

# Home Garden Strawberry Production in New Mexico

Guide H-324

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## INTRODUCTION

Strawberries are many people's favorite fruit and are always popular at local farmers' markets and roadside stands. They are one of the most common small fruits grown in home gardens and are an easy fruit to grow. Strawberries are not only attractive and flavorful but also nutritious. A cup of strawberries has only 55 calories, but will supply more than the daily recommended requirement of vitamin C. A bed of 25–50 strawberry plants will produce enough berries for an average-sized family for fresh eating and some preserves.

Strawberry plants grow best with a long growing season of daily maximum temperatures of 70–75°F. In the U.S., commercial strawberry production is concentrated in Florida and California, where optimal temperatures are achieved for several months. In northern New Mexico, the cold winter and high elevation limit the length of the growing season, while in low-elevation areas of southern New Mexico, the high daytime temperatures in summer make growing strawberries a challenge. Some strawberries also do not perform well in high-pH soil. Nevertheless, not all strawberries respond the same to high soil pH and elevation. To help people choose the best cultivars for northern New Mexico, a strawberry cultivar trial was conducted at the Alcalde Sustainable Agriculture Science Center from 2011 to 2013. The cultivars differed greatly in their cold hardiness, tolerance to high soil pH, and yield potential. With careful cultivar selection, a good fertilizer program, and some frost protection material/equipment, strawberries can grow well in northern New Mexico.



## BOTANY

Strawberry (*Fragaria × ananassa*) belongs to the rose family (Rosaceae). Its fruit is an aggregate fruit with seeds or achenes embedded on the surface of a swollen receptacle.

Strawberries generally propagate vegetatively by producing runners (stolons). In June-bearing strawberries, runners arise from buds at the base (axils) of the leaves in response to longer days (more than 12 hours of sunlight, which occurs from June to August). Day-neutral varieties generally produce fewer runners, so they should be planted closer together in the bed.

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## STRAWBERRY TYPES AND CULTIVARS

There are three types of strawberries: June-bearing, everbearing, and day-neutral. They differ primarily in their response to day length, which affects both berry and runner production.

### June-bearing

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). During the fall (September–November), it is essential that the plants have a full, well-developed leaf canopy to produce sufficient energy for flower bud development. June-bearers tend to out-produce other types of strawberries, but late frosts in the spring can significantly reduce overall yield. Frost protection is highly recommended.

A June-bearing strawberry trial with 16 cultivars in two planting systems (matted-row and black plastic-covered) was conducted at NMSU's Alcalde Sustainable Agriculture Science Center from 2011–2013. To evaluate cultivar tolerance to high soil pH, there was no supplemental iron applied until August of the planting year. Later, chelate iron was applied to manage leaf chlorosis. Among the 16 cultivars tested, Mesabi and Kent were the top two cultivars with the highest yield (Table 1).

Wendy had the worst winter damage in the plastic-covered perennial system. Allstar, Chandler, and Darselect were the cultivars most sensitive to the high-pH soil in northern New Mexico. Earliglow had fruit with good flavor, but yields were extremely low during both harvest seasons. Mesabi plants had iron deficiency symptoms, but they were not as severe as Allstar and Chandler. Mesabi had good flavor and winter hardiness and was very productive and disease resistant; it is a good cultivar for northern New Mexico. Kent had good flavor, was winter hardy, and produced a good yield. Cabot had big fruit with satisfactory fruit quality. Jewel is a longtime performer in several other states with good flavor and reasonable yield, but it is not very hardy in northern New Mexico. Early cultivars like Earliglow, Annapolis, Wendy, and Brunswick were more vulnerable to late spring frost. Growers have a better chance at getting a good crop with mid-season cultivars. For late cultivars, they may run into summer heat stress before they reach their yield potential. Please also refer to [www.strawberryplants.org](http://www.strawberryplants.org) for detailed cultivar descriptions.

### Everbearing

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

### Day-neutral

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 simultaneously, although runner production is generally less than that of June-bearers. A drawback of day-neutral cultivars is that they often produce smaller berries than June-bearers.

Day-neutrals and everbearers are often used interchangeably in the industry since the two behave similarly in temperate regions. There have been no recent cultivar trials for everbearers in New Mexico. However, here are some general recommendations.

**Seascape:** Large berry with good yields, cold tolerance, and flavor.

**Tribute:** Medium-large, short cone- to wedge-shaped, bright red berries; pleasant flavor; good dessert and processing qualities; resistant to red stele root rot.

**Tristar:** Medium-sized, symmetrical, short conic, deep red fruit; good dessert and freezing qualities; more sensitive to high soil pH than Tribute.

**Albion, San Andreas, and Evie 2:** These are newer selections with growing popularity in other states; test before planting in volume.

