

ORGANIC POTATO PRODUCTION ON CALIFORNIA'S CENTRAL COAST: A Guide for Beginning Specialty Crop Growers



Introduction

Potatoes can be a good addition to a small-scale, mixed specialty crop system. With access to the proper tools for mechanized weed management, hilling, and harvest, they are relatively easy to grow. Multiple varieties offer an array of shapes, sizes, and colors to make potatoes an excellent choice for direct sales, including Community Supported Agriculture (CSA), farmers' markets, specialty markets, and restaurants.

The Central Coast's climate is ideal for potato production. Yields can reach an impressive 10 tons per acre. This guide describes the steps involved in growing potatoes organically, reviews equipment needs, and provides information on "new" and "creamer" potato growth habits and recommended varieties.

Features of potato production

- Can be harvested as "new," "creamer," or fully cured storage potatoes, all of which can be grown on the same production schedule
- Easy to store when fully cured
- Mechanization makes weed management and harvest extremely efficient
- A good rotation crop where symphylan pressure is high, being extremely tolerant to symphylan feeding pressure; they have been shown to reduce symphylan populations in subsequent crops

PRODUCTION PRACTICES – SUMMARY

Soil type and pH

- Potatoes grow best in loose, well-drained, non-crusting, sandy loam or loam soils with high organic matter content and pH between 5.5 and 6.5.

Site selection

- Isolate successive potato plantings, and plant as far as possible from other susceptible crops such as tomatoes to minimize the risk and impact of late blight (*Phytophthora infestans*).

Fertility requirements

- Fall/winter cover crop (bell beans, triticale, vetch).
- Compost, as needed (5 tons/acre).

Soil temperature

- Seed pieces can germinate when soil temperatures are cool (less than 55°F).

Bed spacing

- Bed spacing of 48" allows for a balance of workability and yield potential.
- 30" bed spacing is possible if using 4-gang Lilliston cultivators, disc hillers, or shovels.
- 60" beds provide for ease of field operations, but may reduce yield potential.
- Potatoes grow best planted in a single line per row to allow for "hilling" (see page 5) to ensure that potatoes are covered with soil. Potatoes exposed to sunlight turn green and become unmarketable.

Plant spacing within row

- 8–12" between plants in the row. Closer spacing will result in smaller tubers (see page 9, New and Creamer Potatoes).

Planting size and depth

- Use 1.5–3 ounce seed pieces with at least 2 "eyes."
- Place seed pieces 2–4" deep.

Irrigation

- Pre-irrigate beds with overhead sprinklers and cultivate for weed management.
- Use drip irrigation after planting; overhead irrigation increases risks of fungal infection, *Phytophthora infestans* (late blight).

Days to maturity

- Most varieties suitable for the Central Coast region reach full maturity in 100 to 120 days.
- Harvest "new" potatoes at the growth stage following bloom when the canopy is full, typically 8–9 weeks after planting, depending on variety and weather.
- Harvest "creamers" 10–12 weeks after planting, depending on variety and weather.

Crop rotation

- Rotate ground out of solanums and strawberries for a minimum of 4 years to break disease cycles.



PRODUCTION SEQUENCE – OVERVIEW

(crop day -25*)

In spring, mow cover crop to facilitate breakdown.

(crop day -25) Incorporate cover crop residue.

(crop day -11) Form beds with rolling cultivator or listing shovels.

(crop day -21) Begin chitting potato seed.

(crop day -10) Pre-irrigate beds with overhead irrigation (1–1.5"). Wait for dry down and weed emergence.

(crop day -3) Cut potato seed in preparation for planting.

(crop day -1) Work bed surface lightly with cultivator to terminate weeds and re-form beds.

(crop day 0) Create a trench down the center of the bed using a small furrowing shovel or an "Alabama" shovel. Plant potatoes, cover seed lightly with 3–4" of soil using a rolling cultivator (run slowly).

(crop day 11) As soon as first weeds appear, cultivate furrow bottoms and bed sides with sweeps and knives. In the same pass, run chisels in furrow bottoms to break tractor tire compaction.**

(crop day 11) Set up drip irrigation

(crop days 30, 40) Hill plants with soil as potato stems elongate (usually twice prior to bloom).

