UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
Cooperative Extension

Backyards & Beyond

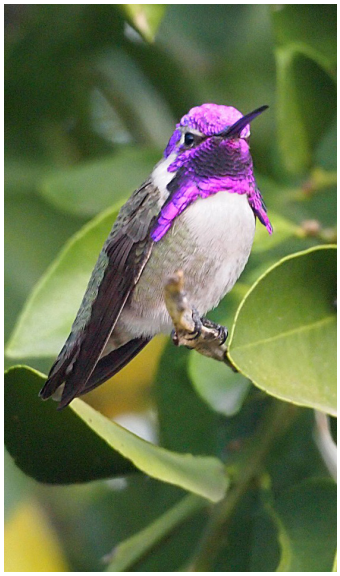
RURAL LIVING IN ARIZONA

Spring 2017

FEATURED BIRD

Dan L. Fischer - Author of Early Southwest Ornithologists, 1528-1900. University of Arizona Press

Common Name: Costa's Hummingbird
Scientific Name: *Calypte costae*



DAN L. FISCHER

The smallest birds in the world, commonly referred to as "hummers," include a large family of more than 330 known species. Mainly inhabiting the tropic regions of the Western Hemisphere, Arizona still has the highest number of 14 species that either visit, migrate, or nest north of the Mexican border.

In 1880, Robert Ridgway, an ornithologist, artist and curator of birds at the U. S. National Museum, compiled a catalogue that included an all inclusive and complete description, which still stands today, about the uniqueness of these charming birds. He scribed: "Of all the numerous groups into which the birds are divided there is none other so numerous in species, so varied in form, so brilliant in plumage, and so different from all others in their mode of life."

Hummingbirds in general are amongst the smallest warm-blooded vertebrates and have the greatest relative energy output. Their wing beat averages 200 per second during courtship, and around 80 in normal forward flight. They not only have the ability to hover for long periods, but have the capability for rapid backward flight. They are also able to enter into a torpid state at night as their body temperatures may drop to nearly half of their normal temperature of approximately 105° F. This is not done every cold night, but when their high metabolic rate becomes difficult to maintain during periods of food shortage. They have a food intake each day of more than half their body weight and their fluids may equal eight times their weight.

The diminutive Costa's hummingbird, one of the real gems in the avian world, has the distinction of being Arizona's smallest breeding bird. These tiny creatures weigh on the average about 0.11 oz and have a length of only 3½ in. The male is very dark in certain conditions giving its head an almost black appearance. But, in proper reflective light the change is dramatic. The male depicted in the accompanying image illustrates this even without camera flash. The brilliant iridescence of the amethyst purple head, gorget and lengthy extensions are reflected even in fading natural twilight. The female will appear as a rather bronze green or brownish gray and can be easily confused with other small hummingbirds. Both sexes have light or whitish underparts.

Unlike most hummingbirds, the Costa's hummingbird is a true desert dweller living in the harsh, hot deserts of the southern and western half of Arizona. Their diet varies with seasonal food availability. The tubular flowers of the colorful chuparosa, ocotillo and desert willow are favored and particularly rich in nectar. During spring their dark face and forehead are often discolored from pollen of these and various flowering species making them appear almost unrecognizable. As insects emerge they are gleaned from the flowers or are easily caught in flight.

Normally a clutch of two tiny white eggs, about one third the weight of the female, are laid in a nest, built among the branches of a shaded bush or tree. The nest is constructed of various fibers, lichen fragments, feathers and bound together by spider webs. The female assumes all building, incubation and care for the young.

In 1837, surgeon Major Adolphe Simon Néboux, serving aboard a French whaling ship, collected a specimen while in Bahia Magdalena on the west side of the Baja California peninsula. After arriving in France two years later Néboux delivered it to Jules Bourcier, who named the bird for a serious collector, nobleman Louis Marie Pantaléon Costa, Marquis de Beauregard (1806-1864).

FEATURED PLANT

Susan Pater, Area Extension Agent, 4-H Youth Development, University of Arizona, CALS Cooperative Extension, Cochise County

Common Name: Wooly Butterflybush
Scientific Name: *Buddleia marrubiifolia*

Genus: Buddleja (BUD-lee-uh)
Species: marrubiifolia (ma-roo-bee-eye-FOH-lee-uh)

DENIZ TOKATLI

Wooly butterfly bush is a striking shrub with velvety, ash-gray foliage that sets off the eye-catching orange ball-shaped cluster of flowers from March to August. This evergreen shrub is tolerant of heat, intense sunlight and drought. It grows well in southern and central Arizona and is native to the Chihuahuan desert. The marble-sized flowers are produced from spring to fall, and the foliage lasts well into winter. The flowers are extremely attractive to butterflies which find them a rich source of nectar.

It grows to 5 feet tall with an equal or greater spread, maintaining a dense form with little maintenance. Its grayish green leaves are elliptical and covered with fine white hairs giving this plant a soft, fuzzy look. Foliage becomes more silvery when watered less. It needs full sun and dry, well-drained, unamended soil to look its best, and requires little care once established; it is prone to root rot if overwatered. Pruning in the early spring will help keep its shape dense and promote flowering, since it blooms on new wood.

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Editors
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PLANT LIFE FORMS

Sarah Noelle, Research Specialist, Sr. and George Ruyle, Ph.D., Marley Endowed Chair Sustainable Rangeland Stewardship, University of Arizona Cooperative Extension, School of Natural Resources and the Environment.

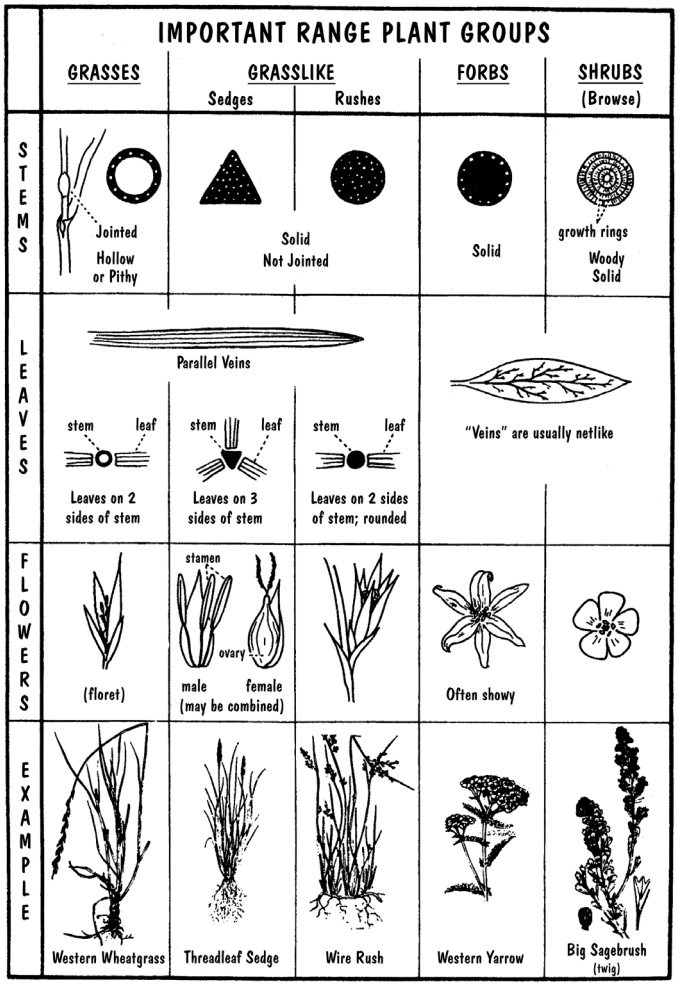

Figure 1. Characteristics of major rangeland plant groups (from Holechek et al. 2011; Gay 1965).

