

Computerized Vegetable Gardening

A Computer Database

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SAMPLE ENTRY

Note: Numbers (other than page numbers) in parentheses and brackets are code numbers for computerized cross-references—precursors of modern-day hyperlinks—as well as for illustrations in the accompanying booklet.

13) TOMATO

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Origins and Geography

The tomato is native to the Andes of Ecuador and Peru. The wild plant, with tiny berries [botanically speaking], was spread by Native Americans, up through modern-day Mexico.

After Columbus discovered the New World, explorers brought the tomato back to Europe; however, this exotic new fruit was often considered poisonous—scientists gave it the name *Lycopersicon*, meaning "wolf-peach" (In France in the 1600s, those in search of an aphrodisiac called the tomato, then grown as an ornamental, the "love apple"). The tomato would, of course, become a staple of Italian cuisine, as in sauces on spaghetti (which was also imported, from China by Marco Polo).

The tomato was reintroduced into the Americas, from Europe. Thomas Jefferson was one of the first Americans to grow and eat tomatoes, which really didn't become a popular food here until after the Civil War. Today, the tomato is much grown all over the U.S. and also in Mexico, Brazil, Spain, Italy, Arab countries, and Japan.

Home-grown, vine-ripened tomatoes are superior in taste and texture to their store-bought counterparts, which in large measure accounts for their popularity with gardeners:

Tomatoes are America's #1 garden vegetable!

"Cultivars" [Cultivated Varieties]

LIFE HABITS: In the wild, tomatoes grow as "perennials" (surviving year after year); but in gardens, they are typically grown as "annuals" (surviving just a single season).

However, given shelter from frosts, a tomato plant (especially one of the relatively hardy "cherry" cultivars) can overwinter even in temperate climates.

GROWTH HABITS: There are 2 basic growth habits—tomato plants may be either "determinate" or "indeterminate."

"Determinate" tomato plants sooner or later put on only flower buds at the ends of their shoots: These plants have a self-limited, usually bushy growth habit (The 1' tall "Patio" cultivars are an extreme example).

"Indeterminate" tomatoes, which are more common, always put on leaf buds at the tips of their main shoots (and flower buds off side shoots): These plants have unlimited growth potential (In fact, in some regions of their native South America, wild tomato plants survive year after year and grow to be immense jungle vines!). The 6' vines of "cherry" tomato plants that commonly grow in our temperate climates in just a single season are a good example of an "indeterminate" cultivar.

STANDARDS & HYBRIDS: Hybrid cultivars produce plants and fruit that are uniform and

often large and disease-resistant (However, as for all hybrid plants, do not save their seed: They may not produce true to variety—see "Saving Seed," with "Harvesting").

EARLY-, MID-, & LATE-SEASON CULTIVARS: There are early-, mid-, and late-season cultivars. Early tomatoes will set fruit at lower temperatures than other cultivars; and some mid- and late-season cultivars will set fruit during high temperatures, when flowers typically drop.

Tomatoes are "day neutral" plants, flowering during either long or short days (actually during periods of either short or long nights), as long as there is enough heat and light or growth—not surprisingly, tomatoes are a popular greenhouse crop overwinter.

EDIBLE PARTS: Bountifully produced typically in clusters from small, pale yellow flowers, the best fruit of tomato plants have smooth (not rough and ridged) shoulders, little cracking as they ripen, only a small scar at the blossom-end, a thin and blemish-free skin, a thick meat, a small seed cavity with few seeds, a small core, and a sweet and delicious flavor.

In general, tomato fruits can be classified as "beefsteak," "cherry," or "pear" (or "plum") cultivars.

"Beefsteak" tomatoes are big, meaty, and mild. Usually, they don't ship well; so they are frequently grown in home gardens. "Beefsteak" tomatoes vary in shape, from flattened to nearly perfectly round, and in size: Early tomatoes

typically weigh about 1/4 pound each; maincrop weigh about 1/2 to 1 pound each; and the largest cultivars (for whom the name "beefsteak" is often reserved) often average 1 pound or more—the *Guinness Book of World Records* verifies a 6-1/2 pound behemoth (a champion specimen of the "Delicious" cultivar).

"Cherry" tomatoes are round and about 1" across. In addition, there are even a few miniature tomato cultivars, whose fruit is only about 1/2 to 3/4" across; and "patio" cultivars are only about 1-3/4" in diameter.

"Pear" tomatoes (indeed pear-shaped and about 1-1/2" wide by 3-1/2" long) are meaty, sweet, sharp-tasting Italian cultivars, grown for making thick tomato sauces and pastes.

Although ripe tomatoes typically have red skin and flesh, some cultivars are pink, orange (as with red or orange flesh), orange-yellow, or even yellow (as some pear-shaped cultivars are). In addition, green, unripe tomatoes are often used in making preserves (as when there is insufficient time at the end of the season for the fruit to ripen before the first frosts).

