



for the
Gardener

CENTER FOR AGROECOLOGY
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UC SANTA CRUZ

Growing Potatoes in the Home Garden

If you could cultivate a vegetable crop that could be grown in almost every climate (except hot tropical zones) from sea level to 15,000 feet, could be eaten for breakfast, lunch, dinner, and snacks, prepared in a myriad of ways, be easily kept without processing or refrigeration for up to 6–8 months, produced high yields (2–5 pounds per square foot) and was extremely nutritious (high in protein, vitamin C, niacin, B vitamins, iron and energy) but low in calories (sans butter and sour cream), you would wouldn't you? If you did you would be in the minority of home gardeners. Most gardeners eschew the illustrious “spud” (*Solanum tuberosum*), thinking it doesn't warrant space in the small garden and that home grown potatoes don't taste much better than their store-bought counterparts. Not true! Wrong on both counts.

Solanum tuberosum (the Andean potato) originated in the highlands of the Andes mountain ranges of South America (Peru, Columbia, Ecuador, Bolivia) at elevations up to 15,000 feet. Potatoes have been in cultivation for more than 2000 years and there are more than 2,000–3,000 varieties extant today. It is an herbaceous perennial in its native habitat, but treated as a tender annual in the temperate zones and damaged by frost at 28°–30° F.

The plant's only edible portions are the tubers produced underground, apically (at the tip) on stolons (horizontal underground stems; see drawing at right). While potatoes produce viable seed, the genetic makeup of sexually-produced plants is so diverse and variable (heterozygous) that production from this seed is negligible. Thus potatoes are propagated asexually from “seed pieces,” either small whole tubers or cut pieces containing one or more “eyes” (vegetative shoot buds). The tubers themselves are modified stems. If you stand a spud on end and cut it in half, the interior displays a pithy central core (stem) with branches leading to the eyes. The tuber's original purpose was to store carbohydrates, sit dormant over the winter and enable the tuber to sprout new shoots and begin a new life cycle the following year.

CLIMATE

The potato is a cool season crop that is sensitive to high temperatures, especially during the period of tuber initiation and enlargement. It requires a frost-free season of 100–120 days to produce a crop suitable for storage. Northern

latitudes compensate for a shorter growing season with increased day lengths.

Optimal air temperatures for vine growth are 60°–65° F, with a maximum of 80° F and a minimum of 45° F. Tuber production is reduced at soil temperatures of greater than 75° F and virtually stops above 85° F. Cool night-time temperatures can compensate somewhat for warm daytime temperatures.

Day length also has an effect on tuber production. The lengthening days of late spring and early summer produce optimal vine growth, while the shorter days of late summer favor tuber initiation and enlargement.



Potato plants grow from a “seed piece” (darkened in this schematic). The tubers develop at the tips of underground stems.

CULTURAL REQUIREMENTS

SEED SOURCES

It is important to use certified disease-free “seed” (see Seed Sources, end of article). Homegrown seed or seed from a gardening neighbor will also work well if it is free of disease. The purpose of the planted seed piece is to shuttle nutrients into the new growing shoots and insure a vigorous start to the growing cycle, irrespective of soil and air temperatures in the cool weather of spring. In fact for the first two to three weeks after emergence, the plant relies almost exclusively on the stored carbohydrates of the seed piece rather than on photosynthesis.

The ideal seed piece is a whole tuber weighing 2–4 ounces (a little larger than a golf ball) with 2 or more live eyes. Larger seed pieces have an excess of carbohydrates that can be a source of rot. Unfortunately, it is virtually impossible to buy 2–4 ounce seed tubers. Thus cutting larger tubers into appropriate size pieces with two or more eyes is standard practice. Cut seed pieces can be dusted with lime, gypsum, or woodash to reduce seed piece rot.

Another garden-scale practice is to “chit” seed pieces. This involves placing seed tubers in a flat or tray, apical tip facing upward, in indirect sunlight at 60°–70° F, with high (85%) relative humidity. These environmental conditions force the apical bud into growth, producing a short, stout shoot. With careful handling these seed pieces can be planted with two notable results: sprouted tubers resist rot much more effectively than dormant seed pieces, and the crop will mature 10–14 days earlier.