Most of us can identify plants by the names of the individual species, either by scientific name or common name. However, in ecology, such classification may be less important than the life form (or growth form) of the plant. Using such classifications may assist in determining the appropriate plant species best suited for certain environmental conditions, landscape position, and function for rangeland restoration projects or even in home landscaping projects.

Plant species (at least the higher forms most easily recognized) are classified taxonomically mainly by the similarity of their flowering parts. Species are grouped into genera, genera into orders, and orders into families. For example, our local velvet mesquite (*Prosopis velutina*) is in the same genus (*Prosopis*) as is a number of different species of mesquite that range throughout the American Southwest and further south into Argentina. They have similar flowers and leaves, but occupy different habitats and ecological zones. The genus *Prosopis* is included in the legume family, Fabaceae, which also contains alfalfa, peas, beans, catclaw, whitethorn, and lupine; plants which have little in common ecologically.

For this reason, ecologists often group plant species by life form rather than by taxonomic groups. Life form is a term that relates to the general growth habit and appearance of the plant, or to its physiological basis for adapting to environmental conditions. There is no single system of classifying plants by life form as there is for taxonomic classification. Many ways of classifying life form have

been used depending on the purpose for which the plants are studied and the kind of ecosystem involved. The following defines a few categories of life forms useful for understanding ecology of arid and semiarid rangelands.

GRASSES, FORBS, WOODY PLANTS

Grasses and forbs are *herbaceous* plants, which means that they have no woody growth. Aboveground parts of these plants die back to the ground each year and regrow in the following year. Grasses belong in the Gramineae family (also called the Poaceae family by some authors), which means they are distinguished by their hollow, jointed stems; fine, narrow leaves with parallel veins; and fibrous root systems (Holechek et al. 2011), and particular flower parts. Sedges (*Carex* sp.) and rushes (*Juncus* sp.) are often grouped with grasses and referred to as *grasslike* plants (they are all in the same family). Sedges and rushes have leaves and fibrous roots like true grasses but they differ in appearance as they have non-jointed, solid stems (Holechek et al. 2011). Forbs include all the non-grasslike broad leafed herbaceous plants with taproots. Shrubs and trees are called *woody* plants, meaning their stems are composed of a living outer portion and a dead, woody inner portion. They do not die back to the ground each year, but continue to add new growth from the existing above ground stems and branches. Trees differ from shrubs as they have a defined trunk that branches well above the ground (Holechek et al. 2011). As with most classifications of natural things, there are some exceptions. For example, bamboo is a grass that is woody. Some shrubs, like burroweed and snakeweed, may partially die back each year. These plants are sometimes called *half-shrubs* or *suffrutescent* plants. Please see Figure 1 for a visual reference to the major rangeland plant groups.

ANNUALS, BIENNIALS, AND PERENNIALS

Plants can also be grouped according to their longevity or life span. Annual plants only live one growing season. They must come up from seed each year. Biennials are plants that require two years to complete their lifecycle. Biennials may germinate in one year, but do not produce seed until the second growing season, after which they die. Normally these plants form a basal cluster of leaves the first year (called a rosette) and send up a seed stalk (or bolt) the second year. Common examples of biennial plants include various thistles (*Cirsium* sp.) and common mullein (*Verbascum thaspus*). Perennials are plants that live for more than two years, and may even persist for hundreds of years. These plants remain alive during the entire year and thus must be able to survive the extremes of dry, wet, cold, and heat that occur during their lifetime. Frequently perennial plants will die back during the winter months and sprout from their rootstock in the spring to begin their reproductive cycle each year.

COOL SEASON/WARM SEASON

This classification refers to the temperature responses of plants and relates to the photosynthetic pathway that each type of plant possesses. Some plants grow best under cool conditions, and some favor warm. As one might expect, plants native to far northern regions are mainly cool-season, and those found in the tropical areas are warm season. In between, as in Arizona, we may find both types occurring and responding to rainfall received in different seasons. When winter rains come, there is abundant growth of such plants as filaree (*Erodium* sp.), red brome (*Bromus rubens*), foxtail (*Hordeum* sp.), lupine (*Lupinus* sp.), and other spring flowers, all cool season plants. Most of the perennial grasses in southern Arizona are warm season plants. They may grow some (green-up) in the spring, but the main growth period for most southern Arizona grasses is in the late spring and summer.

EVERGREEN/DECIDUOUS

This classification applies only to woody plants. Evergreen shrubs or trees keep their leaves through at least one year, sometimes for several years. An evergreen plant must be able to take up enough moisture to keep the leaves alive during the whole year. Examples include pine trees (*Pinus* sp.), live oaks (*Quercus* sp.), juniper (*Juniperus* sp.), creosote bush (*Larrea tridentata*), and burroweed (*Isocoma tenuisecta*). Deciduous shrubs and trees shed their leaves during part of the year, either due to cold weather, dry conditions or both. Examples of deciduous trees or shrubs include mesquite, cottonwood, willows, and whitethorn.

SUCCULENTS

Some plants have “fleshy” parts that contain a lot of moisture. These parts may be stems or leaves. Cactus are classified as “stem succulents” while yucca and desert spoon are classified as “leaf succulents.” The ability to store moisture in the leaves or stems is obviously an advantage in dry environments.

TREES/SHRUBS

We all use these terms, but they are often not well-defined. Generally, we think of trees as taller woody plants and shrubs as shorter. But how tall, and how short? There is not much problem when we compare giant sequoia (*Sequioiadendron giganteum*) to burroweed (*Isocoma tenuisecta*), but sometimes the differences are not so obvious. In general, trees achieve a height of 20 feet or more and usually have a single trunk, such as cottonwoods. Shrubs however, are generally shorter and often have multiple stems originating from the base, like catclaw (*Senegalia greggii*). But some plants can be either a tree or a shrub depending on the environmental conditions where they occur. For example, mesquite achieves tree form in riparian areas where groundwater is fairly shallow,

but may have a shrub form on uplands where moisture is limiting and rooting depth restricted.

BUNCHGRASSES AND SOD-FORMERS

Grasses are often classified as bunchgrasses or sod-formers (Figure 2). Bunchgrasses occur as well-defined individual plants, often appearing with a tufted or bunched growth habit. They generally increase in size by adding new tillers (stems) and produce new plants from seed. Examples include drop seeds and sacaton (*Sporobolus* sp.), threeawns (*Aristida* sp.), and Arizona cottontop (*Digitaria californica*). Sod-formers spread from either underground stems (rhizomes) or aboveground stems or runners (stolons) or both. A good example is Bermuda grass (*Cynodon dactylon*), which has both. Some of these plants do not produce much viable seed and rarely reproduce by seed, such as black grama (*Bouteloua eriopoda*). These are the grasses often used for turf purposes but they also occur on rangelands.