## SITE SELECTION

Strawberry blossoms are susceptible to late spring frosts. Those early blossoms are primary or secondary flowers and produce the largest berries. Loss of these flowers will reduce yield. 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

**Table 1. Strawberry Yield for 2012 and 2013 of 16 June-bearing Strawberry Cultivars at Alcalde, NM**

Cultivar	2012		2013		Average	
	g/10 ft	lb/acre	g/10 ft	lb/acre	g/10 ft	lb/acre
Mesabi	6187	14840	7731	18544	6959	16693
Kent	4823	11568	6739	16165	5781	13867
Cavendish	6288	15084	3213	7706	4751	11395
Cabot	3143	7538	2497	5990	2820	6765
Jewel	3090	7411	2166	5196	2628	6304
Brunswick	2596	6228	2395	5746	2496	5987
Darselect	2059	4940	2495	5985	2277	5462
Allstar	1821	4368	1950	4677	1886	4523
Honeoye	1460	3502	1856	4453	1659	3978
L'Amour	1956	4691	1248	2994	1602	3843
Chandler	571	1370	2358	5655	1465	3513
Wendy	1019	2444	1619	3883	1319	3164
Clancy	512	1227	1885	4521	1199	2875
Annapolis	1162	2786	1143	2743	1153	2765
Ovation	1142	2738	934	2239	1038	2489
Earliglow	288	690	532	1275	410	983

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, but this will also increase the risk of frost damage. Plants may have to be covered with a straw mulch or frost 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 or shade cloth to reduce sunlight intensity may be needed in southern New Mexico. However, shady locations can cause more vegetative plants with fewer berries and more disease problems.

Avoid planting strawberries after peppers, tomatoes, potatoes, eggplant, or okra, all of which are susceptible to *Verticillium* wilt, which can remain in the soil and affect strawberries. Strawberry plots following sod may have to be treated to control white grub. Sites should also be free of noxious and perennial weeds.

## SOIL PREPARATION

Strawberries grow best in well-drained, sandy loam soils high in organic matter and fertility. Before planting, a soil test for pH and nutrient levels is recommended. Soils should be neutral to slightly acidic (pH 6.5). Plants established on more alkaline soils (pH 7.5 or greater) tend to exhibit signs of iron deficiency (yellowing between leaf veins, or interveinal chlorosis, of younger leaves; see Figure 1). In severe cases, pale leaves become white, turn brown around the edges, and then die. Strawberry plants are also highly sensitive to salts in the irrigation water or soil (salinity). High total salinity causes stunting, marginal leaf scorch, and severe yield reduction. Enough water should be applied to ensure that salts are leached below the root zone.

Strawberry cultivars vary in their adaptation to high soil pH. Among the 16 cultivars tested at Alcalde, Allstar, Chandler, and Darselect were the most sensitive cultivars and should be avoided if other choices are available. Wendy was the most tolerant cultivar to high soil pH; however, its winter hardiness was poor.





**Figure 1.** Leaf color of Wendy and Allstar before and two months after iron chelate (FeEDDHA) application. Iron chelate was applied on August 5 and 15, 2011.

The soil should be prepared before planting by incorporating organic matter (2–3 inches of garden compost) into the bed to a depth of at least 8 inches. Organic matter will improve nutrient availability as well as the structure and water-holding capacity of the soil over time. Avoid over-application of some composts that may be high in salt content.

Soil drainage can be improved by planting on raised beds (36 inches wide and 3–4 inches high), which will also warm sooner in the spring than flat ground but can make the plants vulnerable to late frosts. However, planting on flat ground may be preferred where salinity is a problem (electrical conductivity greater than 1.5 mmhos/cm) and it is necessary to flood the beds occasionally to move salts down through the soil profile. If drip or sprinkler irrigation systems are used, salts will be leached down from the tops of the raised beds.

## FERTILIZATION

Before planting, approximately 1.0 lb/100 ft<sup>2</sup> 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 0.5 lb/100 ft<sup>2</sup> 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, and irrigate the bed after application. In following years, spring fertilizer application and after-harvest application are recommended with ammonium sulfate or an alternative with 10-10-10 or 24-8-16 through fertigation or side dressing. Plant-available soil phosphorus, potassium, and other nutrients should be evaluated before purchasing fertilizers.

Iron chlorosis problems can be corrected with applications of an iron chelate. Based on the Alcalde trial, the chelated iron product FeEDDHA could manage iron deficiency efficiently through irrigation or soil application. Two to three applications per year at 20 g/100 ft can control leaf chlorosis for most cultivars. Apply the product either when leaf chlorosis appears or as a combination of one spring and one fall application. Soil or leaf application is also possible if drip irrigation is not available. Please follow the product label.

## PLANTING

Bare-root plants should be ordered early (before spring planting) to ensure that appropriate cultivars are available. Buy only certified virus-free plants that have been inspected for pests and bred for disease resistance. Beds should be prepared before 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, they can be stored at 30–32°F with 85–90% relative humidity (wrapped in moist packing materials). 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, and water them.

Planting depth is critical for strawberries. 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 form. 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.

## PLANTING SYSTEMS

Strawberries can be planted in either a matted-row system or a plastic-covered perennial system (Figure 2). The choice of planting system generally depends upon the type of strawberry and personal preference.

