HOUSEPLANTS AND HOME GARDENING

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GROWING HOUSEPLANTS

If sales volume is any indication, houseplants have never been more popular in the United States than they are now. Many are easy to grow and will brighten windowsills, planters, and other indoor spots for years if a few simple steps are followed to ensure their health and vigor.

Water

Houseplants are commonly overwatered, resulting in the unnecessary development of rots and diseases (see Table 11). As a rule, the surface of the potting medium should be dry to the touch before watering, but the medium should not be allowed to dry out completely unless the plant is dormant. Care should be taken, particularly during the winter, that the water is at room temperature. Rainwater, if available, is preferred over tap water, particularly if the water has a high mineral content or is chlorinated. Broad-leaved plants should periodically have house dust removed with a damp sponge (never use detergents to clean surfaces—they remove protective waxes). Many plants benefit from a daily misting with water, particularly in heated rooms.

Containers

In time, plants may develop too extensive a root system for the pots in which they are growing (commonly called becoming root bound). Nutrients in the potting medium may become exhausted, salts and other residues from fertilizers and water may build up to the point of inhibiting growth, or the plants themselves may produce substances that accumulate until they interfere with the plant's growth. To resolve these problems, the plants should be periodically repotted and, if necessary, divided at the time of repotting.

Temperatures

Most houseplants don't thrive where the temperatures are either too high or too low (see Table 11). In general, they tend to do best with minimum temperatures of about 13°C (55°F) and maximum temperatures of about 29°C (84°F). Many houseplants that prefer warmer temperatures while actively growing also benefit from a rest period at lower temperatures after flowering.

Light

Next to overwatering, insufficient light most commonly contributes to the decline or death of houseplants (see Table 12). This does not mean that houseplants do better in direct sunlight—such light frequently damages them—but filtered sunlight (as, for example, through a muslin curtain) is usually better for the plant than the light available in the middle of the room. Plants can also thrive in artificial light of appropriate quality. Ordinary incandescent bulbs have too little light of blue wavelengths, and ordinary fluorescent tubes emit too little red light. A combination of the two, however, works very well. Generally, the wattage of the incandescent bulbs should be only one-fourth that of the fluorescent tubes in such a combination. Several types of fluorescent tubes specially balanced to imitate sunlight are also available.

Humidity

Dry air is hard on most houseplants. The level of humidity around the plants can be raised by standing the pots in dishes containing gravel or crushed rock to which water has been added. The humidity level can also be raised through the use of humidifiers, which come in a variety of sizes and capacities. Daily misting, as mentioned previously, can also help.

COMMON HOUSEPLANTS

Explanation of environmental-requirement codes given for each plant listed in Table 11:

Water

W1 Needs little water (applies primarily to cacti and succulents; these plants store water in such a way that the soil can be completely dry for a week or two without their being adversely affected)

W2 Water regularly but not excessively; wait until the potting medium surface is dry to the touch before watering

W3 Immerse pot in water for a few minutes each week and water frequently, never allowing the potting medium to become dry; do not, however, leave the base of the pot standing in water

W4 Little to regular

W5 Regular to frequent

Minerals in hard water are taxing on houseplants, and commercial water softeners do not improve water for the plants. Use rainwater or filtered water if at all possible; otherwise, repot more often.

Temperature

T1 Cool. Maximum 13°C–16°C (55°F–61°F); minimum 5°C–7°C (41°F–45°F)

T2 Cool to medium. Maximum 18°C–21°C (65°F–70°F); minimum 10°C–13°C (50°F–55°F)

T3 Medium. Maximum 22°C–29°C (72°F–84°F); minimum 14°C–17°C (57°F–63°F)

T4 Medium to warm. Maximum 30°C–32°C (86°F–89°F); minimum 18°C–20°C (64°F–68°F)

T5 Warm. Maximum 33°C–37°C (91°F–99°F); minimum 21°C–24°C (69°F–75°F)

Many houseplants are native to the tropics, where they thrive under year-round warm temperatures, while cacti and succulents thrive in warm summers and cool winters, with wide daily temperature fluctuations. The closer one is able to imitate a plant's natural environment, the better the plant will grow (see Table 11).