CRYPTOGAMS, MICROPHYTES

Cryptogams are plants that do not reproduce by seeds, but rather by spores. Examples are fungi, lichens, and some mosses. "Crypto" means hidden, and "gam" refers to the reproductive parts, or gametes. Because not all of these soil surface type plants are technically cryptogams (e.g. algae), some prefer to use the term microphytes. These plants represent the earlier or "lower" forms of plant evolution, in contrast to the "higher" flowering plants that evolved later. "Lower" and "higher" refer to their evolutionary status, not their size. These plants may form biological crusts on the soil surface.

Understanding plant life forms is a critical piece of understanding ecosystem dynamics and rangeland ecology. Knowing what plants are suited to what environments helps land managers with selecting the right plant species for rangeland treatment, restoration, and rehabilitation projects.

For more information about rangelands and rangeland plants, please visit GlobalRangelands.org.

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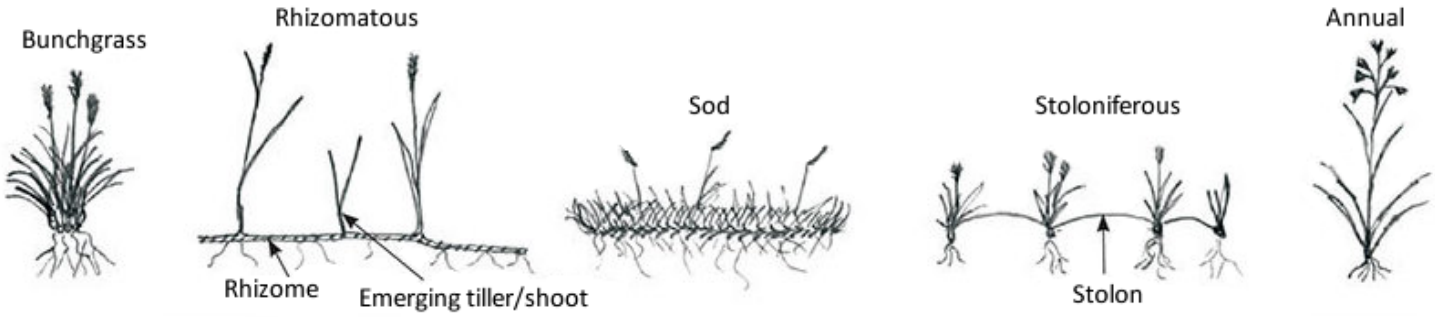

Figure 2. Growth forms of grasses (Illustration by Casey Matney, 2012 from Black. A, 2016).

TROUBLE SHOOTING PROBLEMS OF BEDDING PLANTS IN THE SOUTHWEST

Ursula Schuch
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Fig. 1. Vinca showing symptoms of drying plants right next to healthy plants (top), severe chlorosis (center), and wilting (bottom). Close up inspection of shoots and roots and possibly laboratory analysis are necessary to identify the cause and implement control treatments.

Annual bedding plants create instant impact with long blooming flowers or colorful foliage. In the desert Southwest, bedding plants are installed twice each year: cool season bedding plants are planted at the beginning of fall and warm season plants at the beginning of spring. Installing new plants twice a year is a considerable investment of time and money. To protect this investment, regular inspections and care are necessary to maintain healthy plants. Regular maintenance tasks include removing weeds and debris, irrigation and fertilization, pruning shoots, and removing spent flowers. Inspection or maintenance frequency can vary from a few days during initial establishment, especially during the hot time of year, to every other week once plants are well established.

When a plant is not thriving, the leaves, shoots, flowers, and soil should be examined closely to look for symptoms and determine the cause. Poor color foliage, leaves shriveling or falling off, or evidence of insects or disease on the plant indicate a health problem (Fig. 1 and 2). Small, stunted plants, lack or damage to flowers or flower buds, and plants falling over require close inspection to determine the cause. Soil that is too dry or too wet can be a problem and pulling out the roots of damaged plants can help to diagnose potential root issues. Following are ten of the most common bedding plant problems encountered in the arid climate of the Southwestern United States. The first five are abiotic problems caused by factors such as drought, wind, freezing or overwatering; the next five are biotic problems, caused by different organisms. When trouble shooting, symptoms such as wilting foliage, yellowing leaves, and stunted growth are non-specific and may result from different causes. Some insects damaging plants may hide in

Fig. 2. Zinnia with symptoms of insect infestation and disease.

Fig. 3. Overwatering and poor drainage caused the decline of globe amaranth. Symptoms can also be caused by root diseases.

Fig. 4. Young leaves with iron deficiency show symptoms of interveinal chlorosis. Photo credit: Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org

Fig. 5. *Rhizoctonia* (top) and *Pythium* (bottom) fungi caused root and stem rot. Photo credit top: R.K. Jones, North Carolina State University, Bugwood.org. Photo credit bottom: Chazz Hesselein, Alabama Cooperative Extension System, Bugwood.org

flower buds or on the underside of leaves. Knowing the cultural practices and the history of a site, such as an irrigation system breakdown, flooding, or cold temperatures, can assist in trouble shooting. The origin of a problem should be positively identified before implementing control treatments. This may require laboratory analysis of a fungus or identification of an insect. Early detection may allow for control of an insect or disease problem with a simple spot treatment or by removal of damaged leaves or plants before a large area becomes affected. In all cases, selection of appropriate species for the season and the site, while implementing appropriate maintenance practices will prevent many problems in bedding plants.

1. **ROOT BALLS OF PLANTS IN NURSERY POTS OR TRANSPLANTS IN THE SOIL DRY OUT**
   The growing medium used in small nursery containers dries fast, especially in a semi-arid environment when temperatures are high and relative humidity is low. Irrigating plants before and right after planting can prevent this. Once dry, root balls are often difficult to rewet. Several irrigation cycles may be necessary to rewet dry root balls of plants in containers. If the drought lasts too long, foliage wilts and eventually dies.

2. **OVERWATERING**
   Bedding plants growing in excessively wet soil appear wilted even when the soil is wet. Foliage color can fade to light green and yellow and the leaves may drop (Fig. 3). Excessively wet soil not only lacks oxygen in the root zone, but also impedes uptake of nutrients and water by the roots, and can leach nutrients below the root zone. Roots in these conditions become prone to infection by fungal diseases. Appropriate soil drainage and allowing the soil to dry between irrigations will prevent this problem. Irrigation frequency and length of application should match the soil type, plant material, and weather conditions.

3. **PHYSICAL DAMAGE FROM FROST, WIND, AND EXCESS HEAT**
   Foliage can be damaged and turn brown from both freezing and excessive heat. Strong winds can shred or dry out foliage, and blow off or damage flowers. Selecting the correct plants for the season and the microclimate can help avoid these problems. If frost is forecasted, tender plants in pots can be moved under trees, a covered patio or can be covered temporarily. Flower beds in the open can be covered with frost cloth until the danger of freezing temperatures has passed. Proper watering will minimize damage to plants due to wind and heat by supplying moisture to continue transpiration and photosynthesis when demand for water is high.

4. **LOW LIGHT**
   Many bedding plants are labeled as full sun plants, indicating they require at least six hours of direct sun exposure daily. Low light conditions prevent full sun plants from carrying out photosynthesis at rates necessary to produce enough energy for healthy growth. Plants in low light conditions will appear long and spindly due to stretched internodes, canopies will appear thin due to fewer leaves, and leaves are larger and thinner than comparable leaves of plants receiving sufficient light. Leaf color can appear light green. Moving plants to a location with sufficient sunlight or replacing them with shade tolerant plants corrects this situation.