Incidentally, tomato leaves are poisonous (The tomato is in the deadly-nightshade family, the "Solanaceae," whose leaves produce the poison "solanine").

Ease of Culture

Tomatoes are fairly easy to grow—in fact, most gardeners would say very easy to grow (However, see "Transplanting" for some steps

above and beyond what you have to go through with direct-seeded garden crops). Tomatoes have become the most widely grown garden vegetable in the U.S., and they are one of the most commonly grown of all garden plants—edible or otherwise!

Planting

NOTE: See also "Transplanting" (Unless otherwise noted, spacings and other specifications given below apply to transplants as well as to direct-seeded crops).

"VOLUNTEERS": "Volunteer" tomato plants [typically those that sprout from seeds within fruit that dropped the year before] reportedly should not be transplanted but should be left to grow where they are (circumstances permitting).

WHEN TO SOW: Tomato plants are very tender—definitely a warm-season crop (Hybrids are especially temperamental). In mild-winter regions, tomatoes can be seeded directly into the garden: Sow in warm soil, about 3 weeks after the last expected frost (See booklet for "U.S. Frost Map"). The seeds sprout best when soil temperature is between 70 and 80°F, and the seedlings grow best when the air temperature is between 60 and 70°F.

However, in most regions of the U.S. (with shorter growing seasons), plants should be transplanted—see "Transplanting."

WHERE TO PLANT: (Trans)Plant tomatoes in a sunny location, with good air-circulation.

"Patio" cultivars are often planted in hanging baskets; and just about any tomato plant can be grown in a large pot or basket, if kept regularly water and fertilized (See "Watering & Fertilizing" and the "General Advice" on container gardening, with that section).

SEEDBED TILTH: Plant tomatoes in a well-drained soil, as with much compost dug-in. The roots of a tomato plant can penetrate down to a depth of 6'.

SEEDBED FERTILITY: Tomato plants reportedly prefer a soil rich in phosphorus and potassium but only moderately rich in nitrogen (In general, nitrogen favors the growth of leaves over the production of fruit).

SEEDBED "pH" [ACIDITY OR ALKALINITY]: Tomatoes prefer a somewhat acidic soil, pH 5.2 to 6.7.

DISTANCE WITHIN ROWS & BETWEEN ROWS: Tomatoes that will not be supported (See "Supporting") should be set 2 to 4' apart each way; and those that will be staked or caged, about 1-1/2 to 2-1/2' apart each way "Determinate" cultivars can usually be spaced closer than "indeterminate" ones (See "Cultivars").

PLANTING DEPTH: Sow seed about 1/4 to 1/2" deep.

WATERING & FERTILIZING SEEDBED: Keep soil moist, not soggy or dry. Water small seedlings with a weak liquid fertilizer (such as manure tea or fish emulsion); larger seedlings

with full-strength fertilizer.

TIME TO EMERGE: About a week to 10 days.

THINNING: See booklet for illustration of seedling; however, please note that there are often 3 "cotyledon" seed leaves (a common and harmless mutation).

"Determinate" tomatoes usually grow faster than "indeterminate" cultivars and, thus, will need thinning sooner.

INTERPLANTING: Tomatoes are traditionally planted with such flowers as marigold or nasturtium; such herbs as bee balm, borage, mint, opal basil, parsley [24], or chives [27]; or such vegetables as cabbage [8] or other cole crops, Lima bean [17], carrot [23], celery [25], onion [27], or asparagus [29] (In addition, tomato plants reportedly benefit from nearby plants of sow thistle, which, however, is a weed).

Transplanting

INTRODUCTION: See also "Planting," for spacings and other specifications; and as always, see "General Advice" [0].

Although in mild-winter areas tomatoes are often seeded directly into the garden, in most areas of the U.S. (with shorter growing seasons) tomatoes are transplanted.

Easy to transplant, tomatoes are one of the most commonly available of all garden plants for purchase. Buy only plants with a deep-green color, a medium height, a heavy stem, and no

fruit or open flower buds.

STARTING PLANTS FOR TRANSPLANTING:

Seed should be sown in a coldframe or greenhouse or indoors behind a sunny window about 6 to 8 weeks before the last expected spring frost (See booklet for the "U.S. Frost Map").

Sow a few seeds in each of several 3 to 4" peat pots or sow more seeds, about an inch apart in each direction, in a larger well-drained container filled with a potting mix (See "General Advice" [o]). Cover the seeds with 1/4 to 1/2" of fine soil, firmed and moistened.

The seeds sprout best when the soil temperature is between 70 and 80°F (Seeds sprouted indoors on a windowsill should be moved away from the window at night—remember, too, that hybrids are especially temperamental). In about a week to 10 days the seeds should sprout.

