



5880 Oak Street, Anderson, CA 96007
Phone: (530) 357-2121 Email: cccsd@clearcreekcsd.org

Agriculture Committee Meeting

Directors - Scott McVay, Logan Johnston
Alternate – Vacant

Community Members
Dr. Audra Harl, Dennis Possehn, Robert Wharton

General Manager: Paul Kelley

AGRICULTURE COMMITTEE MEETING

April 9th 2025 at 6:00PM: District Office Board Room

Committee Responsibility

The Board's standing Agricultural Committee shall be concerned with promoting and preserving agricultural customers and assisting them with regulatory compliance, such as Annual Crop Reports.

AGENDA

1. CALL TO ORDER

2. PLEDGE OF ALLEGIANCE

3. OPEN TIME/PUBLIC COMMENT: Pursuant to Gov. code S54950, persons wishing to address the Board of Directors on matters not listed on the agenda should notify the Secretary prior to the start of the meeting. To speak at this time and for any item listed on the agenda – raise your hand, and when recognized by the Chair – proceed to the podium to address the Board.

4. OLD BUSINESS/NEW BUSINESS (Discussion)

- a. Farmers Market – Discussion
 - i. Update - Dates (2nd and 4th Saturday – 8-11am – May – October)
- b. Workshop – “Gardening Basics and More” – Theresa McCausland - Master Gardener With Cassie Leal – Master Gardener & Director of Research at Shasta College
 - i. Topics for hobby gardening process:
 - ii. Soil Types, Site Preparation
 - iii. Irrigation, Planting
 - iv. Cultivating and Harvesting

5. ADJOURN THE MEETING

(Documents attached to packet from Master Gardener for Community information)

ADA Related Disabilities:

Contact the front office and speak with a Staff Member if special consideration is needed to attend any public meeting for disability related accommodations or aide is needed. Please give 72 hours - notice prior to the meeting to allow staff to meet your requests appropriately.

“This District is an Equal Opportunity Provider”

From Soil to Sun:

Essential Tips for New Gardeners in Shasta County

Theresa McCausland and Cassie Leal, Shasta County Master Gardeners

Shasta County Master Gardener Contact Information

Voice mail: 530-242-2219

Email: mastergardener@shastacollege.edu

Welcome to your gardening journey! Starting a vegetable garden offers numerous benefits, including access to fresh, nutrient-rich, home-grown produce, helps to motivate you to be outside and do physical activity, contributes to environmental sustainability, and creates opportunities to engage in educational experiences and the local gardening community. This handout provides foundational knowledge tailored to Shasta County's unique climate, helping you cultivate a thriving and sustainable garden.

I. Start Small

- **Keep it Manageable**
 - Begin with a modest garden plot or a few containers to avoid feeling overwhelmed.
 - Gradually expand your garden as you gain confidence and experience.
-

II. Know Your Growing Zone

- **Local Climate Characteristics**
 - We are located in Zone 9b with approximately 600 chill hours per year.
 - Use Google to find your first and last frost dates. Anderson and Redding's last frost date is April 15, and the first frost date is around November 7.
 - We experience hot, dry summers and mild, wet winters, typical of a Mediterranean climate.
 - Select plants that are well-adapted to these conditions to ensure a thriving garden.
 - **Planting Calendar**
 - Understand that there are cool and warm season plants, and select the plants that will thrive in the season you are in.
 - Refer to planting calendars for specific planting dates and guidelines. <https://www.almanac.com/gardening/planting-calendar> is one source that can be customized based on your location.
-

III. Site Selection

- **Sunlight Exposure**
 - Choose a location that receives at least six hours of sunlight daily, especially during the summer months. Usually, Southern-facing areas of the property.
 - Observe your yard throughout the day to identify areas with consistent sunlight.
 - Consider what the light will be like in the fall and winter so you can grow all year.
 - **Proximity to the Home/Kitchen and a Water Source**
 - Choose a location that is close to a water source to allow for easy irrigation.
 - Choose a location that is convenient for you; the best-kept gardens are the ones that you visit every day.
-

IV. Container Gardening - Utilizing Limited Space

- For those with restricted space, container gardening offers a flexible solution.
 - Choose appropriate containers with drainage holes and use quality potting mix.
 - Ensure containers receive adequate sunlight based on the plant's requirements.
-

V. Soil Preparation

- **Soil Quality**

- Test your soil's composition and drainage.
- If the soil is heavy clay, consider building raised beds or using large containers for planting.
- Use the Cal Soil website to find the soil type at your address.
<https://casoilresource.lawr.ucdavis.edu/>

- **Enhancing Fertility**

- Incorporate organic matter like compost, and aged manure to enrich the soil.
- Give plants a boost with slow-release organic fertilizer.

- **Mulching**

- Organic mulch retains moisture, prevents compaction, attracts worms, suppresses weeds, protects the soil from the damaging effects of the sun, and regulates soil temperature.
 - Apply a 2-4 inch layer of organic mulch like natural bark and wood chips in pathways and perennial beds.
 - Use 2-4 inches of shredded leaves or chopped straw around annual plants.
 - Source large quantities of free woodchips from local arborists by calling local tree service companies or signing up for ChipDrop.com.
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VI. Irrigation Options

- **Watering Techniques**

- Drip irrigation systems deliver water directly to plant roots, reducing waste and minimizing evaporation.
- Soaker hoses provide consistent moisture along their length, suitable for row plantings.

- **Conservation Strategies**

- Group plants with similar water needs together (hydro-zoning) to optimize irrigation efficiency.
- Water during early morning or late evening to minimize evaporation.