5. **PLANT NUTRITION**
   Nutrient deficiencies in bedding plants are often caused by high pH, low nitrogen, and low levels of micronutrients. High pH between 7.0 and 8.0 or greater is common in desert soils and irrigation water. Optimum conditions for most bedding plants growing in the landscape range from pH 5.5 to 6.5. Higher pH can limit uptake of micronutrients such as iron, manganese, zinc, and copper. Micronutrient deficiencies first appear on younger leaves and symptoms often include interveinal chlorosis where the veins of the leaves have a darker color and the area in between are light green or yellow (Fig. 4). Adding sulfur to the soil before planting will temporarily decrease the pH and can prevent this problem.

Fig. 6. Symptoms of powdery mildew (top) and rust (bottom). Photo credit top: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org. Photo credit bottom: Penn State Dept. Plant Pathology & Environmental Microbiology Archives, Penn State University, Bugwood.org

Fig. 7. Aphids (top) and adult whiteflies (bottom) feed on leaves and stems. Credit for both photos: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

If annuals stop blooming or decrease significantly in growth after the first set of flowers has bloomed, lack of several nutrients can be the problem. Adding a complete fertilizer which contains nitrogen, phosphorous and potassium at regular intervals will stimulate more flowers and vegetative growth. Light green foliage starting with older leaves suggests lack of nitrogen and in severe cases the foliage can turn yellow. Regular application of fertilizer will prevent this and foliage should turn green within a couple of days. Other symptoms of nutrient deficiency or excess include smaller, distorted leaves, fewer leaves, weak stems, and discoloration of leaves.

6. FUNGAL DISEASES ON ROOTS

Several soil fungi attack especially the lower stems, the crown and roots of bedding plants. Fungi survive for many years in the soil or they can be present in the root ball of transplants. *Phytophthora, Pythium*, and *Rhizoctonia* fungi can infect a wide range of bedding plants such as petunia, vinca, verbena, snapdragon, stock and others. Symptoms include rotting tissue at or below the soil line followed by wilting and plant death (Fig. 5). Healthy roots are light brown and root tips are white while infected roots turn brown or black with the outer layer easily pulled off. Very young plants are susceptible to damping off; that is seedlings fall over because the fungus damaged the stem tissue at soil level or the roots. Above ground parts are wilted with yellow leaves and stunted growth. Fungal root diseases are favored by overwatering, high temperatures, and soils with high clay content and poor drainage. Soil preparation before planting can improve drainage and prevent severe fungal root problems. Fungicides can be used once the disease causing organisms are identified. Diseased plants should be removed as soon as possible to prevent further spread. Bedding plants benefit when the top layer of the soil is replaced every couple of years to prevent a buildup of disease organisms.

7. FUNGAL DISEASES ON LEAVES AND SHOOTS

Powdery mildew and rust are fungal diseases found on the leaves, stems, flowers, and fruit of bedding plants (Fig. 6). Powdery mildew appears as white or gray powdery spots on the upper leaf surface and other above ground parts of the plant. Conditions favoring the disease are warm day temperatures and cool nights, moderate to high humidity, low light intensity, and poor air flow. Zinnias are very susceptible to powdery mildew. The best approach for prevention is to use resistant plant species or cultivars, thin dense growth to increase air flow, and plant only in appropriate light conditions. Fungicides and other compounds can prevent or control powdery mildew.

Rust is a fungal disease that can be diagnosed through the spores that appear on the lower leaf surface. Color of the spores varies from yellow and orange to brown. Snapdragon, sunflower, geranium and other plants are susceptible to rust. Rust infects plants under moist conditions. Keeping plant foliage dry and promoting good air circulation can reduce infection. Fungicides and neem oil can be used to control rust. It is best to plant resistant species or cultivars whenever possible.

8. APHIDS AND WHITEFLIES

These insects are a problem when populations build up and damage plants by sucking sap from foliage and stems. Aphids prefer soft shoot tips and whiteflies are found on the underside of leaves (Fig. 7).

Aphids and whiteflies excrete sticky honeydew which stays on the leaves and is often colonized by sooty mold. This black-colored fungus feeds off the honeydew and is unsightly, but does not damage the plant tissue. Damage from aphids and whiteflies feeding on plants varies depending on the number of insects, but leaves may turn yellow and can die and shoot growth may be stunted. Besides the primary damage from feeding, these insects also transmit disease causing organisms such as viruses when feeding first on infected plants and then on healthy plants. Aphids and whiteflies are best controlled when present in small numbers and regularly hosed off with a strong stream of water. Reduce the application of nitrogen fertilizer which stimulates growth of tender shoot tips that are attractive to aphids. Natural enemies can manage whiteflies and aphids but usually are not sufficient to permanently reduce large populations. Insecticidal soaps, horticultural oil, and insecticides are available to manage aphids and whiteflies.

9. SLUGS AND SNAILS

Moist conditions and dense vegetation favor slugs and snails. Holes in foliage and flowers and shiny, slimy trails indicate the presence of these mollusks. Certain bedding plants such as geraniums, lantana, and some plants with stiff leaves and fragrant foliage are often not attacked by slugs and snails. Slugs and snails can be controlled with bait. Removing daytime hiding spots makes the area less inviting.

10. VERTEBRATE PESTS

Rabbits can be desirable wildlife, but they can also cause damage feeding on plants and chewing through exposed irrigation lines. Rabbits are most active in the evening and early morning hours. Protecting flower beds with chicken wire or similar material will guard against rabbits. Burying the bottom 6 inches or more of a 4 foot tall fence into the ground will prevent rabbits from digging underneath. There are some chemical repellents that can be sprayed on plants, but they are usually effective for only a short period of time, they may require repeat applications, and animals may continue to feed if alternative foods are not available. Ground squirrels are active during daylight hours and are often found in gardens or landscapes that border the desert. They are excellent climbers and are not deterred by fencing unless it covers an entire area. Control methods are difficult and include trapping and baiting. Woodrats or packrats are nocturnal and are also excellent climbers. Barriers and trapping are effective for managing woodrats. Gophers are burrowing rodents that can disturb and consume plants. Trapping and baiting are the most effective management strategies. See your local Cooperative Extension Office for additional information.

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LOCAL FOODS IN ARIZONA

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More and more consumers are choosing to buy locally produced foods. Many consumers believe locally grown foods taste fresher and are healthier. Buying locally also helps communities by stimulating local economies and protecting the environment. This article outlines the benefits of buying locally grown food and eating seasonally in Arizona.

WHAT IS LOCAL FOOD?

The term "local food" does not have a universally accepted definition. A 2008 national survey found that over 70% of consumers surveyed described "local" as "made or produced within 50 miles of their homes", while another approximately 20% described "local" as "made or produced in my state." [1]

According to the definition adopted by the U.S. Congress in the 2008 Food, Conservation, and Energy Act, the total distance that a product can be transported and still be considered a "locally or regionally produced agricultural food product" is less than 400 miles from its origin [2]. Thus, a definition of "local" may depend on whether it is within a certain radius i.e., county, state or region. And a district's definition of local may change depending on the season, product, and special events [3].

WHY LOCALLY GROWN FOODS?

Consuming locally grown foods is associated with freshness, supporting the local economy, and protecting the environment. Several factors, such as nutritional quality, ripeness at harvest, post-harvest handling, processing and packaging, and distance transported, affect the quality of food produced in Arizona. The following are some reasons to consider buying locally grown foods.