Light

L1 Needs shading or indirect daylight

L2 Prefers bright light but needs to be screened from direct sunlight

L3 Prefers direct sunlight

L4 Shading to bright

L5 Bright to direct light

As mentioned previously, improper lighting is second only to overwatering as a cause of problems for houseplants. They are frequently given too little light or occasionally too much. A south-facing windowsill may be ideal for certain plants in mid- winter but excessively bright in mid-summer; conversely, a north-facing windowsill may have enough light for certain plants in mid-summer but not in mid-winter. Adjustable screens permit manipulation of daylight to suit the plants involved.

Humidity

H1 Will tolerate dry air

H2 Dry to regular

H3 Will tolerate the air in most houses, provided it is mist-sprayed occasionally

H4 Regular to humid

H5 Needs high humidity; use a humidifier if possible

Virtually all plants with H4 or H5 symbols benefit from having a pan of gravel with water beneath the pot.

Potting Medium

M1 Requires a porous, slightly acid medium that drains immediately

M2 Requires a loam that is slightly alkaline (e.g., a mixture of sand and standard commercial potting medium)

M3 Requires a peaty potting mixture and acid fertilizer

TABLE 11

Environments Suitable for Common Houseplants

Plant	***Scientific Name***	***Environmental Requirements***				
		Water	*Temperature*	*Light*	*Humidity*	*Medium*
Abutilon	*Abutilon* spp. and hybrids	W2	T2	L2	H3	M2
Aechmea	*Aechmea fasciata*	W2	T5	L2	H2	M2
See Bromeliad; produces side shoots that should be propagated as main plant dies after flowering						
African lily	*Agapanthus* spp.	W2	T5	L3	H1	M2
Do not repot until pot is full; keep cool in winter						
African violet	*Saintpaulia* spp.	W2	T5	L2	H5	M1
Let rest under cooler conditions after flowering; dislikes cold water						
Agave	*Agave* spp.	W4	T5	L3	H1	M2
Keep cool and dry in winter						
Algerian ivy	*Hedera canariensis*	W2	T2	L4	H3	M2
Resembles a larger-leaved English ivy; leaves often variegated						
Aloe	*Aloe* spp.	W1	T3	L5	H1	M2
Keep cool and dry in winter						
Aluminum plant	*Pilea cadierei*	W2	T5	L3	H5	M1
Plants do not usually survive long in houses						
Amaryllis	*Amaryllis* spp.	W2	T4	L2	H3	M1
Let leaves die back in fall; put bulb in cool, dark place until early spring; then repot, water, and fertilize weekly						
Amazon lily	*Eucharis grandiflora*	W5	T4	L1	H4	M2
Anthurium	*Anthurium* spp.	W3	T5	L2	H5	M1
If it grows but doesn’t flower, try putting it in a cooler location for a few weeks						
Aphelandra	*Aphelandra squarrosa*	W3	T5	L2	H5	M1
Mist-spray frequently; fertilize regularly						
Arabian violet	*Exacum affine*	W2	T2	L2	H3	M2
Aralia (see Fatsia)						
Asparagus fern	*Asparagus plumosus*	W3	T3	L2	H3	M2
Not a true fern; repot annually; fertilize weekly						