- **Deep Watering Techniques Promote Healthy Root Systems**

- Watering deeply but less frequently encourages roots to grow deeper into the soil, enhancing drought resistance.
 - Aim for water penetration of several inches, depending on the plant's needs.
 - Water in the early morning to reduce evaporation and minimize fungal growth.
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VII. Plant Selection

- **Grow What You Love to Eat**
 - Grow plants appropriate to each season that you and your family love to eat.
 - **Heat-Resistant and Slow-to-Bolt Varieties**
 - Choose heat-tolerant plants that thrive in Shasta County's warm climate.
 - Select slow-to-bolt varieties of leafy greens, broccoli, and cauliflower to extend the harvesting period.
 - **Annuals Vs. Perennials**
 - Annuals complete their entire life cycle—from germination to seed production—within a single growing season. After this period, they die.
 - Examples include tomatoes, lettuce, cucumbers, carrots, peas, and beans.
 - Perennials live for more than two years, with the above-ground portion typically dying back during colder months and regrowing from the root system each spring.
 - Examples include asparagus, rhubarb, artichokes, berries, and trees.
-

VIII. Identifying and Managing Insects

- **Identify the Insects in Your Garden**
 - Most insects in your garden will be benign or neutral; they do not significantly harm or benefit the garden.
 - Learn how to identify bugs, their eggs, and larvae. Take time to learn about each one.
 - **Examples of Good and Bad Bugs**
 - Beneficial insects include: Pollinators - bees and butterflies, Predators - ladybugs, lacewings, praying mantises, and certain wasps.
 - Pests include: aphids, caterpillars, cucumber beetles/squash bugs.
 - **Integrated Pest Management System (IPM)**
 - IPM is a system you can use to solve pest problems while minimizing risks to people, pets, and the environment.
 - <https://ipm.ucanr.edu/#gsc.tab=0>
-

IX. Sourcing Seeds and Plants

- **Local Suppliers**
 - Purchasing seeds from regional suppliers ensures plant varieties are well adapted to local conditions.
 - Participate in local seed swaps to find varieties that have been successful for growers in your area.
 - Visit local nurseries that offer California natives, Mediterranean-climate species, and locally adapted perennials. Local nursery options in our area include Turtle Bay, Ghost Pine Nursery, The Native Plant Society, Wyntour, Gold Leaf, and the Shasta College Nursery.
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X. Keep a Garden Journal

• Planning and Reflection

- Use your journal to plan crop rotations, succession planting, and garden layouts.
- Reflect on successes and challenges to improve your gardening practices each season.

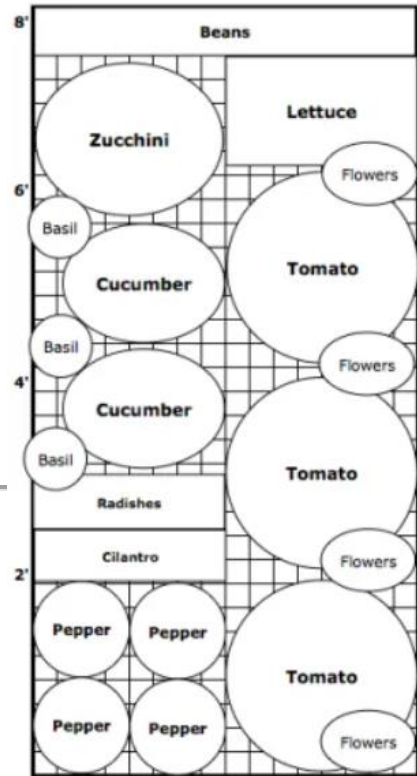
• Track Progress

- Record planting dates, plant varieties, weather conditions, and growth observations.
- Documenting pest occurrences and disease outbreaks can help in future prevention and management.

XI. Utilizing Local Resources

• Community Engagement

- Engage with local gardening groups or online communities to share experiences and advice.
- Participate in your local seed library, and seed swap activities.
- Attend Shasta County Master Gardeners workshops at the Shasta College Farm. Contact Master Gardeners for personalized advice and resources.



XII. Other Tips

• Protect and Cultivate Your Soil

- Incorporate no dig principles to increase the biodiversity of the micro-organisms living in your soil that help your plants grow. This can be accomplished by allowing healthy plant root balls to remain in the bed at the end of the season. When it is time to remove plants, cut them off at the soil surface.

• Hugelkultur Techniques

- Use logs/woodchips at the base of raised beds and large containers. This helps to save money on soil, increases the micro-organisms living in your soil while also assisting with drainage, retaining water, and breaks down over time to add nutrients to the soil.

• Grow Up

- Use trellises and other structures to grow plants up off the ground to maximize your space and improve conditions for the plants.

• Incorporate Permaculture Principles

- Include flowers and herbs in your garden plans to add diversity, and beauty to your garden. This will also attract beneficial insects to your garden and give you a head start with companion planting.

Conclusion

Embarking on a gardening journey and growing your own food is a rewarding endeavor. By understanding local conditions and implementing these foundational practices, you'll be well on your way to cultivating a successful and enjoyable garden. Happy gardening!

MONTHLY PLANTING GUIDE FOR SHASTA COUNTY VALLEY AREAS



Shasta County -- Start Seeds in PROTECTED Areas (Greenhouse, indoors)

January	February	March	April	May	June	July	August	September	October	November	December
Broccoli	Eggplant	Eggplant	Leeks			Broccoli	Kohlrabi*	Kohlrabi		Broccoli	
Cabbage	Leeks	Kohlrabi				Brussel Sprts					
Cauliflower		Leeks				Cabbage					
Leaf Lettuce						Cauliflower					
Peppers	Peppers	Peppers									
Tomatoes	Tomatoes	Tomatoes	*Tomatoes								

Cool Season Crops for Fall/Winter gardens in the Northstate
Warm Season Crops for Spring/Summer gardens in the Northstate