Better Nutrition And Well-Being

Fruits and vegetables provide key nutrients (e.g., carbohydrates, proteins, vitamins, and minerals), dietary fiber, and protective substances (e.g., antioxidants) that contribute to health and general well-being. They are associated with reducing the risk factors for many chronic diseases and aid in weight control. MyPlate, which is based on The Dietary Guidelines for Americans (the Department of Agriculture (USDA) and the Department of Health and Human Services) recommend: "Make half your plate, fruits and vegetables. Choose red, orange, and dark-green vegetables like tomatoes, sweet potatoes, and broccoli, along with other vegetables for your meals. Add fruit to meals as part of main or side dishes or as dessert."[4]

Variety: When different produce is available throughout the year, it encourages individuals to consume a variety of fruits and vegetables. The variety of fruits and vegetables provides many vitamins, minerals, antioxidants and fibers. Eating a variety of foods from the five food groups (fruit, vegetable, grain, dairy, and protein foods such as meat, poultry, seafood, beans and peas, eggs, processed soy products, nuts, and seeds) helps you meet your needs for different nutrients. Nutrients commonly found in foods from one group may not be present in high amounts in another. This is one of the reasons for eating a variety of foods. Eating a variety of foods is one of the best things you can do to prevent and control many health problems, such as heart disease, high blood pressure, type 2 diabetes, and some types of cancer. It is the way to a healthier, nutritious diet.

Freshness: Locally grown produce at a farm stand, farmers' market or grocery store tends to be fresher because it is picked at the peak of its quality and nutritional value. On the other hand, fruits and vegetables grown thousands of miles away are often harvested as early as possible in order to reduce damage. Extra packaging is used to protect the produce during long-distance transportation. Total vitamin C content of several different fruits and vegetables, including tomatoes, red peppers, and peaches, has been shown to be higher when harvested ripe and eaten soon after. Delay between harvest and consumption results in loss of flavor and nutritional potential [5]. Fresher produce, tastes better which makes eating fruits and vegetables more appealing.

Quality: Arizona fruits and vegetables destined for the local markets are generally harvested by hand. Mechanical harvesting methods have

the potential to damage them and can result in nutrient losses. Fortunately, most farms in Arizona –large and small– avoid mechanical harvesting, opting to harvest by hand. Maintaining nutritional quality after harvest also requires special handling, particularly with delicate items like berries and tomatoes. Another good reason to buy locally grown foods is that once produce is separated from its source of nutrients (tree, plant, or vine) it undergoes higher rates of respiration, resulting in loss of moisture, nutrient degradation, and spoilage. Consuming locally grown foods avoids such losses by reducing the distance and time it takes to get from the farm to table.

Building the Local Economy

When buying locally from farmers, consumers help cut the costs for the local farming community by reducing the need for transportation of their crops over long distances. The more people buy locally, the money can be saved on transportation, fuel and packaging of the food. The savings could then be reinvested in the local community. Small, family farms typically spend their money locally by purchasing needed supplies and equipment within their communities. Larger farms can use the money to expand and hire more workers, leading to job growth within the community.

Protecting the environment

Reducing the distance food has to travel from a field to a consumer could be beneficial to our environment. Depending on the distance traveled, locally grown foods require less fuel and energy to transport (by truck, rail or air). Local foods often do not require special packaging for traveling great distances. Thus, buying locally can reduce the use of plastic bags and petroleum based packaging which helps reduce the waste associated with packaging. Fuels, packaging, and preservatives may be applied to maintain freshness of fresh produce. Each has a negative impact on the environment.

WHEN CAN I BUY LOCAL FOODS SEASONALLY?

You can buy Arizona fruits and vegetables throughout the year. Seasonal eating is more than merely buying foods locally. Seasonal eating is when those fruits and vegetables are most plentiful, at maximum ripeness, have the most nutrients and are cheapest. It requires conscious decisions by consumers to buy foods that support the local economy. Use the one page, printable "Seasonal Produce Availability Chart" in the Appendix to help find some of locally grown, in-season produce.

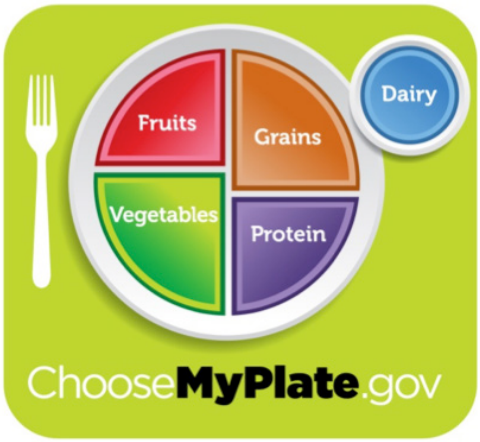
WHERE DO I FIND LOCAL FOODS?

There are many places selling locally produced foods, including farmers' markets, and grocery stores. LocalFresh.Info is an interactive website that enhances connections between consumers and producers of local food. It was established in 2003 by the University of Arizona's Agricultural and Resource Economics Department as a service for Southwest farmers and ranchers wanting to do more direct marketing to local consumers. LocalFresh.info allows anyone to search for offerings of their favorite vegetables, edible flowers, honey, breads, eggs, meat and poultry within a specified distance of any zip code in Arizona. Users can view harvest calendars, maps and information of producers and markets in their area.

localfresh.info

Some other websites that provide information about where to find local foods are listed below.

- LocalFresh.Info has an extensive and dynamic website to connect consumers and local growers. http://localfresh.info/
- Arizona Farm Bureau has a website that shows which foods are grown locally in Arizona and offers links where the foods are sold. http://fillyourplate.org
- Arizona Grown offers information as to which foods are grown in Arizona. http://arizonagrown.org/
- The Arizona Health Department offers information on Arizona's farmers' markets where consumers can use their WIC benefits http://azdhs.gov/azwic/farmers_market



DID YOU KNOW?

Did you know there are apple orchards in Arizona, where you can pick your own apples? Apples are one of the easiest fruits to pick. It is a fun activity the whole family can enjoy together!

Grocery stores are now required to use "country of origin" labels on their produce. These labels can help consumers find local foods. Some stores may have local agricultural promotional marketing campaigns such as "support local farmers." This can help consumers buy fresher, ripe produce when shopping at local grocery stores.

Contact local Extension agents for more information on which locally produced foods are available in your area. (The University of Arizona, Cooperative Extension. https://extension.arizona.edu/)

HOW CAN LOCAL FOODS FIT INTO A MYPLATE?

Local foods can be a part of healthy eating. Here is some example of local foods that fit into the different food groups of MyPlate [6].

Vegetables: celery, corn, eggplant, kale, lettuce, potatoes, pumpkin, tomatoes

Fruits: apples, dates, grapes, grapefruit, lemons, oranges, plums, watermelon

Grains: barley, cornmeal, farro, whole grain cornmeal, whole wheat

Meat and Beans: beef, chicken, lamb, lima beans, pinto beans, pole beans

Dairy: cheese, cottage cheese, milk, yogurt

Others: eggs, honey, olives, pecans, pistachios, wine

SUMMARY

Locally grown foods are fresher, better tasting, and often contain more nutrients being picked at full ripeness than foods that have endured many miles of transportation. Buying locally helps communities by stimulating local economies and protecting the environment. Try a recipe that is easy and affordable using local produce!