Aspidistra	*Aspidistra* spp.	W2	T2	L4	H3	M2
Sometimes called "cast iron plant" because it can stand neglect						
Aucuba	*Aucuba japonica*	W2	T1	L4	H3	M1
Must be kept cool in winter						
Avocado	*Persea* spp.	W2	T4	L3	H3	M2
Easily propagated from seed; provides good greenery but will not produce fruit indoors						
Azalea	*Rhododendron* spp.	W4	T2	L2	H4	M1
Needs acid fertilizer; avoid warm locations						
Bamboo (dwarf)	*Bambusa angulata*	W2	T2	L5	H3	M2
Needs good air circulation, bright light						
Basket grass	*Oplismenus hirtellus*	W5	T4	L2	H3	M2
Hanging-basket cultivated variety sometimes sold as *Panicum variegatum*						
Begonia	*Begonia* spp.	W5	T5	L2	H4	M1
Easily propagated from leaves; repot regularly						
Bilbergia	*Bilbergia* spp.	W2	T3	L2	H3	M1
See Bromeliad; tough plant that can tolerate some neglect						
Birdcatcher plant	*Pisonia umbellifera*	W2	T5	L2	H3	M2
Sticky exudate on fruits attracts birds in the plant's native habitat of New Zealand; strictly a foliage plant in houses						
Bird of paradise plant	*Strelitzia reginae*	W2	T5	L5	H3	M2
Can be grown outdoors in milder climates						
Bird's nest fern	*Asplenium nidus*	W3	T3	L4	H3	M2
Produces a spongelike mass of roots at base; requires much water and regular fertilizing						
Black-eyed Susan	*Thunbergia alata*	W2	T3	L3	H3	M2
Annual climbing vine; grow from seed						
Bloodleaf	*Iresine herbstii*	W2	T3	L5	H3	M2
Easily propagated						
Boston fern	*Nephrolepis exaltata*	W5	T4	L4	H4	M2
Needs regular watering and fertilizing						
Brake	*Pteris cretica*	W2	T4	L4	H4	M3

See Ferns for propagation notes

Bromeliads	Many species	W2	T5	L2	H3	M1
These plants absorb virtually all their water and nutrients through their leaves; they should not be placed in regular potting soil (regular potting soil usually kills them) nor should they be watered with high-calcium-content water; they produce offshoots that should be propagated since main plant dies after flowering						
Cacti	Many species	W1	T5	L3	H1	M2
Contrary to popular belief, these slow-growing plants should not be grown in pure sand; add some humus to potting mixture and withhold water in winter; keep cool in winter						
Caladium	*Caladium* spp.	W2	T5	L2	H5	M1
Must have high humidity; keep root at no less than 18°C (65°F) in pot during winter						
Calceolaria	*Calceolaria crenatiflora*	W2	T1	L2	H4	M1
Discard after flowering						
Calla lily	*Zantedeschia aethiopica*	W2	T3	L3	H3	M2
After flowering, allow plant to dry up; repot in fall and start over						
Cape jasmine	*Gardenia jasminoides*	W2	T5	L3	H3	M2
Night temperatures below 22°C (72°F) needed to initiate flowering; needs cool temperatures in winter						
Carpet plant	*Episcia lilacina*	W5	T4	L1	H4	M2
Carrion flower	*Stapelia* spp.	W1	T5	L5	H1	M2
Cactuslike plants with foul-smelling flowers						
Century plant (see Agave)						
Chinese evergreen	*Aglaonema costatum*	W3	T5	L2	H5	M3
Needs warm temperatures and much water all year						
Chrysanthemum	*Chrysanthemum* spp.	W2	T3	L4	H3	M2
Plants may be artificially dwarfed through use of chemicals; flowering initiated by short days						
Cineraria	*Senecio* x *hybridus*	W3	T1	L2	H3	M2
Other plants called cinerarias include *Chrysanthemum ptarmiciflorum*, *Senecio vira-vira*, and *Senecio cineraria*; needs cool temperatures; discard after flowering						
Cliff brake	*Pellaea rotundifolia*	W2	T3	L4	H4	M1