Shasta County -- PLANT SEEDS DIRECTLY IN SOIL OUTSIDE

January	February	March	April	May	June	July	August	September	October	November	December
Bok Choy	Beets	Beets	Bean,Lima*	Bean,Lima	Bean,Lima	*Bean,Lima	Beets	Beet	Bean,fava*	Bean, fava	Bean, fava
Broccoli Rabe	Broccoli	Carrots	Bean,Snap*	Bean,Snap	*Bean,Snap	Celeriac	Broccoli*	Bok Choy	Bok Choy	Bok Choy	Bok Choy
*Fava Bean	Brocc Rabe	Celeriac	Beets	Chard,Swiss	Pumpkin	*Corn	Cabbage	Broccoli	Broccoli Rabe	Chard, Swiss	Broccoli
Kohlrabi*	*Cabbage	Celery	Carrots	*Chives		LettuceHead*	Carrot	Broccoli Rabe*	*Carrots	Garlic	Broccoli Rabe
Head Lettuce	Carrots	Chard,Swiss	Celeriac	Corn		*Okra	Cauliflower	Cabbage	Chard,Swiss	LeafLettuce	*Garlic
Leaf Lettuce*	Chard,Swiss	Chives	Celery	Cucumber		Parsnip	Celeriac	Carrots	Collards	Mustard	Kale
Mustard	Chives	*Collards	Chard,Swiss	Eggplant		*Pumpkin	Celery	Cauliflower	Endive	Onion Sets	Mustard
Onion Sets	Collards	Endive	Chives	Melon		Rutabaga	Chard,Swiss	Celery	Garlic	Radicchio	Onion Sets
Peas*	Endive*	Fennel,Flor*	Corn*	Mustard		*Squash, Sumr	Collards*	Chard, Swiss	*Leeks	Radish	Radicchio
Radicchio	Kale	Jicama	Cucumber*	Pumpkin		*Squash,Wtr	Chives*	Collards	Leaf Lettuce	Shallots	Radish
Radish	Kohlrabi	*Kale	Endive	Soybean			Endive*	Endive	Mustard		
Radish,Daikon*	Lettuce Head	Lettuce Leaf	Eggplant	Spinach			Fennel,Flor*	*Fennel, Flor	Onion Sets		
	Lettuce Leaf	Mustard	Fennel,Flor	Squash, Sumr			Kale	Garlic	Parsley Root		
	Mustard	*Peas	Jicama	Squash,Wtr			Kohlrabi	Kale	Peas		
	Peas	Potato,White	Melon*	Watermelon			LettuceHead	Leeks	Radicchio		
	Potato,White*	Radish	Mustard				Mustard	LettuceHead	Radish		
	Radicchio	Radish,Daikon	Okra				Onion Seeds	LettuceLeaf	Radish,Daikon		
	Radish	Squash, Smr*	Pepper				Parley Root	Mustard	Shallots		
	Radish,Daikon	Squash,Wtr*	Potato,White				Parsnip	Onion Sets	*Turnips		
	Turnips*	Turnips	Radish				Potato,White	Parsley root			
			Radish,Daikon				Radish,Daikon	*Potato,White			
			Soybean*				Rutabaga	Raddicchio			
			Spinach				Turnip*	Radish			
			Squash, Summer					Radish, Daikon			
			Squash,Winter					*Parsnips			
			*Turnips					Peas			
			Watermelon*					Rutabaga			
								Shallots			
								Turnips			

*Plant during the first half of month if the asterisk is before the plant name, and plant the second half of month if the asterisk is after the plant name

MONTHLY PLANTING GUIDE FOR SHASTA COUNTY VALLEY AREAS



Shasta County suggested guide to SET OUT STARTER PLANTS, TRANSPLANT, SHOOTS, ETC

January	February	March	April	May	June	July	August	September	October	November	December
Asparagus	Broccoli	Chives	Chives	Chives	Celery	Artichoke		Bok Choy	Bok Choy	Bok Choy	Asparagus
Bok Choy	*Cabbage		Eggplant	Eggplant	Eggplant	Asparagus		Broccoli	Broccoli	Broccoli	Bok Choy
	Kale		Peppers	Peppers	Leeks	Celery		Cabbage	Cabbage	Cabbage	
	Leeks	Leeks	SweetPotato	SweetPotato	SweetPotato			Cauliflower	Cauliflower	Cauliflower	
			Tomatoes*	Tomatoes	Tomatoes			Celery	Celery	Celery	
								Fennel,Flor	Fennel,Flor	Fennel,Flor	
								Kohlrabi	Kale	Kale	Kale
								LeafLettuce	Kohlrabi	Kohlrabi	LeafLettuce
								Peas	LeafLettuce	LeafLettuce	LeafLettuce
									Onion Sets	Peas	
									Peas		

Cool Season Crops for Fall/Winter gardens in the Northstate

Warm Season Crops for Spring/Summer gardens in the Northstate

*Plant during the first half of month if the asterisk is before the plant name, and plant the second half of month if the asterisk is after the plant name

SHASTA COLLEGE MASTER GARDENER VEGETABLE PLANTING SCHEDULE

Vegetables	January	February	March	April	May	June	July	August	September	October	November	December
Artichoke							SP	SP				
Asparagus	SP	SP					SP	SP				SP
Beans, Fava												SP
Beans, Lima												
Beans, Snap												
Beets												
Bok Choy	SP	SP							SP	SP	SP	SP
Broccoli			SP	SP					SP	SP	SP	SP
Broccoli Rabe												
Brussel Sprouts												
Cabbage			SP						SP	SP	SP	SP
Cabbage, Chinese			SP									
Carrots												
Cauliflower									SP	SP	SP	SP
Celeriac												
Celery						SP	SP	SP	SP			
Chard, Swiss												
Chives			SP	SP	SP	SP	SP					
Collards												
Corn												
Cucumbers												
Eggplant				SP	SP	SP	SP	SP				
Endive												
Fennel, Florence									SP	SP	SP	SP
Garlic												
Jicama												
Kale		SP	SP							SP	SP	SP
Kohlrabi									SP	SP	SP	SP
Leeks		SP	SP	SP	SP		SP	SP				
Lettuce, Head												
Lettuce, Leaf									SP	SP	SP	SP
Melons												
Mustard												
Okra												
Onion, Seeds										SP	SP	
Onion, Sets												
Parsley Root												
Parsnips												
Peas									SP	SP	SP	SP
Peppers				SP	SP	SP	SP					
Potatoes, Sweet				SP	SP	SP	SP	SP				
Potatoes, White												
Pumpkins												
Radicchio												
Radish												
Radish, Daikon												
Rutabaga												
Shallots												
Soybean, Edamame												
Spinach												
Squash, Summer												
Squash, Winter												
Tomatoes					SP	SP	SP	SP				
Turnips												
Watermelon												

Vegetable Planting Schedule Notes

This vegetable garden planting schedule is designed for Shasta County gardens in USDA Hardiness Zones 9a and 9b. This would include gardens in most parts of Anderson (9a), Cottonwood (9a), Redding (9b) and Shasta Lake (9b).

April 15th is the date many local gardeners use as a "rule of thumb" for the last spring frost of the year, but late frosts do occur. If your garden is at a higher elevation, or has a colder microclimate, then you need to adjust your vegetable garden planting schedule to account for late spring and early fall frost. Because conditions in Shasta County are so diverse, the suggested planting dates are only approximate. Contact experienced gardeners and neighbors in your local community and experiment in your own garden to establish more precise planting dates.