NUTRIENTS

Like many crops with a long maturation period, potatoes are heavy feeders, requiring high fertility levels to produce

an abundant crop. They have a very “efficient” fibrous root system that responds well to fertility inputs, particularly of nitrogen and potassium. The nitrogen is needed almost entirely in the early phases of growth to produce a large plant, as optimal yields are assured by an abundant supply of carbohydrates furnished by the leaves. Potassium is necessary for the high starch content and keeping quality of the tubers.

Potatoes respond to green manures, although you will have to delay planting until the green manure crop decomposes after being turned under. A compost made of a grass/legume cover crop along with a blend of 70% horse manure (high in potassium) and chicken manure (high in nitrogen and phosphorous), plus straw creates a balanced mix of nutrients with an emphasis on nitrogen and phosphorous. The compost mix should be applied at and slightly above the eventual effective feeding root zone of the plant (the top 12”–15” of soil). While the compost needs to be stable, potatoes can deal with a slightly less mature compost than most vegetable crops.

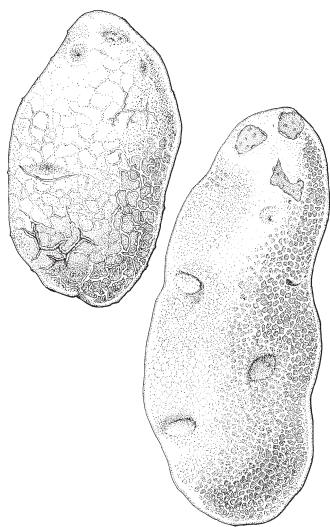
SOIL TYPE AND PREPARATION

Potatoes produce best on lighter textural classes – sands and silts. These lighter soils offer less physical resistance and thus bigger and more uniformly shaped tubers. They also have a greater aerobic capacity to fuel tuber respiration and speed their enlargement. Well-drained soils are requisite, especially on clay, to prevent rot. Potatoes are undoubtedly the most versatile vegetable at dealing with a wide range of pH – values of 5.0–7.0 are acceptable. At lower pH values, the incidence of scab (a fungal disease caused by *Streptomyces scabies*) is dramatically reduced.

It is somewhat a misnomer to call potatoes a deep-rooted crop. Almost all the feeding roots are at or above the seed piece. They have a fibrous root system that extends wider than deep (2 feet wide by 1 foot deep). Thus it is not necessary to prepare the soil deeply, but thorough preparation is needed to facilitate increased pore space for good drainage and uniform tuber enlargement.

Generally, potatoes are planted in V-shaped trenches (with soil banked up on the side) 8–18 inches deep. The seed pieces are planted in the bottom of the trench and covered with 2–6 inches of soil. In heavier textured soils and under wet conditions, a shallower planting is optimal. In sands and silts and under dry conditions, a deeper planting is preferred. It’s recommended that you not water the beds between planting and sprout emergence in order to reduce a variety of potato diseases. If the soil is dry, fully irrigate a few days before planting.

As the potatoes emerge and grow, the ridged up soil is drawn up around the base of the plants (see schematic, page 1), leaving the top 4 to 6 inches exposed. This “hilling up” process can be repeated once or twice. If this operation is



The familiar Russet potatoes last well in storage and are great baked or mashed.

Meg Stalcup

done in the morning when the plants are upright and turgid there is less chance of injuring the plants.

There are two main advantages to hilling –

- It protects surface-forming tubers from sunscald, or greening. Greening of potatoes is associated with the production of the alkaloid solanine, which is disruptive to the human digestive tract. Although solanine accumulates mostly in the skins, eating green potatoes should be avoided. Russet and fingerling varieties tend to form tubers on the surface, so hilling is essential.

- When auxiliary nodes along the stems are covered with soil, excluding light, the potential for stolen and tuber production increases, leading to an increased yield.

SPACING

To a great degree, distance between plants affects the number and size of tubers set. At 9 inches between plants the yield might be 3–4 pounds consisting of 8 to 10 tubers weighing 5–6 ounces each. At 2 feet between plants, plants will produce 4 to 6 tubers weighing 8–12 ounces each. Standard in-row plant spacing varies from 9–18 inches, with 12 inches being common. Distance between rows should be a minimum of 24–30 inches.