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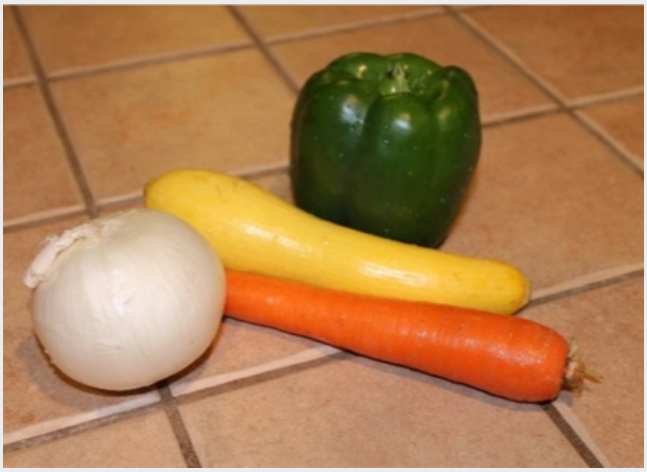
Easy Farmer's Market Vegetable Casserole

When you are buying ingredients for the following recipe, try to choose local foods when available. Cheese, buttermilk, some vegetables, and pasta are grown/made in Arizona!



Prep Time: ≈ 20 Minutes
Cook Time: 30 Minutes
Total Time: ≈ 50 Minutes
Estimated cost to make per serving: $1.17

Ingredients for 6 servings:

- 1 cup dried whole wheat pasta
- 2 cups diced, fresh raw vegetables, such as carrot, eggplant, bell pepper, onion, squash, tomato
- 1 cup shredded low-fat cheddar cheese
- 1 can condensed cream of chicken soup
- 1/3 cup low-fat buttermilk
- 4 tablespoons breadcrumbs (optional)
- Salt and pepper to taste

Directions:

1. Preheat oven to 375°F
2. Cook 1 cup of dried pasta according to package directions, drain and set aside
3. Place diced vegetables in a microwave safe dish with 2-3 tablespoons of water, microwave on high for 4-6 minutes, or until vegetables are soft (Cooking times may differ depending on the type of vegetables you choose. For more help, contact your local Cooperative Extension office The University of Arizona, Cooperative Extension. https://extension.arizona.edu/)
4. Mix cooked pasta, cooked vegetables, shredded cheese, can of soup, and buttermilk in an 8x8 casserole dish
5. Top with breadcrumbs (optional)
6. Cover with oven safe lid or aluminum foil
7. Bake for thirty minutes until bubbly

Per Serving:

Calories: 253 calories; Carbohydrate 37gm; Protein 13g; Total fat 7g; Fiber 6g; Calcium 221 mg; Sodium 550 mg; Iron 2mg; Cholesterol 15mg

Adapted from EFNEP's "Create Your Own Casserole" Recipe [7]

GROWING STRAWBERRIES IN HOME GARDENS

Tom DeGomez
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University of Arizona

Figure 1. Two wild varieties of strawberries used for breeding purposes. Photo courtesy of Scott Bauer, USDA, www.forestryimages.org.

Strawberries are easy to grow. They provide the first fruit of the season, and are quick to bear. When harvested fully ripe in the home garden they have excellent flavor. In stores they can be expensive and are often harvested prior to being fully ripe. Strawberries derive their name from the practice of winter mulching with straw to lessen winter soil heaving caused by soil freezing and thawing cycles. Various types of strawberries are available. Each type has specific environmental requirements such as temperature and hours of daylight for good production. With the wide range of climatic zones in Arizona it is important to choose the right type of strawberry for your growing conditions.

The cultivated garden strawberry, *Fragaria x ananassa*, is a cross between two wild strawberries: *Fragaria virginiana* (meadow strawberry), native throughout much of North America, and *Fragaria chiloensis*, native to the Pacific coast of North and South America. The latter species was brought to France from Chile by Amédée-François Frézier in 1714. This cross was made in France in the 1750's with a strawberry from the Eastern United States and the other from Chile (Figure 1). All types are self-fruitful, needing only one cultivar for pollination and fruit production. http://www.botgard.ucla.edu/html/botanytextbooks/economicbotany/Fragaria/index.html

Strawberries grow from crowns, which are short, compressed stems. The crown produces a whorl of leaves, fruiting structures (inflorescences), branch crowns, and runners. (Runners or stolons, are also called "daughter" plants, which can be used to propagate new strawberry plants.) The strawberry fruit is fleshy, with achenes (seeds) on the surface. The fruit is topped by a calyx (green, leafy cap) which might remain on the plant when the fruit is picked.

These plants are very sensitive to crown depth. Thus, proper planting depth is important. The ideal air temperature regime for growing strawberry fruit is a low of 55° F (13° C) and a high of 70° F (21° C). Temperatures outside of this range will result in vegetative growth of leaves and runners (stolons). Flower buds are produced when day lengths are shorter than 12 hours a day.

Regardless of where you live in Arizona strawberries are adaptable, but variety selection is as important as their care (culture). Strawberry plants respond to good care. Proper care begins with close attention to variety selection, correct planting time, soil improvement, fertilization, irrigation, and mulching. Good care results in larger yields of high quality fruit, 25 plants will yield up to 25 pounds of fruit.

SITE SELECTION

Strawberries require direct, full sunlight for best production. However, high summer afternoon temperatures can damage plants in low and mid-elevation desert locations. Many varieties bloom early in spring, so in frost prone areas don't plant them in frost pockets (areas that cold air drains into at night). Strawberry blossoms are susceptible to late spring frosts, which can kill early flowers. This is a serious loss because these early blossoms produce the largest berries. In colder areas, if possible, select a site slightly higher than the surrounding ground with a gentle slope. This allows for cold air drainage, which follows the flow of water, and helps to minimize frost damage. Another method of reducing frost damage is to cover plants with a gardening/landscape fabric or straw mulch. A southern exposure is usually warmer earlier in the spring, thereby hastening the bloom and ripening season. However, in areas where late spring frosts are rather frequent, a northern exposure, which would delay bloom, might be more desirable. Locations next to houses will be warmer from heat generated from the home.

In the mid to lower elevations of Arizona strawberries should be shaded in the afternoon during summer months. This reduces heat

and water stress to the plants and fruit. Establish planting beds where morning sun is received but plants are in the shade during the afternoon to avoid the heat. Plant next to a wall or fence that provides afternoon shade or erect a cover over the bed with a 65 percent shade cloth for best results.

Avoid planting strawberries after eggplant, peppers, potatoes, tomatoes, blackberries, raspberries and strawberries. These crops can cause the soil to be contaminated with verticillium wilt disease, many strawberry varieties are highly susceptible to this disease (for more information on verticillium see Olsen 2011).

Average strawberry plantings can remain productive for three or four fruiting years, but may be productive for up to eight years. When production drops replant in soil that has not been used to grow strawberries or other verticillium wilt susceptible plants.

SOIL PREPARATION

Strawberries grow best in well-drained, sandy loam soils high in organic matter and fertility. Most sandy loam or sandy soils meet this drainage requirements but are low in organic matter. Saline or alkaline soils (above pH 7.5 to 7.8) are not good because strawberries are highly sensitive to salts in soil and irrigation water. It is wise to prepare soil well in advance of planting (6 to 8 weeks). To prepare the bed, water to encourage weed growth followed by removal of these weeds. Incorporate two to four inches of organic matter into the bed to a depth of 12 inches since this is the depth that strawberry roots grow. Good sources of organic matter are bagged steer manure and/or compost that contain decomposed leaves, grass clippings, and similar materials. Avoid animal manures that have not been hot composted unless nothing else is available. They may contain weed seeds and harmful toxic salts.