Hanging-basket fern; needs minimum temperature above 10°C (50°F)						
Coffee	*Coffea arabica*	W2	T4	L2	H4	M2
Handsome foliage plant that will produce fruit if self-pollinating variety is obtained						
Coleus	*Coleus blumei, C. hybridus,* and others	W3	T5	L3	H3	M2
To control size, restart plants from cuttings annually						
Columnea	*Columnea* spp.	W5	T5	L4	H4	M2
Copperleaf	*Acalypha wilkesiana*	W2	T5	L2	H3	M2
Seldom survives average house environment for long						
Corn plant	*Dracaena massangeana*	W2	T5	L2	H3	M2
Uses much water when large; easy to grow						
Croton	*Codiaeum* spp.	W2	T5	L2	H5	M2
Needs constant high humidity and bright light						
Crown of thorns	*Euphorbia milii* and *E. splendens*	W4	T5	L3	H1	M2
Deviation from watering routine may result in loss of leaves, but plant generally recovers						
Cyclamen	*Cyclamen* spp.	W2	T1	L2	H3	M1
Fertilize weekly; keep cool; withhold water after flowering for a few weeks, then start over						
Donkey tail	*Sedum morganianum*	W1	T5	L3	H1	M2
Keep cool and dry in winter						
Dracaena	*Dracaena* spp.	W2	T5	L2	H3	M2
Many kinds—all easy to grow and tolerant of some neglect						
Dumbcane	*Dieffenbachia* spp.	W2	T5	L2	H4	M2
Needs regular fertilizing; keep away from small children (poisonous)						
Dwarf banana	*Musa cavendishii*	W3	T5	L3	H5	M1
Will produce small edible bananas if given enough light, water, and humidity						
Dwarf cocos palm	*Microcoleum weddelianum*	W2	T5	L2	H3	M2
Keep temperature above 18°C (65°F) at all times						
Echeveria	*Echeveria* spp.	W1	T3	L3	H1	M2
Keep cool in winter						
English ivy	*Hedera helix*	W2	T2	L4	H3	M2

Needs cool temperatures to grow at its best
but will usually survive higher temperatures

False aralia	*Dizygotheca elegantissima*	W2	T5	L2	H4	M2
Benefits from frequent mist-spraying						
Fatshedera	*Fatshedera lizei*	W2	T3	L2	H3	M2
= hybrid between *Fatsia* and *Hedera*; climbing shrub						
Fatsia	*Fatsia japonica*	W2	T2	L4	H3	M2
Also called *Aralia*						
Ferns	Many species	W5	T4	L2	H4	M2
Water regularly; propagate from spores or rhizomes						
Figs:						
Climbing fig	*Ficus pumila*	W2	T5	L4	H3	M2
Damp-sponge leaves regularly						
Fiddleleaf fig	*Ficus lyrata*					
Damp-sponge leaves regularly						
Weeping fig	*Ficus benjamina*					
Damp-sponge leaves regularly						
Fingernail plant	*Neoregelia* spp.	W2	T5	L2	H5	M1
See Bromeliad; named from red tips of leaves						
Fittonia	*Fittonia* spp.	W5	T5	L2	H5	M2
Strictly terrarium plants—humidity too low elsewhere						
Flame violet	*Episcia cupreata*	W2	T5	L4	H5	M1
Add charcoal and peat to potting medium						
Flowering maple	*Abutilon pictum*	W2	T3	L5	H3	M2
Needs bright light to flower						
Fuchsia	*Fuchsia* spp.	W5	T3	L2	H3	M2
Soil must be alkaline						
Gardenia (see Cape jasmine)						
Geranium	*Pelargonium* spp.	W4	T2	L3	H3	M2
Make cuttings annually and discard parent plants each fall; keep cool through winter; available with various scents, including orange, rose, or coconut						
Gloxinia	*Sinningia speciosa*	W3	T5	L2	H4	M1
Fertilize heavily and water frequently; after flowering, withhold water and keep bulb cold for a few weeks						

