptom of rootknot nematode), they are generally hard to detect. Chemical fumigation of the soil is the most effective means of control. Placing clear plastic over a damp, well-rototilled bed in the summer before planting will help to solarize the soil and reduce nematode populations. Adding organic matter (compost) during bed preparation also tends to discourage these microscopic worms.

Verticillium wilt can be a problem in some soils. This soil-borne fungus causes outer leaves of the strawberry plant to dry up, first around the margins and then between the veins. New leaves are often greatly retarded, making the plants look flattened and stunted. Shoots will often have blackened tips. Severe infection will cause collapse of the entire plant. Symptoms generally occur in the mother plant, not in the runners. Plant in noninfected soil, fumigate soils, and use resistant cultivars.

Botrytis gray mold can be a very destructive disease on strawberry fruit, particularly when the humidity is high or air movement around plants is restricted. Mold will generally cover the blossoms on developing green fruit, especially when they touch the ground, another berry, or a dead leaf. The dusty gray mold will eventually cover the entire fruit. Avoid heavy foliage cover that impedes air flow around the plants. Nitrogen should only be applied after harvest in the spring. Light mulches (straw, pine needles, plastic) will help keep the berries off the soil and decaying vegetation.

Black root rot is a name for several root and crown rot diseases, the most common being *Pythium* spp. These soil-borne fungi cause plants to decline in vigor and productivity, with often poorly developed, black root systems. Cutting vertically through the crown will often reveal discolored (dark) tissue. Control involves crop rotation and a balanced fertilizer program for good growth.

Red stele (*Phytophthora*) is generally more prevalent in heavy, poorly drained soils. Inner cores of infected roots are generally red. Leaves may be off-color. Infected plants will wilt and die quickly during the hot summer. Well-drained soils and planting resistant cultivars are the best controls.

Viruses can reduce plant vigor without any notable symptoms, although some plants can become small and spindly, or produce a multiple number of crowns with small leaves. Aster yellows, spread by leafhoppers, will result in symptoms similar to 2,4-D damage with yellow, cupped leaves. Controls include planting virus-free plants, roguing sick plants, and controlling insects.

Other pests include weeds and birds. Weeds can be controlled with various mulches or pulling by hand. Birds are best controlled with netting spread across the beds.