IRRIGATION

As might be obvious from observing the succulent biomass above ground and the high water content of the tubers below ground, potatoes are a water consumptive crop, requiring 1–2 inches of water per week. An even flow of water, especially during the period of tuber enlargement, is critical for evenly shaped tubers and high yields. As potatoes are subject to innumerable foliage diseases (see below), subirrigation (drip, T-tape or furrow) is superior to overhead sprinkling. As the plants begin to senesce and turn yellow, withhold irrigation for 10–14 days prior to harvest to finish off the crop and facilitate curing and storage.

HARVESTING AND STORAGE

When a digging test indicates that a variety is at the maximum preferred size (90–120 days, depending on variety), they can be cured for storage. This process slows the tubers' respiration and thickens their skin. Cut off the vines at ground level and remove them from the field to reduce the chance that spores of early and late blight (see below) or infection on the leaves will come in contact with the tubers. Test dig 8 to 10 days later to check the skins' toughness, leaving them a few more days if they're not yet ready.

Harvested tubers can be bagged or boxed and stored at 40°–50° F, with low light levels and high relative humidity (85%–90%). At temperatures less than 40° and approaching freezing, the starch is converted to sugar and the tubers develop an “off” taste and a caramelized look.

DISEASES

Like their relatives the tomatoes, potatoes are undoubtedly subject to more diseases than any other vegetable crop. Two principal disease that can potentially wreak havoc on a potato crop are late blight and early blight.

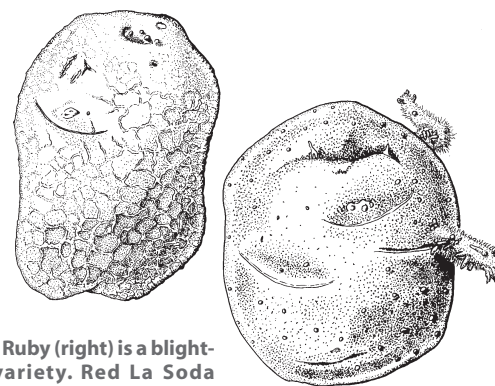
Late blight (*Phytophthora infestans*) is a fungal disease that attacks both potatoes and tomatoes. This is the culprit responsible for the devastating potato famines that swept Ireland and northern Europe in the 1840s. These famines are probably the most graphic example of overdependence on a limited gene pool in food crops. In reality, almost 100% of the Irish potato crop relied on one variety, a large storage potato named the “Lumper.”

Late blight attacks potato foliage during extended humid-wet warm conditions (mid 50's F to mid 70's F). Irregular-shaped, water-soaked areas occur on stems and leaves, and a downy white-gray growth appears initially on the underside of the leaves. The foliage eventually loses vascular capability and plants begin to rot, giving off a putrid stench. Tubers are infected not by downward movement of the disease in the plant, but by spores falling on the soil. A thick mulch can help retard the disease's spread.

Although it is termed late blight, this disease often strikes early in the crop season, due to cool, wet spring weather. It is possible to have a moderate infection and still achieve acceptable yields of tubers that are suitable to mid-term storage.

Tips for preventing late blight –

- Plant certified, disease-free “seed.”
- Delay planting until warm, dry weather is prevalent. In mild winter areas, spores overwinter on living plant tissue, on volunteer plants; in cold winter regions, they overwinter on infected tubers left in the ground.
- Reduce or eliminate overhead irrigation.
- Plant resistant varieties, such as Buffalo, Bison, Carola, and Carlotta.



Buffalo Red Ruby (right) is a blight-resistant variety. Red La Soda (left) is an excellent choice for new potatoes.

- Mulch plants to prevent spores moving from leaves to tubers.
- Use a 3–4 year rotation, avoiding all *Solanaceae* family members, i.e., tomatoes, peppers, and eggplant (which are also subject to late blight) between potato crops.

Early blight (*Alternaria solani*) is another potentially devastating potato disease. Ironically, early blight tends to strike late in the plant's growth cycle. Circular, concentric, dark brown lesions form on older leaves and cause yellowing, eventually stunting or killing the plant. Conditions and remedies are similar to late blight. Without using a microscope, it's difficult to distinguish late blight from early blight in the field.

GROWTH PHASES

The growth cycle of potatoes has four distinct phases –

1. Planting to Day 30: Emergence and almost complete vegetative establishment. Plants produce almost all their stem and leaf surface.

2. Day 30–60: Stolon and tuber initiation take place.

3. Day 60–90: Tuber enlargement. It is critical to have optimal environmental conditions and a steady flow of water during this phase.