Goldfish plant	*Columnea* spp.	W3	T5	L2	H5	M3
Pot in mixture of leaf mold, fern bark, peat moss, and charcoal; use only rainwater or filtered water						
Goosefoot plant	*Nephthytis* spp.	W5	T5	L1	H5	M3
Not related to true goosefoots in the Goosefoot family—Chenopodiaceae; soil should have high organic content and be kept evenly moist; humidity must be maintained						
Grape ivy	*Rhoicissus rhomboidea*	W5	T3	L4	H3	M2
Tolerates low light better than most plants						
Gynura (see Velvetleaf)						
Hart's tongue fern	*Phyllitis scolopendrium*	W2	T2	L4	H3	M3
Haworthia	*Haworthia* spp.	W1	T5	L3	H1	M2
Aloelike plants that need minimum temperatures above 10°C (50°F) in winter						
Hen and chickens	*Sempervivum tectorum* and hybrids	W1	T1	L3	H1	M2
Keep cool in winter						
Hibiscus	*Hibiscus rosa-sinensis*	W2	T4	L3	H3	M2
Fertilize weekly; does better outdoors in mild climates						
Hippeastrum (see Amaryllis)						
Holly fern	*Cyrtomium falcatum*	W2	T5	L2	H4	M1,3
Relatively tough fern; keep cool in winter						
Houseleek	*Sempervivum* spp.	W1	T1	L3	H1	M2
Keep cool in winter						
Hydrangea	*Hydrangea* spp.	W4	T2	L2	H3	M1
Prune after flowering; keep cool in winter; blue-flowering plant can be converted to pink by changing the soil to acid and vice versa. (**Caution:** Leaves and buds are poisonous.)						
Hypocyrta	*Nematanthus* spp.	W2	T3	L2	H2	M2
Hypoestes (see Pink polka-dot plant)						
Impatiens	*Impatiens* spp.	W3	T3	L5	H3	M1
Exceptionally easy to propagate from cuttings						
Ivy-arum	*Epipremnum aureum*	W2	T5	L4	H3	M1
Can tolerate some neglect						

Jade plant	*Crassula argenta* and others	W1	T5	L3	H1	M2
Keep cool in winter						
Jamaican pansy	*Achimenes* spp.	W5	T4	L2	H3	M2
Kaffir lily	*Clivia miniata*	W2	T3	L4	H3	M2
Save the plant's energy by removing flowers as they wither						
Kalanchoe	*Kalanchoe* spp.	W2	T4	L5	H2	M2
Withhold water and fertilizer for a few weeks after flowering, then repot and start over						
Lantana	*Lantana camara*	W2	T3	L3	H3	M2
Fertilize twice a month; can be espaliered						
Madagascar jasmine (see Stephanotis)						
Maidenhair fern	*Adiantum* spp.	W3	T5	L2	H5	M1
Mist-spray regularly						
Meyer fern	*Asparagus densiflora* var. *meyeri*	W1	T5	L3	H1	M2
Not a true fern; fertilize regularly; repot annually						
Moneywort	*Lysimachia nummularia*	W2	T3	L2	H3	M2
Hanging pot plant; needs bright light						
Moonstones	*Pachyphytum* spp.	W3	T3	L4	H3	M2
Keep cool in winter						
Moses in the cradle	*Rhoeo* spp.	W2	T5	L2	H5	M2
Can tolerate some neglect						
Mother in law's tongue (see Sansevieria)						
Mother of thousands	*Saxifraga* spp.	W2	T4	L2	H4	M1
Also called Saxifrage; hanging plant; plantlets formed on runners can be removed and grown separately						
Neanthe palm	*Chamaedorea elegans*	W1	T5	L3	H1	M2
Sometimes also called parlor palm; stays less than 1 meter tall						
Nerine	*Nerine* spp.	W2	T5	L5	H2	M2
Water freely until flowering completed, then rest bulbs for a few months						
Norfolk Island pine	*Araucaria* spp.	W2	T4	L4	H3	M2
Needs cold temperatures, 2°C–3°C (36°F–38°F), in winter						