When preparing the bed add three pounds of ammonium phosphate (16-20-0) per 100 square feet (0.5 pounds of actual nitrogen). Ammonium phosphate will supply needed nitrogen and phosphorous to the new plants. The addition of soil applied sulfur may be desirable if soil pH is above 7.5. Apply at the rate of three to five pounds per 100 square feet. After incorporating all of these materials into the soil, thoroughly water to settle the bed for future planting.

Where soluble salts are a problem, planting on a raised bed (setting the plants halfway up the side of the bed) allows for salts in the soil and water to rise to the peak of the bed above the root zone. Flat beds can be better than raised beds because it is easier to leach (applying large quantities of water during an irrigation) toxic salts below the root zone. Leaching is done by applying three to four times the amount of water normally applied during an irrigation. Leaching may be done every six to eight weeks during the growing season.

Special strawberry beds may be prepared where space is limited or the soil is not optimum for normal plantings. The bed is usually surrounded by wooden boards (landscaping timbers), rocks or other suitable materials. To develop the bed, mix one-half part coarse builder sand, one-fourth part organic matter and one-fourth part topsoil. The beds should be at least ten inches deep for good root development, high water-holding capacity and sufficient internal drainage.

CULTIVARS AND CULTURE

Cultivars (cultivated varieties) of strawberries are classified as three types. They are: 1) June-bearing, producing one spring crop per year; 2) everbearing types, producing fruit twice each year, in the spring and fall; and 3) day-neutral types, which produce when temperatures are below 90° F. (32° C.).

June-bearing types produce about twice as many berries as everbearers. They also produce numerous runners as temperatures warm. June-bearing plants are set in the spring in upper elevations (Northern and Southeastern Arizona) and should not be allowed to fruit the first season. Removal of flowers strengthens the plant and promotes runners, which result in a larger crop with better fruit quality the following spring. June bearing cultivars planted in the fall in the lower elevations (Southern Arizona, Gila and Salt River valleys) are fruited the following spring and summer. Plants are allowed to fruit for one year and are normally replaced the following fall for best results. The summer heat causes too much stress for strawberries and they will probably not produce well.

Everbearing types do well in the northern part of the state but should not be allowed to fruit until the latter part of the first growing season. In the lower elevations everbearing types do not tolerate heat well and will not perform as well as June-bearers. These plants produce few runners. Both day-neutrals and everbearers may be sold as “everbearing” types in retail nurseries.

Day-neutral cultivars will produce when temperatures are below 90° F. (32° C.) and will revert to vegetative growth when temperatures are above 85° F. (29° C.). They produce few runners. These varieties will produce much like everbearing varieties in Arizona. In lower elevations day-neutral cultivars may be grown as annual plants.

June-bearing varieties, which perform well in the lower elevation ranges, and available from local nurseries are, ‘Earliglow’, ‘Honeoye’, ‘Lateglow’, ‘Sequoia’, ‘Camarosa’, ‘Chandler’, ‘Tioga’, and ‘Sweet Charlie’. Everbearing varieties which can be tried are ‘Gem’,’ Streamliner’, and ‘Ozark Beauty’. Day-neutral cultivar which perform well are ‘Seascape’, and ‘Tristar’.

In the higher elevations, June-bearing varieties, which may perform well, are ‘Honeoye’, ‘Sequoia’, ‘Tioga’, ‘Jewel’, ‘Sparkle’, and ‘Robinson’. Everbearing varieties, which have a better success for crops because of potential frost damage, are ‘Gem’ (‘Superfection’), ‘Ozark Beauty’, ‘Fort Laramie’, ‘Ogallala’ and ‘Quinault’. Day-neutral varieties which perform well are ‘Tribute’, ‘Seascape’, and ‘Tristar’.

PLANTING

Best results are obtained with dormant, virus-indexed plants purchased from a reliable nursery or mail order firm. Strawberries can be planted during two different seasons (spring or fall). The time will vary depending on elevation. In areas above 3,000 feet, a spring planting (March 15 to May 15) is suggested, since temperatures are cool and the plants have a better chance for survival. Plant as soon as the soil can be worked. In areas below 3,000 feet, a fall planting (September 15 to November 15) is suggested. This allows for plants to become well established to support a crop of fruit the following spring.

Obtain plants that are dormant and healthy. For all plantings in the lower elevations, obtain plants that have been chilled (also known as "frigo" plants commercially), for best fruit production the following srping.

Be sure to spot-check plants for signs of winter injury, mold, and root rot. Plants showing signs of winter injury (golden orange-colored crowns) are likely to die if the weather turns hot and dry. A heavy mold

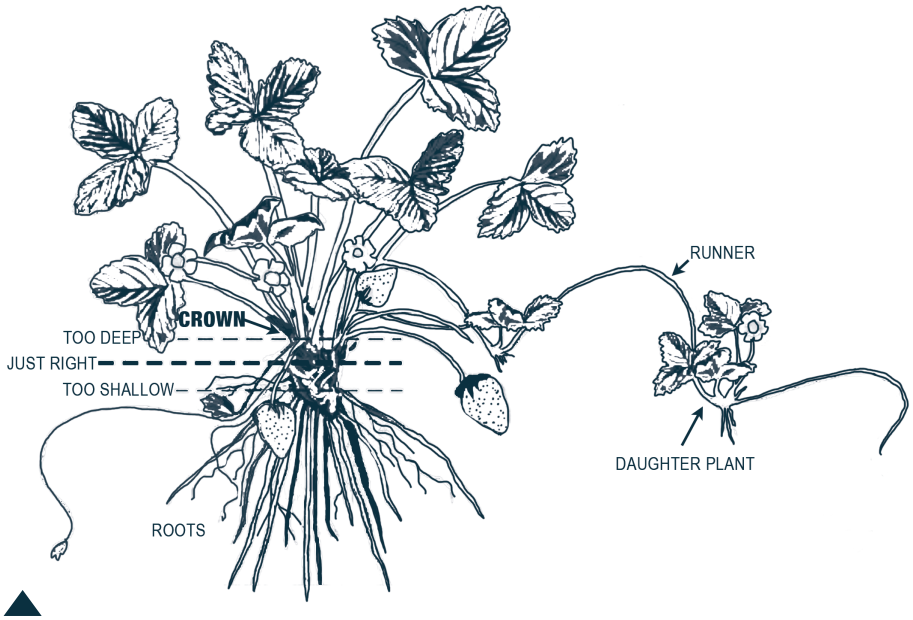

Figure 2. The proper depth of planting. Runners that develop into daughter plants can be planted to fill in a row or start a new bed.

on strawberry roots and crowns is an indication of improper storage. If plants are moldy, discard them. When plants arrive, keep them in the refrigerator until you are ready to plant.

Plants should be spaced 12 inches apart in most planting beds. In areas where plants will be grown for three to four years (higher elevations) and allowed to develop new plants from runners, a wider spacing (24 to 36 inches) is more desirable. Care should be taken to set out new plants at the proper depth. Set plants so crowns (the space between leaves and roots) are level with the surface of the soil where the plants were growing in the nursery (Figure 2). If plants are set too shallow or too deep they could die. Soil should be firmed around the roots so no air spaces are left. Water plants immediately after planting.