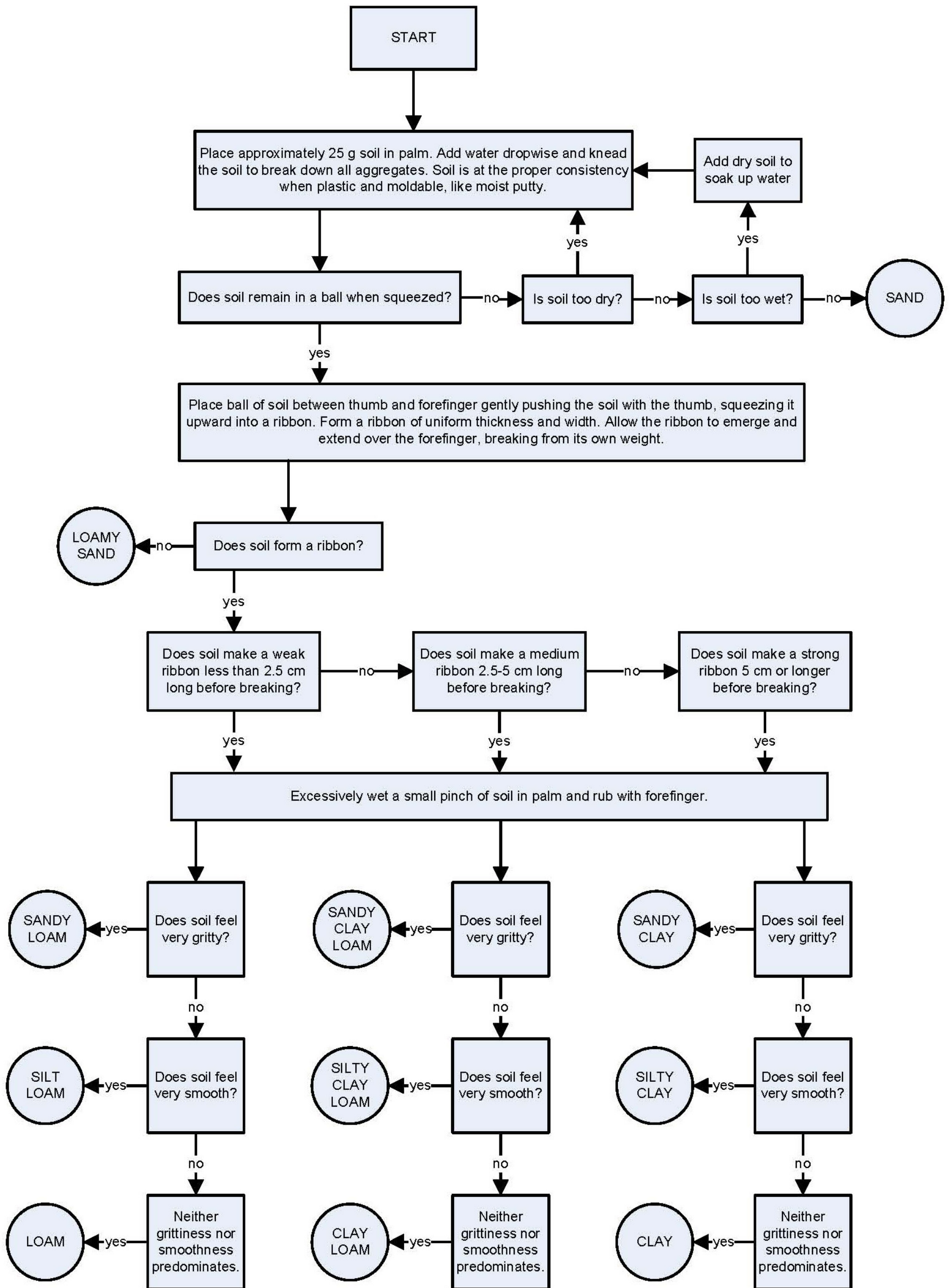


Vegetable Planting Schedule Legend

	Start Seed or Plants in a Protected Area
	Plant Seed Directly in the Garden
SP	Set Out Plants, Transplants, Shoots, etc.

Guide to Texture by Feel

Modified from S.J. Thien. 1979. *A flow diagram for teaching texture by feel analysis.* Journal of Agronomic Education. 8:54-55.



Texture class is one of the first things determined when a soil is examined. It is related to weathering and parent material. The differences in horizons may be due to the differences in texture of their respective parent materials.

Texture class can be determined fairly well in the field by feeling the sand particles and estimating silt and clay content by flexibility and stickiness. There is no field mechanical-analysis procedure that is as accurate as the fingers of an experienced scientist, especially if standard samples are available. A person must be familiar with the composition of the local soils. This is because certain characteristics of soils can create incorrect results if the person does not take these characteristics into account.