(crop day 30) Begin drip irrigation. Note: Drip irrigate to maintain even moisture until the tubers for main crop harvest are ~75% of desired size, then cut irrigation and let vines die. Potatoes will continue to size up.

(crop days 55–95) Check tuber size after flowering. Harvest new potatoes at 8–9 weeks after planting; creamers at 10–12 weeks.

(crop day 60) Spot weed large flowering weeds.

(crop day 116) Run overhead irrigation (0.25–0.5") prior to harvest of main crop to make harvest easier and avoid scuffing.

(crop days 120, 140) Harvest main potato crop.

(crop days 160) Pull drip lines.

(crop day 180) Disc plants, prepare soil for fall cover crop.

Drill cover crop seed prior to fall/winter rains.

*Numbers in parentheses refer to crop day, with crop day 0 = planting day, based on a typical season at the CASFS/UC Santa Cruz Farm.

See Appendix (page 12) for more on crop days and related activities.

**Some growers use a flame weeder at this stage, ideally just before potato leaf emergence, but even just after emergence, if necessary.

Production Practices — Additional Details

Soil type

Potatoes grow best on light textural soil classes: sands and silts with organic matter (O.M.) >3%. Potato tubers have a high respiration rate, and require ample oxygen in the soil. Lighter soils let in air that allow potatoes to breathe. Lighter soil textures also offer less physical resistance to tuber formation; thus the plant can put more caloric energy into forming large, cosmetically even tubers. Lighter, sandier soils also make harvest easier.

Heavier soils higher in clay content tend to provide better fertility and water holding capacity, but can cause tuber deformation, and make washing challenging. Although you cannot change the texture of soil, you can enhance its structure by increasing its organic matter content by adding compost and incorporating cover crops (green manures).

Fertility

Potatoes yield well when planted following incorporation of a mixed legume/cereal cover crop, e.g., bell bean (30–35%), peas (20–30%), vetch (30%), and triticale (10–15%). When incorporated well, the cover crop residue leaves the soil loose and friable, and microbial decomposition releases nutrients to provide adequate fertility (available nutrients).

If applying compost, use a rate of not more than 5 tons per acre (100 lb. N per acre) to avoid over-application of nitrogen (N). Excess nitrogen can:

- Make plants more susceptible to late blight (*Phytophthora infestans*)
- Delay tuber set and maturation
- Increase water content in tubers, which leads to a shorter storage life and more post-harvest physiological disorders

Bed spacing

Plant potatoes in a single line system to facilitate hilling. Depending on equipment available and standard bed spacing used on your farm, beds can be spaced from 30" up to 60" center to center. Hilling potatoes is more challenging with narrower beds; 4-gang Lilliston cultivators, disc hillers, or shovels are potential options with this spacing. Wider bed spacing means loss of yield potential. Consider the trade-offs between ease of hilling operations, efficiencies of land use, and labor required to adjust equipment. Take into account the other crops you grow, and choose the bed spacing that works best for your farming system as a whole.

Timing of planting

Spring is the best time to plant potatoes on California's Central Coast. Potato seed pieces can easily germinate in cool soils (less than 55°F). Plant following incorporation and initial breakdown of cover crop residue, typically in late April or early May. The goal is for the crop to develop prior to the onset of foggy conditions that favor late blight infestations in late summer (August). Staggered plantings are not recommended in areas where fog may be a factor. Some growers successfully plant in late July, growing a fresh market crop for fall holidays. In inland valleys, potatoes are usually planted in February so that tuber maturation takes place prior to high summer temperatures that can delay tuber formation.

Preparing seed potatoes for planting

"Certified seed" sold for planting has been inspected and meets the tolerance for pest and disease disorder symptoms established by an agricultural certification program (e.g., White Rock Specialties seed is certified by the Colorado Board of Agriculture). This use of the word "certified seed" is complementary to, and distinct from the meaning of seed that is "certified organic." The National Organic Program (NOP) requires that organic growers purchase organic seed, unless the variety needed (or an equivalent variety) is not commercially available in an appropriate form, quantity, or quality.