4. Day 90–120: Senescence. Vines die down and skin thickens, which promotes long storage. During this phase tuber weight increases dramatically as does the conversion of water and sugars to starch. It is at this point that the individual taste traits of different varieties express themselves. Fully matured potatoes offer a much higher nutritional profile than “new” potatoes.

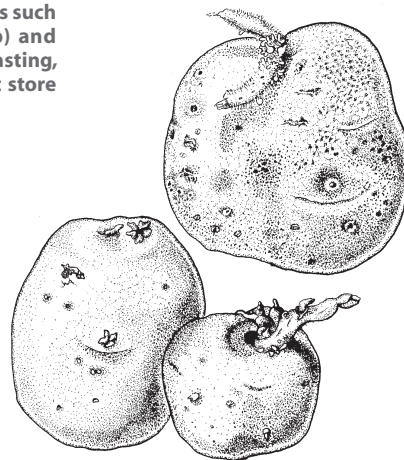
NEW VS. STORAGE POTATOES

The potato is actually two different vegetables if you compare new potatoes to storage tubers. New potatoes are simply young, small (2–6 ounce), thin-skinned spuds harvested 70–90 days after planting. You can “rob” a few new potatoes by carefully harvesting from the hilled-up plants, disturbing only stolons and not the feeding roots, then replacing the soil and letting the main crop develop.

For commercial growers, new potatoes are often justified by high market prices early in the season. For the home gardener, it's all about impatience and a taste treat. Because new potatoes have thinner skins, a high water content, and a low percentage of starch, they possess a light, almost sweet taste. They are best enjoyed lightly steamed (whole or mashed with a fork), adding just a touch of butter, black pepper, and ground rosemary. While they are delectable, remember that yields are significantly lower (1–2 pounds versus 3–5 pounds per plant) and nutrition is less than that of storage potatoes. New potatoes keep for only a matter of days and the full taste-texture features of each cultivar are blurred. Recommended varieties for new potatoes –

- Red La Soda – sets and bulks up early
- Early Red Norland – produces 2–3 pounds per plant at 70–80 days (note: prone to late blight)
- Yukon Gold – much earlier than Yellow Finn
- Cherry Red – many small (2–4 ounce) round spuds
- Rote Erstling – early set
- Anoka – the earliest white-fleshed variety

Yellow-fleshed varieties such as Morning Gold (top) and Yukon Gold are rich-tasting, versatile potatoes that store well.



Meg Stalcup

TASTE AND TEXTURE

Potato taste and texture are measured by the starch or soluble solids content of each variety. There are three basic categories – moist, waxy and dry.

MOIST

Characteristics – Low starch content, high water content.

Uses – Lightly boiled or steamed.

Varieties – Almost all reds, especially white-fleshed types,

Red Gold, Rote Erstling, Red La Soda, Buffalo All Red.

WAXY

Characteristics – Intermediate between moist and dry, with the richest taste and texture of all spuds. Most versatile usage.

Uses – Steamed, roasted, mashed or baked.

Varieties – Yellow Finn, Yukon Gold, Bintje, Carola, Carlotta, Morning Gold. Most fingerling types, including Austrian Crescent, Rose Finn Apple, Ruby Crescent, Yellow Russian Banana.

DRY

Characteristics – Mealy (which is actually a positive term when referring to potatoes as opposed to fruit), crumbly, dry, flaky. Dry spuds fall apart and become soggy when steamed or boiled.

Uses – These are the best bakers and mashers (as well as the longest storing).

Varieties – All Russets and Bakers, Blues, Daisy Gold, Burbank Russet, All Blue, Blue Viking.

GREATEST HITS AND VARIETIES OF NOTE

YELLOW (WAX) FLESH VARIETIES

Carlota/Carola – A highly productive, medium-sized oblong variety, with a perfect blend of water and starch. The skin is a pretty light yellow. Best roasted or steamed. Scab and blight resistant.

Bintje – An oblong-shaped Scandinavian heirloom variety developed in 1911. This all-purpose potato is the best of the “waxy” yellow varieties. It grows well under a range of conditions, producing high yields (up to 5–6 pounds per plant at the Center’s UCSC Farm & Garden).

Yellow Finn – This pear-shaped variety has a “netted” skin and light yellow flesh. A late-maturing, moderate yielder with a “pre-battered” taste and dry, firm, “fluffy” flesh. Best baked or mashed.