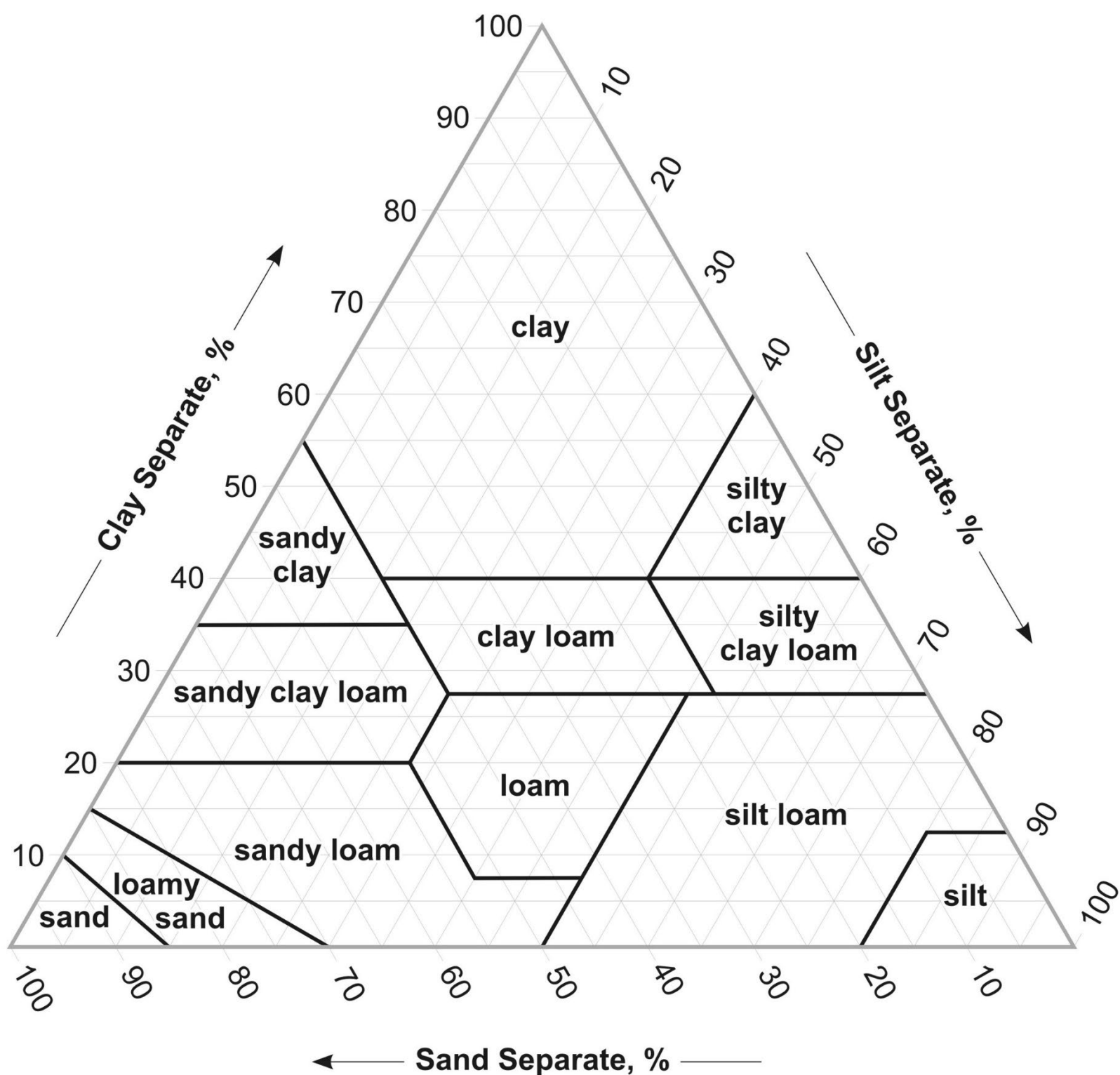
In some environments clay aggregates form that are so strongly cemented together that they feel like fine sand or silt. In humid climates iron oxide is the cement. In desert climates silica is the cement and in arid regions lime can be the cement. It takes prolonged rubbing to show that they are clays and not silt loams.

Some soils derived from granite contain grains that resemble mica but are softer. Rubbing breaks down these grains and reveals that they are clay. These grains resist dispersion and field and laboratory determinations may disagree.

Many soil conditions and components mentioned earlier cause inconsistencies between field texture estimates and standard laboratory data. These are, but not limited to, the presence of cements, large clay crystals, and mineral grains. If field and laboratory determinations are inconsistent, one or more of these conditions is suspected.

Soil Textural Triangle

Soil Textural Triangle



Soil Texture Analysis

Courtesy of Ted Sammis at New Mexico State University

A simple method to estimate the percent sand silt and clay in a soil and determine its texture.



1. Get a quart jar from the supermarket with a lid or use any jar with a large mouth.
2. Fill the jar half full of soil
3. Wet the soil to a mud consistency and tap the jar to settle the soil.
4. Mark the level of soil on the jar with a marking pen or whiteout
5. If you have some calgon put a teaspoon full in the jar
6. Add water to the top of the jar and shake the soil water mix till the soil is all mixed up in the water
7. Put the jar on a table and let the soil settle out for 40 seconds, mark the level of soil on the jar. This is sand portion in the soil.

8. Wait 6 hours and mark the level of the soil in the jar. The difference between the bottom mark, which is the sand, and the second mark up is the silt portion of the soil. The total sand plus silt is the distance from the bottom of the jar to the second mark.

9. Calculate the percent sand, silt and clay by measuring the depth of the soil by measuring the distance from the bottom to the first mark up in inches which is the sand fraction, the distance from the first mark up to the second mark up which is the silt fraction and the distance from the bottom to the third mark up from the bottom which is the sand plus silt plus clay fraction. . Sometimes, when all the sand silt and clay has settled, the height of the soil is higher than when you marked the jar after making a mud solution. This can only be determined by letting the jar sit for several days. If you have the time to do this , then a more accurate calculation of % sand silt and clay can be determined based on this new measured total height. Also, the percent sand, silt, and clay is a volume percentage. The soil triangle and table below for soil classification is in percent by weight. You need to correct this problem by converting from percent volume to percent weight by multiplying the percentage of sand by 1.19, the percentage of silt by 0.87 and the percentage of clay by 0.94. These numbers are the weight ratio's of bulk density compared to average bulk density of the material.



- 10. The percent sand is the depth of the sand divided by the depth of the total soil
- 11. The percent silt is the depth of the silt divided by the depth of the total soil
- 12. The percent clay is 100 minus the percent sand plus silt.
- 13 To determine the soil texture knowing percent sand silt and clay using the table below

Soil classification	Clay Soil	Loam soil	Sandy soil
percent clay	40-100%	7-27%	1-10%
percent silt	0-40%	28-50%	1-15%
percent sand	0-45%	23-52%	85-100%

14. A more precise determine of soil texture can be determine from percent sand silt and clay using the [soil triangle](#).

This simple approach to determining texture will not work if the soil contains a lot of gypsum. Soils that contain a lot of gypsum are normally are pinkish white in color.

APHIDS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Aphids are small, soft-bodied insects with long slender mouthparts that they use to pierce stems, leaves, and other tender plant parts and suck out fluids. Almost every plant has one or more aphid species that occasionally feed on it. Many aphid species are difficult to distinguish from one another; however, management of most aphid species is similar.

IDENTIFICATION

Aphids have soft pear-shaped bodies with long legs and antennae and may be green, yellow, brown, red, or black depending on the species and the plants they feed on. A few species appear waxy or woolly due to the secretion of a waxy white or gray substance over their body surface. Most species have a pair of tubelike structures called cornicles projecting backward out of the hind end of their body. The presence of cornicles distinguishes aphids from all other insects.

Generally adult aphids are wingless, but most species also occur in winged forms, especially when populations are high or during spring and fall. The ability to produce winged individuals provides the pest with a way to disperse to other plants when the quality of the food source deteriorates.

Although they may be found singly, aphids often feed in dense groups on leaves or stems. Unlike leafhoppers, plant bugs, and certain other insects that might be confused with them, most aphids don't move rapidly when disturbed.