CARING FOR PLANTS FOR TRANSPLANTING:

Grow the seedlings in the coldframe or greenhouse or, indoors, on the windowsill or 4 to 8" under a plant "grow light" kept on for 12 to 18 hours a day.

The best temperature for the seedlings is 60 to 70°F (If grown on a windowsill, move the seedlings away from the window at night).

To prevent "damping-off" [a disease rotting the seedlings at or below the soil line] keep the soil surface from becoming soggy: Water seedlings only as needed, preferably from below (by setting their containers in a pan of water, which

soaks up into the planter mix—once again, see "General Advice" [o]).

A weak liquid fertilizer (as of manure tea or fish emulsion) should be applied weekly.

"Determinate" cultivars will usually grow faster than "indeterminate" ones (See "Cultivars").

When the seedlings have at least 2 true leaves (See booklet for illustration), cut-off or otherwise thin plants to the strongest 1 per 3" or 4" pot or, for plants not in pots, transplant seedlings within larger containers so that they stand 3 to 4" apart.

Continue to water regularly, keeping the soil moist, not dry or wet; and feed with liquid fertilizer at almost the full-recommended rate.

Unless the plants are to be grown in a greenhouse all season, it is beneficial to "harden off" the plants: For the first week after the last expected frost (See booklet for "U.S. Frost Map"), withhold water somewhat; and then over the next 2 weeks or so, gradually expose the seedlings to the outside air—start with a short exposure during the first day and gradually increase the exposure daily (Once again, see "General Advice" [o]).

SETTING TRANSPLANTS: About 3 weeks after the last expected frost, after the soil has warmed nicely, the plants will be ready to transplant into their final, sunny, airy, well-drained location outdoors.

Wilting of the transplant can be minimized by

working on an overcast day.

"Transplant shock" can be minimized by a solution of commercially available vitamin B-1 or a solution of 2 parts water and 1 part sifted compost added to the hole that will receive the transplant and later to the soil over the roots of the transplant.

Disturb the roots as little as possible and bury the plant so that only the upper leaves stick out of the soil: Roots will form along the buried stem and help feed the growing plant.

CARING FOR TRANSPLANTS: In cold climates, transplants may be given some additional protection from cold temperatures, especially at night, by covering them with baskets, "hotcaps," or bottomless gallon jugs (capped and set upright over the plants) or by building windbreaks, as with bales of hay (Once again, see "General Advice" [o]).

Supporting

"Determinate" cultivars (See "Cultivars") are usually short and bushy—supporting these plants is not necessary.

In contrast, "indeterminate" tomato plants left unsupported will sprawl out over the ground: Although sprawling, unsupported tomato plants usually produce more pounds of fruit per plant, tomatoes spaced closer together and supported upright usually bear more pounds of fruit per square foot of garden space; and the fruit produced by plants held upright are usually more uniform in size and less subject to rot than

those lying on the ground. In addition, it is easier to weed the garden if the vines are held up off the ground.

The most common method of supporting tomatoes is tying them loosely with such soft materials as yarn or linen to stakes at least 1" x 1" thick and 6' tall, stuck into the ground. Plants on stakes are usually limited to just 2 main shoots, no taller than the stake: Pinch back excess side shoots after they have grown 6" long and pinch back the top shoots when they reach the top of the stake.

Other good methods of supporting tomato plants include caging them with wire mesh (open wide enough to allow handpicking of the fruit inside the cages) and growing them over wooden A-frames.

In greenhouses, tomatoes are often pruned and attached to hanging cords or wires, which may be lowered from above as the fruiting level of the plant goes ever higher, over the course of the season!

Watering & Fertilizing During the Season

INTRODUCTION TO IRRIGATION: See "General Advice" [o].

WHEN TO WATER: Keep the soil moist, not dry or soggy.

HOW TO WATER: Typically water slowly and deeply.

WHEN & HOW TO FERTILIZE THE SOIL:

Fertilize the soil every other week, or every other watering, from the time of the first blossom-set to the end of harvest.

WHAT TO FERTILIZE THE SOIL WITH:

Typically, feed plants with a balanced fertilizer (such as rich compost). Avoid excessive nitrogen, which will tend to favor the production of foliage over fruit.

CONTAINER GARDENING: Patio cultivars are often grown in hanging baskets; and almost any tomato plant can be grown in a large pot, if kept regularly watered and fertilized (See "General Advice" [O]).

Cultivating & Mulching

CULTIVATING: Cultivate lightly to kill weeds, without disturbing the tomato roots.

In particular, get rid of any orangish, leafless vines of the parasitic plant dodder before it goes to seed! Also be on the look-out for the whitish, yellowish, brownish, or purplish stems of the parasitic plant broomrape, with bractlike leaves and snapdragonlike flowers, producing many tiny seeds.

It is easier to weed the garden if the vines are supported up off the ground (See "Supporting").