To prepare seed for planting (also called "greening" or "chitting"), bring potatoes to room temperature (or warm up your cooler to 50–55°F) two to three weeks before planting to initiate sprouting. Expose to bright shade, but do not let them dry out while sprouting.

Seed potatoes that are large enough can be cut into smaller pieces to extend planting stock volume. Cut tubers into



FIGURE 1. Preparing seed pieces for planting. Photo: Elizabeth Birnbaum



FIGURE 2. Alabama shovels with “drop tubes” for placing seed pieces. Photo: Martha Brown



FIGURE 3. Plant potato seed into furrows created by furrowing or Alabama shovels. Photo: Martha Brown

1.5–3-ounce pieces (a little larger than a hen’s egg) with at least two “eyes” on each cut piece (Figure 1). Cut through the center of the potato and allow the cut to heal over for 3 days prior to planting. Seed cut immediately before planting may experience decay in the ground, especially if soil is too dry or too warm at planting.

Planting technique

Because tubers form adjacent to and above the seed piece, place seed as deep as possible. Deep planting leaves room to

“hill” the plant as the stems elongate (see below). However, plant no deeper than the depth of your harvester to reduce risk of slicing potatoes during harvest.

Create a depression down the middle of the planting bed—to the depth of the furrow if possible—using a small furrowing shovel or an “Alabama” shovel (Figure 2). Drop the seed pieces into this depression or trough (Figure 3) and cover with 3–4” of soil (enough to cover the seed pieces and keep them from drying out) by re-forming the bed using a rolling cultivator, reverse disc hillers, or shovels.

Hilling potatoes

Re-form the beds after planting deep, then again after the plants emerge, building the beds higher to keep potatoes covered with soil as the stems elongate (Figure 4). This re-forming of the bed, or “hilling,” is essential for potato production because it blocks sunlight from the tubers as they form. Any light contact causes “greening”; the presence of chlorophyll and potential for accumulation of toxins (glycoalkaloids), render any green tuber unmarketable. Hilling also facilitates weed management and boosts yields.

Potatoes grow remarkably fast once they emerge (usually about 14 days after planting). Do the first mechanical hilling once plants reach a height of 8–10” (within 30–33 days after planting). Use a rolling cultivator during this time of initial growth to smother any weeds germinating in the bed, and to keep furrows clean of annual weeds. Work the furrows with shallow chisels to break tractor wheel compaction and deepen the furrows. Do the second hilling 5–7 days after the first (Figure 5). On small plots, hilling can be done by hand with a shovel.

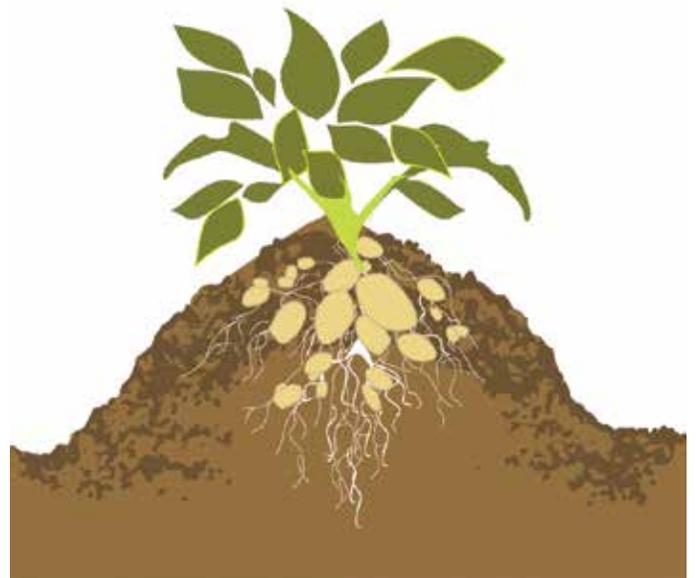


FIGURE 4. Potatoes developing in a “hill.” Illustration: Laura Vollset



FIGURE 5. Hilled potatoes at the UC Santa Cruz Farm.
Photo: Elizabeth Birnbaum

Irrigation

Drip irrigation is the best option for potatoes, allowing you to control irrigation rate and timing, and apply water directly to the growing plants. At planting, set the drip lines in the center of the bed on top of the seed pieces; cover it as you close the furrow and bury it further as you hill the potatoes (note that you can also lay drip tape after the plants have emerged). See the irrigation sequence at right.