Octopus tree	*Schefflera octophylla*	W2	T3	L2	H3	M2
Does best under cool conditions						
Oleander	*Nerium oleander*	W2	T5	L2	H4	M2
Keep pot cool in winter for better flowering; keep away from small children (very poisonous)						
Orchid	Thousands of species					
No single set of environmental conditions applies. Contrary to popular belief, the common *Cattleya* and related orchids do not need high temperatures and humidity; most can get along with a minimum temperature of 13°C (56°F) at night and a minimum humidity of 40%. Most need bright light. They should never be placed in soil; pot them in sterilized pots with chips of fir bark or shreds of tree fern bark. See Additional Reading on Houseplants and Gardening for culture references.						
Oxtongue	*Gasteria* spp.	W2	T3	L2	H3	M2
Can tolerate some neglect; needs a cool and relatively dry winter to flower						
Palms	Many species	W2	T1	L2	H3	M1
Use deep pots; fertilize regularly						
Parlor palm	*Chamaedorea elegans*	W2	T3	L4	H3	M2
See also Neanthe palm; palm is relatively easy to grow						
Peperomia	*Peperomia* spp.	W2	T4	L3	H2	M2
Many varieties; keep warm, humid; fertilize regularly						
Persian violet	*Exacum affine*	W2	T5	L2	H3	M1
Needs good air circulation						
Philodendron	*Philodendron* spp.	W2	T5	L2	H4	M2
Relatively tough plants; repot each spring						
Piggyback plant	*Tolmiea menziesii*	W2	T3	L2	H5	M1
Plantlets formed on leaves can be separated and propagated						
Pilea (see Aluminum plant)						
Pineapple	*Ananas comosus*	W2	T5	L2	H3	M1
See Bromeliad; easily grown from the top of a pineapple; if plant has not flowered after one year, enclose it in a plastic bag with a ripe apple for a few days (ethylene from apple should initiate flowering); no temperature below 15°C (59°F)						
Pleomele (see Dracaena)						

Pink polka-dot plant	*Hypoestes sanguinolenta*	W2	T5	L2	H3	M1
Susceptible to diseases and pests; usually does not last long as a houseplant						
Pittosporum	*Pittosporum* spp.	W2	T4	L2	H3	M2
Put several cuttings in one pot for bushy appearance						
Poinsettia	*Euphorbia pulcherrima*	W2	T3	L5	H3	M2
After flowering, let plant dry under cool conditions until it loses its leaves, place in total darkness for a month, then restart						
Prayer plant	*Maranta leuconeura*	W3	T5	L4	H5	M1
Name derived from fact that leaves fold together in evening						
Primrose	*Primula* spp.	W3	T1	L4	H4	M1
Needs much water; does well outside in cool weather						
Pteris (see Brake)						
Purple tiger	*Calathea amabilis*	W2	T5	L4	H4	M1
Use pots that are broader than deep						
Rosary plant	*Ceropegia woodii*	W1	T5	L4	H1	M2
Hanging pot plant whose potting medium must drain well or plant will not survive						
Rubber plant	*Ficus elastica*	W2	T5	L4	H3	M2
Do not overwater!						
Sago palm	*Cycas revoluta*	W3	T4	L2	H3	M3
Very slow growing (not a palm but a gymnosperm); never allow to dry out, but be certain water drains						
Sansevieria	*Sansevieria* spp.	W1	T5	L4	H1	M2
Perhaps the toughest of all houseplants—nearly indestructible						
Satin pothos	*Scindapsus pictus*	W2	T5	L2	H3	M1
Basket or pot plant						
Schefflera	*Schefflera* spp.	W5	T5	L2	H3	M2
Plants can get quite large if growth is not controlled						
Screw pine	*Pandanus* spp.	W2	T5	L2	H5	M2
If given space, can become large; mist-spray often						
Selaginella (see Spike moss)						
Sensitive plant	*Mimosa pudica*	W2	T5	L2	H5	M2
Leaves fold when touched; does not usually last more than a few months in most houses						