MULCHING: Mulching not only keeps down weeds but also keeps fruit of unstaked tomatoes off the soil, where it is prone to rot—after the soil has thoroughly warmed, apply a mulch, such as black plastic or several inches of grass-clippings, partially rotted leaves, or compost (A loose mulch,

as of straw, will help provide a dry surface for fruit to rest on). However, to prevent the spread of tobacco mosaic virus, don't use tobacco stems as a mulch. See "General Advice" [O].

Controlling Physical Disorders

GENERAL ADVICE: As always, see also "Controlling Diseases," "Controlling Nematodes," and "Controlling Insects and their Kin. "

SOIL-MOISTURE DISORDERS: Keep soil moist, not dry or soggy, to prevent most such disorders.

"Leafroll" may result from too much water in soil or from disease. Starting from the bottom of the plant, leaves curl and may thicken (and rattle when shaken). The loss of many leaves, especially on staked plants, may lower the quantity and quality of fruit. To prevent leafroll, grow on well-drained soil, do not overwater, do not over-prune plants, and do not cultivate too deeply near plants. Dry weather tends to control leaf roll.

Leaf swelling results from too much water in leaves.

"Cuticle crack" or "stem-end cracking" of green fruit may result from soil that is too wet and air that is too hot. Especially during rapid growth, cracks open and heal over but will reopen easily and deeply, disfiguring fruit and allowing diseases in. Plant resistant cultivars (such as many paste tomatoes). Keep soil evenly moist. Pick fruit a bit early if need be.

"Catface" [fruit distortion] may result from uneven growth, as from uneven watering.

Fruit "pockets," or "puffing" may result from poor growth and poor pollination.

"Blossom-end rot" often results from uneven watering, or calcium deficiency, especially after proper early growth. Plant resistant cultivars. Plant in porous, well-warmed soil. Keep soil moist, not soggy or dry. Don't overfertilize with nitrogen. Don't cultivate too closely or too often (Tramping over the soil, especially when moist, will compact it, hampering both its drainage and water- holding ability). Mulch soil.

CHEMICAL DISORDERS: As always, see the "Plant Nutrient Deficiency Key" [ndk] for identifying possible causes of stunted, deformed, and/or discolored leaves, stems, roots, buds, flowers, fruits, and/or seeds.

"Fasciation" [flattening or fusing of shoots] may result from a mineral imbalance (or may be inherited).

An excess of soil nitrogen will favor the production of many bright, light green leaves, especially on seedlings, at the expense of flowers and fruit—cut down on the nitrogen applied; or add phosphorus and potassium, for balanced nutrition.

Blotchy ripening of fruit may result from a mineral deficiency, perhaps of potassium.

"Blossom-end rot" (of fruit) may result not only from uneven watering (See above) but also from

a calcium deficiency—if soil-testing before planting indicates the latter, add ground limestone (but then re-test soil pH).

"Walnut wilt" results from poisons put into soil from roots of nearby or previously planted walnut trees. If you live in a smoggy area, consult local experts for cultivars resistant to air pollution.

WEATHER-RELATED DISORDERS: To promote pollination and, thus, blossom- and fruit-set, plant in a breezy location. In the absence of sufficient wind, shake the plant or hit the top of its stake during the middle of a warm day (In greenhouses, flower clusters are regularly shaken by applying an electric toothbrush to them). Fruit pockets, or puffing, may result from poor pollination (or poor growth in general).

Fruit usually will not set if the temperature drops below 55°F at night or if it goes about 95°F during the day. However, early cultivars can stand lower temperatures than most cultivars; and some cultivars, especially some "cherry" tomatoes, are relatively heat-resistant. In addition, a commercially available hormone spray may help set blossoms and fruit in low temperatures, but not in high.

See also chemical disorders (above) and diseases for other possible causes of blossom-drop.

"Cuticle crack" of green fruit may result from hot air and dry soil (See above).

"Sunscauld" of fruit is common in hot, dry

weather, especially on plants with few leaves, either by nature or from defoliation (as by disorders or disease).

Finally, plants can be covered with cloth or plastic sheets when light frosts threaten in fall.

Controlling Diseases

CONDITIONS GENERALLY FAVORING DISEASES: Most tomato diseases in the home garden develop under warm and humid conditions.

GENERAL PRECAUTIONS: As always, see also "Controlling Physical Disorders," "Controlling Nematodes," and "Controlling Insects and their Kin. "

Especially if you will be planting in the same location as in years before, plant resistant cultivars, such as "VFNT" hybrids, bred to be resistant to Verticillium and Fusarium wilts, tobacco-mosaic virus, and nematodes (Consult your county agent or other local expert for updates on this and other subjects).

Rotate tomatoes on a 3-year schedule with plants in other families (but not with okra [11]), and don't grow plants susceptible to the same diseases nearby.