In a matted-row system, plants are generally spaced around 18 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. In New Mexico, some cultivars tend to produce excessive runners. The study in Alcalde encountered a crowded bed issue. Runners can root themselves and should be 6–8 inches apart. If the strawberry bed becomes overcrowded, pinch the later runners or thin some runners out manually. A 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. A problem with the matted-row system is that too many plants can form, which can result in smaller berries and poor yields. Another issue with this system is weed management, especially the first year after planting.

The plastic-covered perennial system uses black woven fabric (weed barrier) to cover the raised bed. Plants are placed in a single row, or staggered double rows about 1 foot apart. It can be used for both June-bearing and everbearing/day-neutral strawberries. Runners do not root in the plastic cover system and have to be removed periodically. There is less weed pressure with this system. Some tender cultivars tend to have winter damage in this system since the mother plants have branched crowns and root themselves higher and higher each year. Growers should either select hardy cultivars or protect the plants in winter by covering with straw or tree leaves.

During the first growing season, the flowers are generally removed in the spring but can be allowed to set berries in the fall for everbearing/day-neutral cultivars. They normally fruit well for two harvest seasons and then decline and need to be removed or replanted.

## MANAGEMENT

Drip irrigation is highly recommended for strawberries in order to save water and ease weed management and fertilizer applications. Sprinklers can be used for frost protection during blooming time. If sprinklers are used for routine irrigation, it can cause disease problems.

Mulches are often used in strawberry production to reduce soil moisture evaporation, reduce weed growth, prevent mud from splashing on berries, reduce fruit rots, and protect plants from winter damage. The choice of mulch depends on the type of strawberry being grown, 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,





**Figure 2. A plastic-covered planting system.**

which tend to mat and attract pests such as snails, slugs, and sowbugs (pillbugs or roly-polies). Runners can be easily manipulated to root down through the mulch.

White plastic (non-translucent) 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 woven plastic fabric can be used in colder areas of the state. Woven fabrics are preferred because they allow the soil to “breathe” and water to penetrate. Drip irrigation can be used underneath either plastic or fabric for optimal irrigation efficiency.

When using plastic or fabric, a hill system planted with everbearing or day-neutral cultivars is preferred because runners are discouraged, but plastic/fabric could also work for June-bearing cultivars.

Straw mulch can also be used in northern New Mexico to protect plants from freezing in the winter. A 3- to 4-inch straw mulch layer should be applied after frost in early winter and should

not be removed until after new growth (2 inches) begins in the spring. The straw mulch does not need to be fully removed; pull some in between the rows and keep some in place to help keep the fruit clean.

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

After harvest in the spring, matted-row strawberry beds should be renovated. The main objectives of renovation are to replace old leaves with new foliage, improve sunlight penetration, reduce disease pressure, and control weeds.

Renovation 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 because 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 for

matted-row planting, with an optimal plant density of 5–6 plants/ft<sup>2</sup>. Topdress beds with 0.5–1 inch of soil (optional) and a balanced fertilizer (refer to the **FERTILIZATION** section). Most plantings will last 3–4 years using a matted-row system.

## PESTS AND DISEASES

The major pests/diseases we noticed at Alcalde were tarnished plant bugs, anthracnose, leaf chlorosis, and fruit rot. For home gardens, you may also encounter white grubs, spider mites, slugs, snails, and sowbugs on strawberries.

Tarnished plant bug is a small bug (1/4 inch long), but it causes severe damage to the fruit—it sucks the juice of the fruitlets, deforming the fruit and making it unmarketable. Its infestation period is during blooming time and the fruitlet stage. To manage tarnished plant bugs, scout the field around blooming time to monitor its population and spray when necessary.

Anthracnose is a fungal disease that affects not only the leaves but also flower clusters. It causes lesions on leaf petioles and can clip the leaves in severe situations. Keeping plants healthy and maintaining good air circulation can prevent/reduce anthracnose.

Leaf chlorosis is a physiological disorder in high-pH soils. It is more prevalent during wet, cold springs, or when irrigation is started too early in the year. As mentioned in the **FERTILIZATION** section, iron chelate application (preferably the EDDHA form) is recommended to manage leaf chlorosis and improve plant health.

Botrytis fruit rot is very common for strawberries, and a crowded bed, humid conditions, and sprinkler irrigation will all make it worse. Appropriate cultural and sanitation practices can help to reduce fruit rot.

Viral infections are also possible in any strawberry fields, and some of them are not visible. Always purchase clean plants from reliable nurseries and replant your strawberry beds with new plants after 3–4 harvest seasons.

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.

## HARVEST AND STORAGE

Pick berries in the morning when temperatures are cool to prolong their shelf life. The surface of the berry should be dry to prevent fruit rot. Since berries will not continue to ripen after harvest, pick them when fully ripe (red from calyx to tip). Be sure to remove any overripe, diseased, or insect-damaged fruit to keep plants producing.

Berries should be harvested every other day if possible to maintain quality. Keep berries out of the sun, and refrigerate unwashed berries until needed. Strawberries can be stored for 2–6 days at 32–34°F (high humidity). Remove the tops and clean berries when ready to eat, freeze, or process.

## REFERENCES

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