In general, strawberry barrels and pyramids have not proven successful in Arizona because they dry out quickly in low and mid-elevation areas. Higher elevations have had better success.

CARE AND CULTURE

Strawberry plants produce runners that make new plants when temperatures are out of the optimum fruit producing range (Figure 2). These new plants may be transplanted to make a new bed or fill in the gaps of an existing bed. These runners may be removed or left to grow. When runners are removed, the mother plants will produce fewer berries but they will be larger. If runners continue to develop into new plants more berries will be produced but they will be smaller. Selective thinning can be conducted to balance out yield and berry size depending on how dense a stand is desired. In row plantings new plants from runners are placed down the row.

When the bed becomes too crowded then renovation (pruning) needs to take place. The process has several steps. Step 1) raise a rotary mower to its highest wheel setting and mow the strawberry plants, after fruit has been harvested in the spring; Step 2) narrow row to 8 to 12 inches with a rototiller or by hand digging; Step 3) remove all weeds; and Step 4) fertilize with nitrogen. Weed control at this time is important. Weeds may be controlled by hand removal, hoeing, mulching or judicious use of herbicides.

Plastic film or straw mulch, commonly used in strawberry production, which helps keep berries clean and reduces fruit rots, it also promotes earlier harvest and increased yields (Figure 3). Clear plastic film increases soil temperature and promotes more vigorous early growth and earlier yields but does not control weeds. Black plastic film reduces weed growth but does not increase soil temperature as much as clear plastic mulch, although the plastic itself is hotter. Plastic film may be put into place prior to planting or after plants have been established. The disadvantage of applying prior to planting is that wind can whip the plastic and pull the young plants out of the ground. Make sure the plastic film is well anchored around the edges and at each plant. If film is applied after planting wait 2-3 weeks for roots to become well established to minimize plant damage. The soil should be wet at the time of film installation. Straw mulch also works well, providing it does not add weed seeds to the bed or is not blown away.

Irrigation should be frequent because of the shallow root system (12 inches). However, too much water can cause yellowing of leaves because of iron chlorosis. During the fruiting period irrigate every 3-6 days on light soil and every 7-10 days on heavy soil. New plants should receive water almost daily for about a week to lessen the shock of transplanting. Drip irrigation methods are well adapted to strawberry culture. Irrigation water containing more than 640 ppm total salts is hazardous. If water does contain excessive salts, make sure enough water is applied at each irrigation to prevent the accumulation of salts in the root zone. After harvest, the roots should be kept moist if plants are to be retained for another growing season.

Strawberries need additional fertilizer once new growth begins in late winter or early spring and three to four months later after harvest and during renovation. Apply 1½ pounds of ammonium sulfate (21-

Figure 3. Strawberries planted through plastic mulch. Photo courtesy of Howard F. Schwartz, Colorado State University, www.forestryimages.org.

Figure 4. Red stele root rot of strawberry (*Phytophthora fragariae*). Photo courtesy of Scottich Crop Research Institute, www.forestryimages.org.

0-0), or the equivalent, per 100 square feet (0.3 pounds of actual nitrogen), in several applications. Scatter the fertilizer on the ground and wash it off the leaves to prevent salt burn before irrigating. If possible, work fertilizer into the ground prior to the next irrigation. If drip irrigation is used for watering, fertilizer can be injected into the system. If injection is used, reduce the amount of nitrogen applied by ½ to prevent nitrogen burn.

STRAWBERRY PROBLEMS

Chlorosis of leaves is a major problem in Arizona. In the early stages, leaves turn pale green then yellow between the veins. As the condition becomes more severe, leaves become white, then turn brown around the edges and may die. The cause may be too much water on poorly drained soils that do not allow the roots to mine the soil for iron. Also, high calcium carbonate (lime) content of soils may limit iron uptake. Treating the first condition requires water drainage and change in irrigation scheduling. Lengthen the intervals between watering to allow the soil to dry. The second condition is corrected by adding iron chelate compounds or iron sulfate to the soil or more effectively, in the form of foliar sprays. Add a tablespoon of iron sulfate crystals to one gallon of water and spray on leaves to give temporary control. This treatment must be applied at 14- to 21-day intervals to relieve the problem. In lower valley areas iron chelate such as Sequestrene 138 applied as a soil treatment has been the only satisfactory method of curing iron chlorosis. Follow manufacturer's application directions.

Nematodes are serious pests of strawberries in some areas. On strawberries, these pests do not usually cause the characteristic knots on the roots common to many other plants, although some swelling may be evident. For this reason, a nematode infestation is more difficult to detect. Stunted plants in an area known to be infested with nematodes may indicate that they are the problem. Soil solarization during the summer is the only adequate solution. This is done before planting strawberries. This is a three step process. Step 1) irrigate the area to be pasteurized to the depth of 12 inches; Step 2) rototill or double-dig the area; and Step 3) place clear plastic over the tilled area and seal the edges with soil. Leave the plastic in place for at least six weeks. The heat produced under the plastic will kill or drive nematodes deeper into the soil. This treatment will also reduce weed seed viability and some soil pathogens.

Black-Root disease (*Rhizoctonia solani*) is caused by a fungus that lives in the soil. Plants decline in vigor and productivity and have poor, typically black root systems. The best control is rotation and better cultural practices.

Phytophtera (*Phytophtera* species) root and crown rot (red stele disease) is first seen when leaves and overall growth are stunted (Figure 4). Young leaves may wilt. Leaves and crowns turn reddish to brown in color. Wilted plants eventually collapse and then die. Proper water management is needed to reduce or eliminate this problem. If water puddles for more than six hours then disease spores will be activated and may infect the plants water conducting system. Let soil dry out before watering again. Planting on raised beds will also help by keeping roots and crowns from sitting in water. Replace plants every few years. If Phytophtera becomes severe soil solarization may help. Follow the directions found in the nematode section.

Catfacing or irregular shaped fruit is common on the earliest crop in some years. The cause is improper pollination, often due to low temperatures. Insect feeding may also cause catfacing.

Verticillium wilt caused by a soil-borne fungus, is a problem in some soils, especially in lower and mid-elevation valley areas. As the disease progresses, outer leaves begin to dry up, first at the margins, then between the veins because this disease affects the water conducting tissue. Growth of new leaves is greatly retarded, making plants look flattened and stunted. Plants may wilt and will die under severe attacks of this disease. If Verticillium wilt is suspected, have a plant diagnosed by a laboratory to be sure. Do not replant in soil infected with Verticillium wilt.

Spider mites often build up in large enough numbers on strawberry plants to cause damage. Leaves become dirty and gritty, and a close inspection reveals tiny light colored mites. These very tiny "pests"

suck the plant juices from the leaves. A strong jet of water on the leaves or employing insecticidal soap will usually discourage them, but dusting with a 300 mesh sulfur dust is sometimes needed after harvest. (Sulfur should not be applied when temperatures are over 85° F.) Do not use insecticides to try and control spider mites. They are not insects and insecticidal use will only kill spider mite predators and cause larger populations of this pest.

REFERENCE

eXtension.org. Search hundreds of Cooperative Extension sites. https://search.extension.org/

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Further information concerning pests and their control for strawberries is available at: University of California Davis Integrated Pest Management. For information on strawberry pest management go to: http://www.ipm.ucdavis.edu/PMG/GARDEN/FRUIT/strawberries.html

Trade names used in this publication are for identification purposed only and do not imply endorsement or criticism of products named or use of similar products not named.

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