Sentry palm	*Howea fosterana*	W2	T3	L4	H3	M2
Palm that is easy to grow						
Setcreasea	*Setcreasea pallida*	W5	T3	L4	H3	M2
Shrimp plant	*Beloperone guttata*	W2	T3	L3	H3	M2
Winter temperatures should be above 15°C (59°F)						
Spathe flower	*Spathiphyllum* spp.	W5	T5	L4	H4	M3
Prefers warm winters and even warmer summers; potting soil should have high organic content						
Spider plant	*Chlorophytum comosum*	W2	T3	L4	H5	M2
Plantlets formed at tips of stems can be propagated separately						
Spiderwort	*Tradescantia* spp.	W2	T4	L4	H3	M2
Easy to grow; do not overwater						
Spike moss	*Selaginella* spp.	W2	T3	L1	H5	M1
Can become a weed in greenhouses						
Splitleaf philodendron	*Monstera deliciosa*	W2	T4	L4	H5	M2
Plant adapts to various indoor locations quite well						
Sprenger fern	*Asparagus densiflora* var. *sprengeri*	W3	T3	L4	H3	M2
Not a true fern; fertilize weekly; repot annually						
Staghorn fern	*Platycerium* spp.	W2	T5	L4	H3	M1
Tough plant; immerse in water weekly						
Stephanotis	*Stephanotis floribunda*	W2	T3	L4	H3	M2
Use very little fertilizer; keep cool in winter but water sparingly						
Stonecrop	*Sedum* sp.; *Crassula* spp.	W1	T5	L3	H1	M2
Keep cool in winter						
Stove fern	*Pteris cretica*	W3	T3	L2	H4	M2
Water and fertilize regularly						
String-of-pearls	*Senecio rowleyanus*	W1	T5	L3	H1	M2
Keep cool in winter						
Stromanthe	*Stromanthe* spp.	W3	T5	L4	H5	M2
Sundew	*Drosera* spp.	W3	T3	L2	H5	M1
Sterilize pots; grow only on sphagnum moss (plants die soon in soil)						

Syngonium	*Syngonium podophyllum*	W2	T5	L4	H3	M1
Repot annually in spring						
Tillandsia	*Tillandsia* spp.	W2	T5	L2	H3	M1
See Bromeliad; best-known species is called Spanish moss, which does best suspended from wires or other plants						
Ti plant	*Cordyline terminalis*	W2	T4	L2	H5	M2
Needs high humidity; seems to do better with other plants in pot						
Treebine	*Cissus antarctica*	W2	T5	L4	H3	M2
Plant does not do well in acid potting medium						
Umbrella plant	*Cyperus* spp.	W2	T5	L2	H3	M2
One of very few plants that need to stand in water						
Velvetleaf	*Gynura sarmentosa*	W2	T5	L2	H3	M2
Gets "stringy" but is easily restarted from cuttings; flowers have unpleasant odor						
Venus's flytrap	*Dionaea muscipula*	W3	T5	L2	H5	M1
Sterilize pots; grow only in sphagnum moss; repot annually						
Vriesia	*Vriesia* spp.	W2	T5	L2	H5	M3
See Bromeliad						
Wandering Jew	*Zebrina pendula*	W2	T4	L4	H3	M2
Easy to grow; do not overwater						
Wax plant	*Hoya* spp.	W2	T5	L2	H5	M2
Climber; leave pot in one place—does not like to be moved						
Zebrina (see Wandering Jew)						

TABLE 12

Common Ailments of Houseplants

Problem Symptoms	***Possible Causes***
Wilting or collapse of whole plant	Lack of water; too much heat; too much water or poor drainage resulting in root rot
Yellowish or pale leaves	Insufficient light; too much light; microscopic pests (especially spider mites); too much or too little fertilizer
Brown, dry leaves	Humidity too low; too much heat; poor air circulation; lack of water

Tips and margins of leaves brown	Mineral content of water; drafts; too much sun or heat; too much or too little water
Ringed spots on leaves	Water too cold
Leaves falling off	Improper watering or water too cold; excessive use of fertilizer or wrong fertilizer; too much sun or, if lower leaf drop only, too little light
Stringy growth	Needs more light; too much fertilizer
Base of plant soft or rotting	Overwatering
No flowers, or flower buds drop	Too much or too little light; night temperatures too high
Water does not drain	Drain hole plugged; potting mixture has too much clay
Mildew present	Fungi present—arrest with sulphur dust

Common Pests	***Controls****
Aphids	Wash off under faucet or spray with soapy (not detergent) water; pyrethrum or rotenone sprays also effective
Mealybugs	Remove with cotton swabs dipped in alcohol; spray with Volck oil
Scale insects	Remove by hand; spray with Volck oil
Spider mites	Use sprays containing small amounts of xylene (act as soon as possible—spider mites multiply very rapidly)
Thrips	Spray with pyrethrum/rotenone or Volck oil sprays
White flies	Spray with soapy water or pyrethrum/rotenone sprays every four days for two weeks (only the adults are susceptible to the sprays)

*For additional controls, see Biological Controls.