LIFE CYCLE

Aphids have many generations a year. Most aphids in California's



Figure 1. Wingless adults and nymphs of the potato aphid.



Figure 2. Woolly apple aphid adults showing waxy coating.

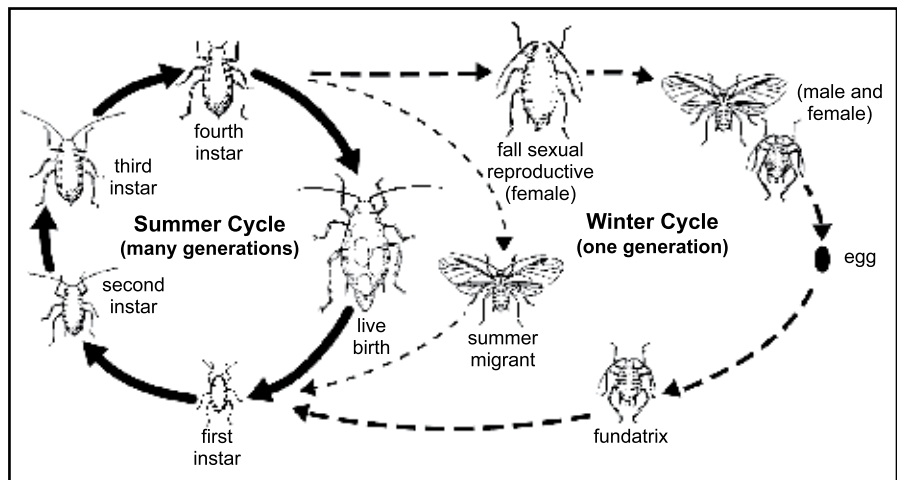


Figure 3. General life cycle of aphids. Asexual reproduction occurs during most of the year (summer cycle). Some aphid species produce a generation of sexual individuals that produce overwintering eggs as shown in the winter cycle.

mild climate reproduce asexually throughout most or all of the year with adult females giving birth to live offspring—often as many as 12 per day—without mating. Young aphids are called nymphs. They molt, shedding their skin about four times before becoming adults. There is no pupal stage. Some species produce sexual forms that mate and produce eggs in fall or winter, providing a more hardy stage to survive harsh weather and the absence of foliage on deciduous plants. In some cases, aphids lay these eggs on an alterna-

tive host, usually a perennial plant, for winter survival.

When the weather is warm, many species of aphids can develop from newborn nymph to reproducing adult in seven to eight days. Because each adult aphid can produce up to 80 offspring in a matter of a week, aphid populations can increase with great speed.

DAMAGE

Low to moderate numbers of leaf-feeding aphids aren't usually damag-

ing in gardens or on trees. However, large populations can turn leaves yellow and stunt shoots; aphids can also produce large quantities of a sticky exudate known as honeydew, which often turns black with the growth of a sooty mold fungus. Some aphid species inject a toxin into plants, which causes leaves to curl and further distorts growth. A few species cause gall formations.

Aphids may transmit viruses from plant to plant on certain vegetable and ornamental plants. Squash, cucumber, pumpkin, melon, bean, potato, lettuce, beet, chard, and bok choy are crops that often have aphid-transmitted viruses associated with them. The viruses mottle, yellow, or curl leaves and stunt plant growth. Although losses can be great, they are difficult to prevent by controlling aphids, because infection occurs even when aphid numbers are very low; it takes only a few minutes for the aphid to transmit the virus, while it takes a much longer time to kill the aphid with an insecticide.

A few aphid species attack parts of plants other than leaves and shoots. The lettuce root aphid is a soil dweller that attacks lettuce roots in spring and summer, causing lettuce plants to wilt and occasionally die. In fall, this species often moves to poplar trees, where it overwinters in the egg stage and produces leaf galls in spring. The woolly apple aphid infests woody parts of apple roots and limbs, often near pruning wounds, and can cause overall tree decline if roots are infested for several years. Heavy infestations of crown and root aphids on carrots may weaken tops, causing them to tear off when carrots are harvested.

MANAGEMENT

Although aphids seldom kill a mature plant, the damage they do and unsightly honeydew they generate sometimes warrant control. Consider the nonchemical controls discussed below, as most insecticides will destroy beneficial insects along with the pest. On mature trees, such as in cit-

rus orchards, aphids and the honeydew they produce can provide a valuable food source for beneficial insects.

Monitoring

Check your plants regularly for aphids—at least twice a week when plants are growing rapidly—in order to catch infestations early, so you can knock or hose them off or prune them out. Many species of aphids cause the greatest damage in late spring when temperatures are warm but not hot (65°-80°F). For aphids that cause leaves to curl, once aphid numbers are high and they have begun to distort leaves, it's often difficult to control these pests, because the curled leaves shelter aphids from insecticides and natural enemies.

Aphids tend to be most prevalent along the upwind edge of the garden and close to other infested plants of the same species, so make a special effort to check these areas. Many aphid species prefer the underside of leaves, so turn leaves over when checking for aphids. On trees, clip off leaves from several areas of the tree. Also check for evidence of natural enemies such as lady beetles, lacewings, syrphid fly larvae, and the mummified skins of parasitized aphids. Look for disease-killed aphids as well; they may appear off color, bloated, flattened, or fuzzy. Substantial numbers of any of these natural control factors can mean the aphid population may be reduced rapidly without the need for treatment.

Ants are often associated with aphid populations, especially on trees and shrubs, and frequently are a clue that an aphid infestation is present. If you see large numbers of ants climbing your tree trunks, check higher up the tree for aphids or other honeydew-producing insects that might be on limbs and leaves. To protect their food source, ants ward off many predators and parasites of aphids. Managing ants is a key component of aphid management. (See Cultural Control.)

In landscape settings, you can monitor aphids by using water-sensitive paper to measure honeydew dripping



Figure 4. Some aphids overwinter as eggs such as the mealy plum aphid on plums.



Figure 5. Honeydew produced by the hackberry woolly aphid.



Figure 6. Leaf curling caused by rosy apple aphid.

from a tree. This type of monitoring is of particular interest where there is a low tolerance for dripping honeydew, such as in groups of trees along city streets or in parks and for tall trees where aphid colonies may be located too high to detect. (See Pests of Landscape Trees and Shrubs in References for more details.)