Moist potting soil can be sterilized by heating it in an oven at 350 to 400°F for 1 hour (a smelling proposition indoors), or you can buy sterilized potting mix.

Sow only seed certified to be disease-free. If in

doubt, treat seed in 122°F hot water for 25 minutes (This will kill most seed-borne pathogens but not the seed). Thin seedlings properly—don't overcrowd.

Keep seedlings at 60 to 70°F and in sunlight.

Buy and/or transplant only healthy plants.

Keep good records or consult your county agent for the best (time and) location for transplanting, typically sunny and airy (Keep temperature and ventilation adequate in greenhouses).

Transplant into a well-drained soil, warmed and with no recent history of disease.

Shading plants, as by close spacing, may help control some diseases.

Plants produced up off the ground, on supported plants, are less subject to rot.

Pinch side shoots off staked plants without touching the rest of the plants.

Water evenly—keep soil moist, not soggy or dry—and use pure water, not that which has contacted infected plants. Do not handle plants when they are wet.

Disinfect cultivating, pruning, and other tools in 1 part bleach with 10 parts water.

Get rid of nearby weeds, and get rid of any infected plants (and sometimes their neighbors, even if symptomless).

Wash hands well with soap and water after handling diseased plants or after smoking or chewing tobacco (which, in the same family, often carries a tomato-infecting virus), never smoke or chew tobacco amongst tomato plants, and never use tobacco stems for mulch.

Mulch soil, especially under unstaked plants, so that mud does not splash up on plants and fruit does not lie on soil (A loose mulch, as of straw, is most apt to provide a dry surface).

Inspect plants regularly.

If you use fungicides, follow label directions exactly!

Control nematodes and such insects as leafhoppers [i37], aphids [i42], and cucumber beetles [i74].

Pick fruit a bit early if problems arise during ripening.

Burn or deeply bury vines after harvest.

Do not save seed from infected plants.

DEFORMED GROWTH

DEFORMED ROOTS: Hairy root, witches' broom.

GALLS: Crown gall, wart.

DEFORMED LEAVES: Curly top, or yellow blight.

DEFORMED BUDS: Big bud.

WILTING

WILT DISEASES: Bacterial wilt, Fusarium wilt (with yellows), spotted wilt, Verticillium wilt.

DISCOLORATION

YELLOWING: Yellow net, yellow top, yellows.

MOSAIC: Cucumber mosaic (with stunting), "etching" [strongly defined mosaic], mosaic with "fernleaf" and internal browning of fruit, mosaic with "shoestring," ring mosaic, "rugose" [ridged vein] mosaic, tobacco mosaic.

SPOTTING: Fruit spot, leaf spot (including ring spot), speck, stem spot.

DEATH OF TISSUES

"ANTHRACNOSE" [Distinct Dead Spots, Often Pinkish And Slimy, On Shoots]: Including ripe rot of fruit or leaves.

CANKERS & SCABS: Birds-eye spot; powdery scab; stem canker, as with fruit rot.

BLIGHTS & "NECROSIS" [Death With Or Without Rotting]: Blossom blight; early blight, with collar rot or fruit rot; late blight, a fruit rot; seedling blight; Southern blight; stem necrosis; "wildfire"; etc.

ROTTING: Brown rot, of roots; buckeye rot, of stems; charcoal rot; crown rot; damping-off, as with collar rot or stem canker; fruit rot, as in storage; fruit rot, a black mold; fruit rot, or black

spot; fruit rot, or cloudy spot; fruit rot, a green-and-yellow mold; fruit rot, a green mold; fruit rot, or sour rot; gray-mold rot, or ghost spot, on stems, leaves, and fruit; nailhead spot rot, on stems and fruit; pith rot; root rot, as with wilt; root rot, black dot; root rot, with stunting of seedlings; stem- and fruit-rot, as in greenhouses; soft rot.

SIGNS OF PATHOGENS

MILDEWS: Downy mildew; powdery mildew, as on seedlings indoors.

MOLDS: Leaf mold, as in greenhouses or coldframes.

Controlling "Nematodes" [Roundworms, or Eelworms]

GENERAL ADVICE: See "Nematodes, in general" [n0].