Potatoes can be irrigated overhead, but this method favors development of late blight due to prolonged periods of leaf wetting. If overhead sprinklers are used, irrigate mid-day following dry-down of foliage from morning dew, and shut down the sprinklers early enough for leaves to dry prior to sunset.

IRRIGATION SEQUENCE

- Pre-irrigate with a minimum of 1–1.5" using overhead irrigation (if available) to bring up weeds and provide adequate deep soil moisture to support the early growth stage of the potato seed pieces. Cultivate before planting. (See *Tillage, Bed Formation, and Planting to Moisture* in this Grower Guide series for additional details.)
- Plant seed pieces into residual moisture.
- Lay drip line at time of planting or once plants have emerged.
- Initiate drip irrigation after plants have emerged and are well established (between 2 and 4 weeks after planting), and the first hilling has taken place. Depending on weather and soil conditions, pre-irrigation moisture deep in the soil may be adequate to support up to 3 or 4 weeks of growth.
- Schedule irrigations based on regional evapotranspiration (Et) data (available at cimis.water.ca.gov):
 - When plants are at 25% canopy (percentage of the bed's soil covered by crop foliage), irrigate at a rate roughly equal to 25% of the estimated daily Et.
 - Follow this percent canopy rule to determine irrigation rate; when plants are at 100% canopy, irrigation will match Et.
 - During the period of tuber enlargement (usually days 60–90), field capacity should not drop below 60–65%. Uneven irrigation in this phase leads to uneven tuber formation and jeopardizes marketability.
 - Water can be cut to "dry off" and cure crop once plants start to show signs of senescence (yellowing of leaves) and tubers have reached ~75% of marketable size. Wait another 10–14 days before harvest for skins to cure.
 - Apply .25–.5" of water prior to harvesting the main crop to make harvest easier, and to avoid scuffing spuds, which can compromise salability and storage life.

GROWTH PHASES

Phase 1: Vegetative establishment, 0–30 days

Most vegetative growth occurs during this phase. Adequate pre-plant nitrogen (in the nitrite form) ensures a large, effective plant that can support tuber development through sugar and starch translocation.

Phase 2: Stolen and tuber initiation, 30–60 days

Flowering begins at approximately 40–50 days (Figure 6). Dig “new” potatoes during this phase (see sidebar, page 9).

Phase 3: Tuber enlargement, 60–90 days

It is critical to provide adequate irrigation during this phase. Dry down should be less pronounced than in phases 1 and 2; never let the plants get to less than 60–65% field capacity. Dig “creamer” potatoes during this phase (see sidebar, page 10).

Phase 4: Tuber enlargement, skin set and curing, 90–120 days

Tubers enlarge, increase in starch content and individual varietal characteristics. Skins set and thicken, allowing for long-term storage.



FIGURE 6. Potatoes begin to flower at approximately 40–50 days post planting. Photo: Elizabeth Birnbaum



Harvest and harvesting equipment

“New” potatoes (see next page) must be harvested by hand. Push a garden fork under the cluster of potatoes and gently lift the plant by the leaves as you push down on the fork handle to raise the tubers to the surface (Figures 7 and 8). New potatoes are extremely delicate; handle very gently to avoid damaging the skin.

When harvesting mature tubers by hand, the process is the same. Take extra care not to “fork” through the potatoes, but get under the tubers.

Use a dedicated potato harvester or an under-cutter pulled behind a tractor for mechanized harvest. For potato production areas much larger than one-quarter acre, it is best to harvest mature tubers with a dedicated potato harvester, such as a single-row PTO- operated digger with an undercutter bar and shaker cage. The harvester lifts the spuds and leaves them on the soil surface to pick up (Figures 9 and 10). Break the furrow tire compaction with chisels before harvest to ensure that the under-cutter or harvester can get below the lowest tuber and work effectively.