Biological Control

Natural enemies can be very important for controlling aphids, especially in gardens not sprayed with broad-spectrum pesticides (e.g., organophosphates, carbamates, and pyrethroids) that kill natural enemy species as well as pests. Usually natural enemy populations don't appear in significant numbers until aphids begin to be numerous.

Among the most important natural enemies are various species of parasitic wasps that lay their eggs inside aphids. The skin of the parasitized aphid turns crusty and golden brown, a form called a mummy. The generation time of most parasites is quite short when the weather is warm, so once you begin to see mummies on your plants, the aphid population is likely to be reduced substantially within a week or two.

Many predators also feed on aphids. The most well known are lady beetle adults and larvae, lacewing larvae, soldier beetles, and syrphid fly larvae. Naturally occurring predators work best, especially in garden and landscape situations. For photos and more information about aphid natural enemies, see the Natural Enemies Gallery.

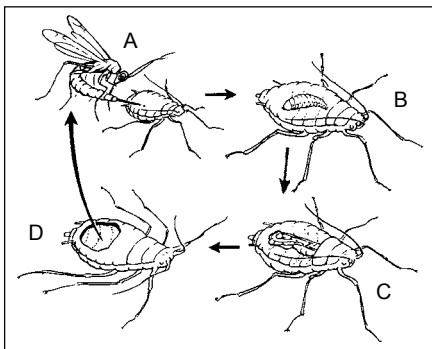







Figure 7. Life cycle of an aphid parasite. A: An adult parasite lays an egg inside a live aphid. B: The egg hatches into a parasite larva that grows as it feeds on the aphid's insides. C: After killing the aphid, the parasite pupates. D: An adult wasp emerges from the dead aphid then flies off to find and parasitize other aphids.



Figure 8. Mummified aphid bodies indicate that they have been parasitized. The parasitic wasp (center) has emerged from the circular hole in the top left mummy.

Table 1. Common Aphids on Vegetables and Flowers.

Common name	Scientific name	Common hosts
bean aphid 	<i>Aphis fabae</i>	legumes, various woody ornamentals, and flowers
cabbage aphid 	<i>Brevicoryne brassicae</i>	cole crops and other mustard family plants
green peach aphid 	<i>Myzus persicae</i>	peppers, spinach, tomato, cucurbits, carrot, lettuce, legumes, corn, flowers, flowering plum, and stone fruit
melon (cotton) aphid 	<i>Aphis gossypii</i>	cucurbits, carrot, citrus, many flowers, and various woody landscape ornamentals
potato aphid 	<i>Macrosiphum euphorbiae</i>	potato, spinach, lettuce, tomato, and many others

Photos by J. K. Clark

Lady Beetle Releases

Applying commercially available lady beetles (the convergent lady beetle, *Hippodamia convergens*) may give some temporary control when properly handled, although most of them will disperse from your yard within a few days.

If releasing lady beetles, keep them refrigerated until just before letting them go, doing so at dusk, as those released in broad daylight will fly away immediately. Mist the lady beetles with water just before release, and also mist the surface of the plant you are releasing them onto. Place the lady beetles at the base of infested plants or in the crotches of low branches. Lady beetles will crawl higher into the plant in search of aphids. University of California research indicates that high numbers of lady beetles are required to control aphids. One large, heavily infested rose bush required two applications, spaced a week apart, of about 1,500 lady beetles each. For more information about making lady beetle releases, see UC IPM's convergent lady beetle page in the Natural Enemies Gallery.






Aphids are very susceptible to fungal diseases when it is humid. These pathogens can kill entire colonies of aphids when conditions are right. Look for dead aphids that have turned reddish or brown; they'll have a fuzzy, shriveled texture unlike the shiny, bloated, tan-colored mummies that form when aphids are parasitized.

Weather can also impact aphids. Summer heat in the Central Valley and desert areas reduces the populations of many species, and aphid activity is also limited during the coldest part of the year. However, some aphids may be active year-round, especially in the milder, central coastal areas of California.

Ant Management

In some situations ants tend aphids and feed on the honeydew aphids excrete. At the same time, ants protect the aphids from natural enemies. If you see ants crawling up aphid-

Table 2. Common Aphids of Fruit Trees.

Common name	Scientific name	Common hosts	Comments
green apple aphid 	<i>Aphis pomi</i>	apple, pear, hawthorne, cotoneaster	
leaf curl plum aphid 	<i>Brachycaudus helichrysi</i>	plum, prune	curls leaves, goes to Asteraceae in summer
mealy plum aphid 	<i>Hyalopterus pruni</i>	plum, prune	curls and stunts leaves, goes to cattails and reeds in summer
rosy apple aphid 	<i>Dysaphis plantaginea</i>	apple	curls leaves, goes to plantain in summer
woolly apple aphid 	<i>Eriosoma lanigerum</i>	apple, pear, pyracantha, hawthorn	primarily found on wood or roots, creates galls in roots and waxy deposits

Photos by J. K. Clark

infested trees or woody plants, put a band of sticky material (e.g., Tangle-foot) around the trunk to prevent ants from climbing up. (Don't apply sticky material directly to the bark of young or thin-barked trees or to trees that have been severely pruned, as the material may have phytotoxic effects. Wrap the trunk with fabric tree wrap or duct tape and apply sticky material to the wrap.)

Alternatively, ant stakes or containerized baits may be used on the ground to control ants without affecting aphids or their natural enemies. Prune out other ant routes such as branches touching buildings, the ground, or other trees.

Cultural Control






Before planting vegetables, check surrounding areas for sources of aphids and remove these sources. Some aphids build up on weeds such as sowthistle and mustards, moving onto related crop seedlings after they emerge. On the other hand, these aphid-infested weeds can sometimes provide an early source of aphid natural enemies. Always check transplants for aphids and remove them before planting.

Where aphid populations are localized on a few curled leaves or new shoots, the best control may be to prune out these areas and dispose of them. In large trees, some aphids thrive in the dense inner canopy; pruning out these areas can make the habitat less suitable.

High levels of nitrogen fertilizer favor aphid reproduction, so never use more nitrogen than necessary. Instead, use a less soluble form of nitrogen and apply it in small portions throughout the season rather than all at once. Slow-release fertilizers such as organic fertilizers or urea-based time-release formulations are best.