Purchase plants labeled "VFN"—they are bred to be resistant to Verticillium and Fusarium wilts and nematodes. In addition, do not transplant plants with knots on roots. As always, see also "Controlling Physical Disorders," "Controlling Diseases," and "Controlling Insects and their Kin. "

n1) **ROOT-KNOT NEMATODES:** Produce very small to large galls on roots, bulbs, and tubers (These hard galls are not the same as the cheesy, nitrogen-fixing galls with pinkish centers normally present on the roots of legume plants.). A gelatinous mass, containing the eggs of the roundworm, may be found on the outside

of galls. Infested roots are rough-looking and prone to rot. Roots may branch excessively. Because of poor root growth, the shoots of plants infested by root-knot nematodes are often stunted and yellow; and although adding fertilizers to the soil may bring back the green color, the plant will not produce full yields. Wilting may occur and require additional watering.

n2) **CYST NEMATODES:** Although free of galls (as formed by root-knot nematodes [n1]), roots of infested plants may become tough and brownish, with the whitish or yellowish adult female roundworms and the brown cysts of eggs visible on the surface of the roots. Roots may become very hairy. Seedlings may be killed. Leaves may be yellow and wilted, even if soil is well-fertilized and -watered (Compare root-knot nematodes.). Plants grow poorly—yields are lowered.

n3) **ROOT-LESION NEMATODES:** Concentric patterns of lesions, sometimes followed by rot, are found within infested roots. Small, side roots may be killed. Seedlings are often stunted, stunting further growth. The growth of plants is stunted, leaves are often yellow and few in number, and the end-growth of stems may be reduced. Yields are lowered.

n4) **STING NEMATODES AND THEIR KIN:** Lesions are scattered over the surface of roots, which may become infected with rot. Roots may be stubby. Roots may have "curly tip"—a gall at the end of the root. There are sometimes fewer roots. Overall plant growth may be stunted; leaves, yellowed, dying first at the edges of older,

lower leaves; and yields, reduced. Plants may become prone to disease, such as fusarium wilt.

n5) KIDNEY-SHAPED NEMATODES: Plants are stunted because of infested roots. Yields are reduced. Damages caused by such diseases as fusarium wilt are increased, sometimes dramatically. Note: Because plant-infesting nematodes are microscopic, you will not be able to see any sign that these roundworms are indeed "kidney shaped. "

n6) NEMATODES THAT CARRY VIRUSES OF PLANTS: Symptoms are like those for other nematodes. Lesions may be scattered over the surface of roots, which may be prone to rot. Roots may be stubby. Roots may have "curly tip"—a gall at the end of the root. There may be fewer feeder roots. Plant growth may be reduced; leaves, yellowed; and yields, lowered. Plants may be more susceptible to diseases, even those not directly carried by the nematodes. Symptoms caused by the plant diseases that are carried by nematodes include discoloration of leaves (yellowing, "mosaic," or "vein-banding"), deformation of leaves, "corky ring spot," dying-off of plant tissues, stunting of growth, and/or lowering of yields.

Controlling Insects & their kin

INTRODUCTION: As always, see also "Controlling Physical Disorders," "Controlling Diseases," and "Controlling Nematodes. "

Tomato and other plants in the (deadly) nightshade family naturally produce a chemical compound ("solanine") in their green foliage

that acts as a somewhat effective insect repellent (and a very effective poison for us, if ingested).

See booklet for illustrations of insects etc.

CHEWING PESTS

i72) THE COLORADO POTATO BEETLE:
Larvae and adults consume leaves.

i73) FLEA BEETLES: Chew tiny holes in leaves, especially of young transplants.

i74) SPOTTED & STRIPED CUCUMBER BEETLES: Carry some diseases.

i130) THE TOMATO & TOBACCO HORNWORMS: Feed on leaves and green fruit, often extensively. Look for their black droppings; and don't be afraid of their empty threats, including their tail-end horn, red for the tobacco hornworm and green-and-black for the tomato hornworm (Both species feed on tomato and related plants).

i138) CUTWORMS: Often chew seedlings or transplants off at soil level and may also chew on roots, leaves, or fruit.

SUCKING PESTS

i5) MITES: Feeding produces "russetting" [reddish browning].

i24) STINK BUGS: Feeding forms cloudy spots on fruit.

i34) PLANT BUGS: Feeding produces "cloudy

spot. "

i37) LEAFHOPPERS: May carry disease.

i40) PSYLLIDS ["JUMPING PLANTLICE"]: Feeding of nymphs causes leaves to be yellowed and curled ["psyllid yellows"], plants to be spindly, and fruit to be of lower quality and quantity.

i41) WHITEFLIES: Feeding weakens plants and produces sweet "honeydew," nurturing a black sooty mold (which blocks light from leaves) and attracting ants (which may carry aphids). One species of whitefly is especially a problem in greenhouses, cold frames, and warm climates.

i42) APHIDS: Weaken plants, produce honeydew (as from whiteflies), and may spread diseases.

TUNNELING PESTS

i117) THE EUROPEAN CORN BORER: May migrate from dying corn to healthy tomato plants.

i139) THE TOMATO FRUITWORM [A.K.A. THE CORN EARWORM]: Bores into buds and fruit, especially from the stem end. There are other, similar worms that cause similar damage.

i142) THE STALK BORER: Chews a hole, up to 1/4" across, in a stem and enters, feeding within and withering the plant.