FIGURE 7. Harvest new potatoes using a garden fork. Photo: Elizabeth Birnbaum



FIGURE 8. Handle new potatoes gently to avoid damaging the fragile skins. Photo: Elizabeth Birnbaum

“NEW” POTATOES AND “CREAMERS”

Both new potatoes and creamers offer good niche marketing possibilities, including CSA projects, farmers’ markets, roadside stands, and restaurants.

NEW POTATOES are simply young, small, freshly-dug potatoes. They must be marketed quickly (within a few days of harvest) and will last only 7–10 days (refrigerated).

The possibility of digging 100–200 pounds per day for 2–3 weeks offers early season income and a premium price. Also, if well done, new potatoes can create a loyal following of customers and improve your “brand.”

In theory, any variety can be used for new potatoes, but those described as early season (maturing in <90–100 days) work best, as they tend to set ample tubers early, and size up evenly.

Suggested varieties include–

‘Red Gold’

‘Early Red Norland’ (distinct from ‘Dark Red Norland’, which is a high-yielding, mid-season variety)

‘Mountain Rose’

Planting seed of the above varieties are easy to source. They are all spectacularly early and high yielding, producing 2.5–3 pounds/plant at 60+ days from planting. The following also offer a reasonable ratio of pounds per plant to days in the ground (most are red varieties)–

‘Anoka’ (very early, difficult to source)	‘Cherry Red’	‘Purple Viking’
‘Caribe’	‘Desiree’	‘Red LaSoda’
	‘Early Purple’	‘Rose Gold’
	‘Kerr’s Pink’	‘Yukon Gold’

Tips for Growing New Potatoes

- Use small, whole seed potatoes (1–2 ounces)
- Plant seed 8–9” apart, using standard row spacing
- Plant 2–4” deep in 6–8” deep trenches
- Hill plants at 20–30 days from emergence
- Dig when size of 6–10 tubers reaches 2–8 ounces, usually 60–75 days post planting
- Dig when soil is dry; box and let sit 1–2 days, then wash and pack
- Note that some nicked skins are inevitable with new potatoes. It identifies them as truly new and freshly dug.

CREAMER POTATOES offer another niche market that can generate some early season income due to high demand and relatively low supply.

Creamer potatoes are similar to new potatoes in that they are small (2–4” in diameter, 2–4 ounces). They may be dug early or at full maturation. The main distinction is that they have thicker skins and are thus easier to dig and pack than new potatoes, and rival storage potatoes in their shelf life.

Although not as moist, light, and sweet as new potatoes, they do have an intense, earthy taste and texture that makes them more distinctive than full-size storage potatoes, and offer more nutritional value than new potatoes.

Creamer potatoes show themselves off both on display and on the plate. They can be displayed for loose pack in small net bags by mixing varieties, shapes, sizes, and colors.

As with new potatoes, choose early varieties with plants that mature at <90–100 days. In addition to those listed for new potatoes, preferred varieties include:

‘Austrian Crescent’ (fingerling)

‘Early Ohio’

‘Viking Purple’

Fingerling varieties (2–3” long) can also be adapted for this format.

Tips for Growing Creamer Potatoes

- Use close in-row spacing when planting (5–6”)
- Grow for 10–12 weeks
- Kill vines (mechanically)
- Dry off (no irrigation) 7–10 days before harvest to set skin
- Hand dig, box, and refrigerate
- Wash only when needed for packing and distribution



FIGURE 9. Example of a PTO-driven harvester with “shaker cage.” Photo: Martha Brown



FIGURE 10. Shaker cage deposits harvested potatoes on the soil surface. Photo: Martha Brown

Post-harvest handling

Tubers going direct to market are usually washed immediately after harvest, especially if the soil is prone to sticking. Tubers harvested for storage should not be washed, as water can spread disease (especially fungal spores that cause late blight), and increase potential for higher incidence of infection while in storage.

Crop rotation

Because potatoes are host to many of the same diseases commonly found on other Solanaceae family crops (tomatoes, peppers, etc.), as well as strawberries, rotate ground out of solanums and strawberries for a minimum of 4 years.

Late blight (*Phytophthora infestans*) is the primary disease of potatoes in the Central Coast region. Because the fungal spores that cause late blight move easily with water and wind, it is best to keep a significant buffer between blocks of potatoes and tomatoes since the blight will most often start on the foliage of potatoes (early season) and spread to tomatoes.