Yukon Gold – A “prettier” potato than Yellow Finn, Yukon Gold matures earlier – as early as 70 days after planting – and produces large tubers. Great for new potatoes. Thin-skinned with a light taste and waxy, moist flesh. High yields.

Note that all yellow varieties keep well in storage.

RED VARIETIES

Red LaSoda – This is the standard supermarket red potato, a mid-season maturer that can be harvested early for early creamers and new potatoes. Produces good yields of uniform-sized tubers with a light taste. Performs well in warm conditions, with higher water needs than some varieties. Mature crop is best boiled or steamed. Subject to hollow heart, a condition caused by heavy watering late in the season that causes sudden regrowth.

Early Red Norland – This adaptable variety yields well (2–4 pounds per plant) and can be ready as early as 70 days after planting. Earlier plantings may produce slightly lower yields. Prone to late blight.

Huckleberry – An early-mid season pink-fleshed variety. Produces high yields.

Bison and Buffalo Red Ruby – Great taste, resistant to blight.

Rote Erstling – Early producer with yellow flesh.

FINGERLING VARIETIES

Austrian Crescent – The biggest and arguably the best of the Finn-like varieties, producing 2 pounds per plant of 7”–10”-long tubers. This firm, waxy potato is best roasted or steamed, although steaming gives the skin a slightly bitter taste. Great for salads.

Rose Finn (Fir) Apple and Ruby Crescent – These varieties are very similar to one another, maturing in 100–120 days. Both have rose-colored skin with yellow flesh.

Yellow Russian Banana – An early, high-yielding variety. Yellow skin and flesh, firm textured. Disease prone.

Butterfinger – Produces small tubers with russeted skin. The fluffy, dry, firm flesh holds together well when cooked. Qualities are similar to Russets.

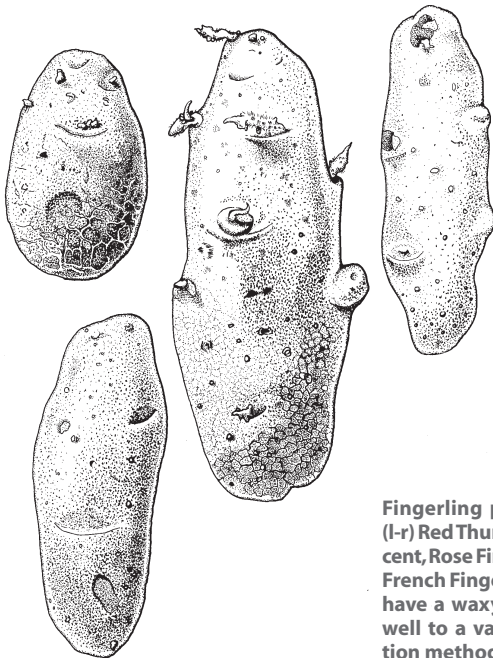
Ozette/Anna’s Cheeka/Haida/Kasaan – These are different names for the same genetic variety of heirloom potato. Originally brought from Peru by the Spanish in the late 1700s, this variety was grown in a Native American village at Neah Bay, on Washington’s Olympic Peninsula. Creamy yellow flesh with a nutty flavor.

Red Thumb – A unique, attractive red fingerling with pink flesh.

– ORIN MARTIN

Orin Martin manages the Alan Chadwick Garden on the UC Santa Cruz campus. He has conducted numerous variety trials to identify crops and varieties that perform well under Central Coast conditions.

Meg Stalcup



Fingerling potatoes such as (l-r) Red Thumb, Austrian Crescent, Rose Finn (Fir) Apple, and French Fingerling (below left) have a waxy flesh that takes well to a variety of preparation methods.

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- World Vegetables: Principles, Production, and Nutritive Values*, by Vincent Rubatzky and Mas Yamaguchi. Aspen Publishers, Inc., 1997.

SEED SOURCES

- Irish Eyes—Garden City Seeds
(509) 964-7000
www.gardencityseeds.net
- Johnny's Selected Seeds
955 Benton Ave.
Winslow, ME 04910
(877) 564-6697
www.johnnyseeds.com
- Territorial Seed Company
PO Box 158
Cottage Grove, OR 97424
(800) 626-0866
www.territorial-seed.com
- Peaceful Valley Farm Supply
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