Controlling Wildlife

See "General Advice" [0].

Harvesting

DAYS TO HARVEST: The first "Patio" tomatoes are ready to harvest about 52 to 55 days after transplanting; miniature tomatoes, about 55 days; early-crop "beefsteak" tomatoes, about 54 to 62 days; "cherry tomatoes," about 65 to 70 days; and main-crop "beefsteak" tomatoes, about 70 to 80 days.

HOW TO HARVEST: Ripe fruit pulls easily off the vine.

LENGTH OF HARVEST: A planting of early-, mid-, and late-season cultivars can provide the longest harvest.

"Determinate" cultivars (See "Cultivars") ripen over a relatively short period: These tomatoes are desirable for short-season areas or for home-canning (and were developed for commercial harvesting).

"Indeterminate" cultivars keep bearing as long as their fruit is kept picked and the weather remains warm.

Although the plants can be covered with newspaper, cloth, or plastic to protect them from light frosts, temperatures of even 50 to 60°F for a week before harvest can cause considerable losses in storage: In general, it is best to pick all fruit—ripe and green—well before heavy frosts hit (See booklet for "U.S. Frost Map"). Although they will not ripen in storage (See "Storing"), completely green tomatoes may be used for preserves.

YIELDS: A healthy tomato plant yields abundantly—8 to 10 pounds of fruit on average (However, we've gotten up to 50 pounds from a single plant—container-grown, caged, and continuously drip-irrigated with a solution containing a complete fertilizer). Various estimates for the yield of tomatoes include 6 to 20 plants for "a family of 4" (and probably the whole neighborhood, in good years), 4 to 6 bushels of fruit from 32 plants, or 200 pounds from 100' of row.

Although sprawling, unsupported tomato plants usually produce more pounds of fruit per plant, tomatoes spaced closer together and supported upright usually bear more pounds of fruit per square foot of garden space; and the fruit produced by plants up off the ground are usually more uniform in size (and less subject to rot). In addition, pruning off side branches will encourage the production of larger fruit.

SAVING SEED: Tomato cultivars will sometimes "cross-pollinate" with one another: You should take some care that undesirable cultivars are not blooming near your desired cultivar.

To save your own seed (of a standard—not hybrid—cultivar), mash red-ripe tomatoes, combine them with an equal volume of water, keep and stir this mix for several days at 70°F, pour off the mash (Fermentation kills many seed-borne pathogens), wash the good seeds (which have sunk to the bottom), dry these seeds on paper in a shady place, and store them in a dry container.

Tomato seeds are very long-lived (sometimes good for more than 5 years in storage).

See also "General Advice" [0].

Storing

TEMPERATURE & HUMIDITY: Low temperatures, long storage times, and overripe fruit will lead to losses of color and firmness; and high temperatures will reduce storage life and promote rotting.

Firm ripe tomatoes will keep 4 to 7 days at 85 to 90% relative humidity and 45 to 50°F (They will freeze at or below 31.1°F); and firm ripe tomatoes (reportedly including those ripened off the vine to this stage) can be held for up to 3 weeks at 32 to 35°F if they are eaten immediately after being taken out of this cold storage.

Greenhouse-grown tomatoes that are pink-red to firm-red (including those ripened off the vine at 70°F to this stage) will keep best at 50 to 55°F.

Tomatoes that are 1/2 to 3/4 red will keep over a week at 50°F.

Mature green tomatoes will keep 1 to 3 weeks, at 85 to 90% relative humidity and 55 to 70°F (They will freeze at or below 31.0°F). At 57 to 60°F mature green tomatoes will ripen in 1 to 2 weeks, maintaining their nutrition (although the color and taste will not be as good as vine-ripened tomatoes); but at temperatures below 50°F many mature green tomatoes will rot as they ripen (See also "Harvesting" for storage

losses due to cool-weather outdoors).

METHODS: Some tomatoes (especially some orange cultivars) are bred to keep 6 to 12 weeks (although they are not of as good taste or texture as vine-ripened fruit). Typically, the big, meaty, mild "beefsteak" cultivars don't store well—that's why so many gardeners grow them in the first place!

If you do store tomatoes, it is reportedly best to store them in the light (but not direct sunlight) and upside-down (not stem-side up). A gas naturally produced by ripening tomatoes (and other fruit) will hasten the ripening of mature green tomatoes (and other fruit)—do not store ripening tomatoes with other fruit or produce that you wish to keep for any length of time.

Immature green tomatoes will not ripen off the vine: They are best used for pickling.

DEHYDRATING: Tomatoes are sometimes dried in the sun or a dehydrator unit and then stored in oil (The sweet, meaty, tasty Italian "pear" cultivars are often stored this way). To reconstitute dried fruit, simply soak it in water (See also "General Advice" [O]). In addition, tomatoes may also be smoked, for a handy condiment.