Pests and Diseases

Before you select varieties and plant your potato crop, look up common pests and diseases that affect the crop in your area. Learn about pest and disease life cycles, preventive practices, and possible treatments using resources such as the UC IPM website (ucipm.edu), your county Cooperative Extension offices, ATTRA's Biorationals: Ecological Pest Management Database (www.ncat.org/attra-pub/biorationals), neighboring farmers, and other knowledgeable professionals.

The main potato arthropod pests in the Central Coast region are:

- Tuber moth, *Phthorimaea operculella*: larvae cause economic damage when they tunnel into potato tubers, both in the field and in storage.
- Aphids and viruses—Green peach aphid, *Myzus persicae* and Potato aphid, *Macrosiphum euphorbiae*: aphids act as vectors that transmit Potato Leaf Roll Virus (PLRV), cucumber mosaic and alfalfa mosaic (calico) viruses.
- Cucumber beetle: Western spotted cucumber beetle, *Diabrotica undecimpunctata undecimpunctata*, and Western striped cucumber beetle, *Acalymma trivittatum*: damage foliage.

- Tuber Flea Beetles, *Epitrix tuberis*: beetle larvae feed on tubers.
- Wireworms. Common local species of wireworms include: Pacific coast wireworm, *Limonius canus*. Sugarbeet wireworm, *Limonius californicus*. Dryland wireworm, *Ctenicera pruinina*: wireworms are click beetle larvae that live in the soil. They cause economic damage by eating potato seed pieces or roots of young plants, or burrowing into developing tubers.

The main potato diseases in the Central Coast region are:

- Late Blight, *Phytophthora infestans*: late blight develops rapidly, and can defoliate a crop within a few weeks.
- Verticillium Wilt, *Verticillium dahliae*: this wilt appears as yellowing (chlorosis) and death (necrosis) of lower leaves; it interferes with the plant water transport (vascular) system, so the impact becomes visible quickly in hot weather.
- Scab, *Streptomyces* spp.: causes potato tubers to be unmarketable.

See *Organic Pest and Disease Management in Selected Crops on California's Central Coast* in this **Grower Guide** series for additional information on the pests and diseases listed here, and suggestions for their control in potatoes.

ADDITIONAL RESOURCES

Introduction to weed management in a small scale organic production system (video). Produced by the Center for Agroecology & Sustainable Food Systems.

www.youtube.com/user/casfsvideo

Knock weeds out at critical times, by Mark Schonbeck. eOrganic, 2010. articles.extension.org/pages/18882/knock-weeds-out-at-critical-times

Ospud participatory organic potato project, Oregon State University. horticulture.oregonstate.edu/content/

[publications-and-presentations-ospud-project](#)

Pest management strategic plan for organic potato production in the west.

Summary of workshops held on February 16, 2006, Buhl, Idaho and January 9, 2008, Portland, Oregon. Jennifer Miller, Ronda Hirnyck, Lisa Downey-Blecker. Issue Date, December 19, 2008.

www.ipmcenters.org/pmsp/pdf/CA-CO-ID-OR-WAOrganicPotatoPMSP.pdf

Potatoes: Organic production and marketing, by Rex Dufour, Tammy Hinman, and Jeff Schahczenski. NCAT IP337, 2009.

attra.ncat.org/attra-pub/summaries/summary.php?pub=96

Selecting, cutting and handling potato seed, Bulletin #2412, 2015, by Steven B. Johnson, Ph.D., Extension crops specialist, University of Maine Cooperative Extension extension.umaine.edu/publications/2412e/

Organic Potato Production on the California's Central Coast: A Guide for Beginning Specialty Crop Growers by Jim Leap, Darryl Wong, Orin Martin, and Kirstin Yogg-Comerchero, with contributions from Ann Baier and Doug O'Brien. Edited by and Martha Brown and Ann Baier.

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Photos, p. 1: Left, Martha Brown; top right, Elizaeth Birnbaum, bottom right, CASFS; p. 2: Elizabeth Birnbaum. Icon illustrations, p. 3, Laura Vollset.



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