Because many vegetables are susceptible to serious aphid damage primarily during the seedling stage, reduce losses by growing seedlings under protective covers in the garden, in a greenhouse, or inside and then transplanting them when the seed-

Table 3. Some Problematic Aphids on Woody Ornamentals.*

Common name	Scientific name	Common hosts	Comments
ash leaf curl aphid 	<i>Prociphilus</i> species	ash (other Prociphilus species attack other trees)	causes leaves to curl, distort, and form pseudo-galls
crapemyrtle aphid 	<i>Sarucallis kahawaluokalani</i>	crapemyrtle	
giant conifer aphid 	<i>Cinara</i> species	fir, pine, spruce, cedar	may be mistaken for ticks
hackberry woolly aphid 	<i>Shivaphis celti</i>	hackberry	produces waxy tufts
oleander aphid 	<i>Aphis nerii</i>	oleander, milkweed	

* Green peach aphid, bean aphid, and melon aphid may also occur on many woody ornamentals. Photos by J. K. Clark, except crapemyrtle aphid, Jim Baker, North Carolina State University, Bugwood.org

lings are older and more tolerant of aphid feeding. Protective covers will also prevent transmission of aphid-borne viruses.

Silver-colored reflective mulches have been successfully used to reduce transmission of aphid-borne viruses in summer squash, melon, and other susceptible vegetables. These mulches repel invading aphid populations, reducing their numbers on seedlings and small plants. Another benefit is that yields of vegetables grown on reflective mulches are usually increased by the greater amount of solar energy reflecting onto leaves.

To put a reflective mulch in your garden, remove all weeds and cover beds with mulch. Bury the edges with soil to hold them down. After the mulch is in place, cut or burn 3- to 4-inch diameter holes and plant several seeds or a single transplant in each one. In addition to repelling aphids, leafhoppers, and some other insects, the mulch will enhance crop growth and control weeds. When summertime temperatures get high, however, remove mulches to prevent overheating plants.



Ready-to-use reflective mulch products include silver-colored plastic sold in rolls. You can also make your own by spray-painting construction paper, landscape fabric, or clear plastic. If you use plastic mulches, you will need to use drip irrigation underneath. Landscape fabric and most paper mulches will allow water to flow through.

Another way to reduce aphid populations on sturdy plants is to knock off the insects with a strong spray of water. Most dislodged aphids won't be able to return to the plant, and their honeydew will be washed off as well. Using water sprays early in the day allows plants to dry off rapidly in the sun and be less susceptible to fungal diseases.

Chemical Control

When considering whether to apply insecticides for aphid control, remember that most larger plants can tolerate light to moderate levels of

Table 3. Some Problematic Aphids on Woody Ornamentals.* ... continued from previous page

Common name	Scientific name	Common hosts	Comments
rose aphid 	<i>Macrosiphum rosae</i>	rose	
tuliptree aphid 	<i>Illinoia lirioidendri</i>	tuliptree	

* Green peach aphid, bean aphid, and melon aphid may also occur on many woody ornamentals. Photos by J. K. Clark, except crapemyrtle aphid, Jim Baker, North Carolina State University, Bugwood.org

aphids with little damage. Larger aphid populations often rapidly decline due to biological control or when hot temperatures arrive. Often a forceful spray of water or water-soap solution, even on large street trees, when applied with appropriate equipment, will provide sufficient control.

If insecticides are needed, insecticidal soaps and oils are the best choices for most situations. Oils may include petroleum-based horticultural oils or plant-derived oils such as neem or canola oil. These products kill primarily by smothering the aphid, so thorough coverage of infested foliage is required. Apply these materials with a high volume of water, usually a 1 to 2% oil solution in water, and target the underside of leaves as well as the top. Soaps, neem oil, and horticultural oil kill only aphids present on the day they are sprayed, so applications may need to be repeated. Although these materials can kill some natural enemies that are present on the plant and hit by the spray, they leave no toxic residue

so they don't kill natural enemies that migrate in after the spray.

These and other insecticides with contact-only activity are generally ineffective in preventing damage from aphids such as the leaf curl plum aphid or the woolly ash aphid, which are protected by galls or distorted foliage. Also, don't use soaps or oils on water-stressed plants or when the temperature exceeds 90°F. These materials may be phytotoxic to some plants, so check labels and test the materials on a portion of the foliage several days before applying a full treatment.

Supreme- or superior-type oils will kill overwintering eggs of aphids on fruit trees if applied as a delayed-dormant application just as eggs are beginning to hatch in early spring. (On plums dormant applications right after leaves have fallen in early November are preferred.) These treatments won't give complete control of aphids and probably aren't justified for aphid control alone but will also control soft scale insects if they are

a problem. Common aphid species controlled with these types of oils include the woolly apple aphid, green apple aphid, rosy apple aphid, mealy plum aphid, and black cherry aphid.

Many other insecticides are available to control aphids in the home garden and landscape, including foliar-applied formulations of malathion, permethrin, and acephate (nonfood crops only). While these materials may kill higher numbers of aphids than soaps and oils, their use should be limited, because they also kill the natural enemies that provide long-term control of aphids and other pests, and they are associated with bee kills and environmental problems. Repeated applications of these materials may also result in resistance to the material.

Insecticides such as oils and soaps are also safer to use when children and pets may be present. Formulations combining insecticidal soaps and pyrethrins may provide slightly more knockdown than soaps alone yet have fewer negative impacts on natural enemies than malathion, permethrin, and acephate, because pyrethrins break down very quickly.

Systemic insecticides are also available for aphid management, primarily for woody ornamentals. These materials, including imidacloprid, are very effective and are especially useful for serious infestations of aphids such as the woolly hackberry aphid, which is often not effectively controlled by biological control or less toxic insecticides. Imidacloprid can have negative impacts on predators, parasitoids, and pollinators, so its use should be avoided where soaps and oils will provide adequate control. To protect pollinators, don't apply imidacloprid or other systemic insecticides to plants in bloom or prior to bloom.

Home-use soil-applied imidacloprid products are often diluted with water in a bucket and poured around the base of the tree or plant. Professional applicators can use soil injectors, which provide better control with less runoff potential. Applications are

usually made in spring when aphids first become apparent.

Adequate rain or irrigation is required to move the product through the soil to the roots and up into large trees, and it may take several weeks to see an effect on aphids feeding on leaves. One application on hackberry is enough to control hackberry woolly aphid for two to three years. See *Pest Notes: Hackberry Woolly Aphid* for more discussion about control methods using imidacloprid.

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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