HOME CANNING: Some cultivars are better for canning than others; however, because all tomatoes are acidic fruit, they are relatively easy to process at home, for storage in jars (Consult a good cookbook for precautions and methods—for example, the easy way to peel a tomato is simply to drop it in boiling water for a few

moments first). Tomatoes may be canned whole, halved, quartered, as paste, pureed, or juiced, or even in catsup or chili sauce. Immature green tomatoes are often used for pickling.

FREEZING: Some cultivars are better for freezing than others. See "General Advice" [O]. To freeze tomato juice, wash, sort, and trim firm, vine-ripened tomatoes. Cut in quarters or eighths. Simmer 5 to 10 minutes. Press through a sieve. If desired, season with 1 teaspoon salt to each quart of juice. Pour into containers, leaving head space. Seal and freeze.

To freeze stewed tomatoes, remove stem ends, peel, and quarter ripe tomatoes. Cover and cook until tender (10 to 20 minutes). Place pan containing tomatoes in cold water to cool. Pack into containers, leaving head space. Seal and freeze.

Eating

INTRODUCTION: Horticulturally a vegetable, botanically a fruit, tomatoes are used as either. The rich red color and tasty, tangy flavor—especially of home-grown and vine-ripened tomatoes—add greatly to many recipes.

Some cultivars—such as big, meaty, mild "beefsteak" tomatoes—are better for slicing; others—such as sweet, meaty, tasty "pear" tomatoes—for sauce-making.

There's more than one way to skin a tomato, but the best is to simply drop it in boiling water for a few moments first.

Tomatoes may be used fresh or canned, as wholes, halves, quarters, paste, puree, juice (or even catsup or chili sauce).

In addition, dried or even smoked tomatoes can be kept on-hand, for handy flavoring.

BEVERAGES: Tomato juice, as with other vegetable or fruit juices (as in punch) or for a "bloody Mary" cocktail.

APPETIZERS: Tomatoes sliced (as with mayonnaise), tomato and shrimp hors d'oeuvres, stuffed cherry tomato canapes, cherry tomatoes carved as "roses. " Fresh tomatoes may be enjoyed either chilled or at room temperature.

SALADS: Green salads with sliced tomatoes, stuffed tomatoes, jellied tomatoes, tomato aspic (as with vegetables), crab flakes or chicken soup in tomato jelly.

SOUPS: Tomato soup (creamed or not), as with cauliflower and cheese or ham and beans; "gazpacho" [cold tomato soup]; tomato and corn chowder; tomato bouillon.

SIDE DISHES: Tomatoes may be baked, stewed (red or green, as with croutons), breaded and broiled, sauteed, stir-fried, grilled, or deep-fat fried ("French fried"). Cooked tomatoes may be served creamed, scalloped, candied, crumb-topped, or "Creole style. " Tomatoes combine well—in flavor and color—with spinach and asparagus (among a great many other foods).

ACCOMPANIMENTS TO THE MAIN COURSE: Tomatoes are essential in catsup or the increasingly popular Mexican salsa; barbecue

sauces; tomato- and-horseradish sauce; red-, yellow-, or (especially) green-tomato preserves; green- tomato "mincemeat"; green-tomato pickles (as in "chutney"); tomato-celery "chow chow"; and tomato-cheese sauces.

Accompaniments to the main course may include cabbage and tomatoes with cheese; tomatoes stuffed hot (as with salads or other vegetables); cheese/spinach/tomato loaf; tomato casserole (as with olive or sauerkraut); beans in tomato sauce; tomato dumplings; or tomatoes and hominy, couscous, pasta, or rice.

MAIN COURSE: Sliced tomato on sandwiches (as with egg), on hamburgers, or in tacos.

Tomato in goulash, pasta meat-sauces, casseroles, omelets, poached eggs, "rarebit" [tomato soup with eggs and cheese], scalloped salmon, ham-and-beans.

DESSERTS: Tomato ice, custards, puddings, or tarts. Tomatoes stuffed with cherries and cream cheese!

NUTRITIONAL VALUES: The vitamin content of tomatoes is highest if they are picked fresh from the garden and are prepared just before using.

Raw tomatoes and boiled tomatoes are both significant sources of copper, manganese, and thiamin [vitamin B-1].

Tomato sauce (canned, with added salt) and stewed tomatoes (with breadcrumbs, etc.) are both significant sources of digestible carbohydrate and sodium (presumably as added salt); and tomato sauce is also a significant

source of iron, magnesium, copper, thiamin [vitamin B-1], and niacin.

In addition, raw tomatoes, boiled tomatoes, tomato sauce, and stewed tomatoes are all significant sources of potassium, ascorbic acid [vitamin C], and vitamin A.

As always, for specific amounts of specific nutrients—and summaries of their value to the human body—see the nutrition index [n].