GROWING VEGETABLES

General Tips on Vegetable Growing

Seed Germination

Many gardeners germinate larger seeds (e.g., squash, pumpkin) in damp newspaper. A few sheets of newspaper are soaked in water for a minute and then hung over a support for about 15 minutes or until the water stops dripping. The seeds are then lined up in a row on the newspaper and wrapped, and the damp mass is placed in a plastic bag. The bag is tied off or sealed and placed in a warm (not hot!), shaded location (the floor beneath a running refrigerator is an example). Depending on the species, germination should occur within two to several days.

Tiny seeds (e.g., carrots, lettuce) may be mixed with clean sand before sowing to bring about a more even distribution of the seed in the rows.

Transplanting

Roots should be disturbed as little as possible when seedlings or larger plants are transplanted. Even a few seconds' exposure to air will kill root hairs and smaller roots. They should be shaded (e.g., with newspaper) from the sun and transplanted late in the day or on a cool, cloudy day if at all possible. To minimize the effects of transplanting, immediately water the seedlings or plants in their new location with a dilute solution of vitamin B/hormone preparation (e.g., Superthrive).

Bulbs or Other Plants with Food-Storage Organs

All plants with food-storage organs (e.g., beets, carrots, onions) develop much better in soil that is free of lumps and rocks. If possible, the areas where these plants are to be grown should be dug to a minimum depth of 30 centimeters (12 inches) and the soil sifted through a 0.7-centimeter (approximately 0.25-inch) mesh before planting. Obviously such a procedure is not always practical, but it can yield dramatic results.

Cutworms

Cutworms forage at or just beneath the surface of the soil. Their damage to young seedlings can be minimized by a collar placed around each plant. Tuna cans with both ends removed make effective collars when pressed into the ground to a depth of about 1 to 2 centimeters (0.4 to 0.8 inch).

Protection Against Cold

Some seedlings can be given an earlier start outdoors if plastic-topped coffee cans with the bottoms removed are placed over them. The plastic lids can be taken off during the day and replaced at night during cool weather. Conical paper frost caps can serve the same purpose.

Watering

Proper watering promotes healthy growth. It is much better to water an area thoroughly (e.g., for 20 to 30 minutes) every few days than to wet the surface for a minute or two daily. Shallow daily watering promotes root development near the surface, where midsummer heat can damage the root system. Conversely, too much watering can leach minerals out of the topsoil.

Fertilizers

Manures, bone and blood meals, and other organic fertilizers, which release the nutrients slowly and do not "burn" young plants, are preferred. Plants will utilize minerals from any available source, but in the long run, the plants will be healthier and subject to fewer problems if they are not given sudden boosts with liquid chemical fertilizers.

Pests and Diseases

Preferred means of dealing with pests are listed under Biological Controls. If sprays are necessary, biodegradable substances, such as rotenone and pyrethrum, should be used.

Common Vegetables and Their Nutritional Values

Note: The nutritional values (NV) given are per 100 grams (3.5 ounces), edible portion, as determined by the United States Department of Agriculture.

Asparagus
NV (spears cooked in water): 20 calories; protein 2.2 gm; fats 0.2 gm; vit. A 900 I.U.; vit. B1 0.16 mg; vit. B2 0.18 mg; niacin 1.5 mg; vit. C 26 mg; fiber 0.7 gm; calcium 21 mg; phosphorus 50 mg; iron 0.6 mg; sodium 1.0 mg; potassium 208 mg.

Asparagus can be started from seed, but time until the first harvest can be reduced by a year or two if planting begins with one-year-old root clusters of healthy, disease-resistant varieties (e.g., "Mary Washington"). Asparagus requires little care if appropriate preparations are made before planting in the permanent location. Seeds should be sown sparsely, and the seedlings thinned to about 7.5 centimeters (3 inches) apart. Before transplantation the following spring, dig a trench 30 to 60 centimeters (12 to 24 inches) deep and about 50 centimeters (20 inches) wide in an area that receives full sun, usually along one edge of the garden. If the soil is heavy, place crushed rock or gravel on the bottom of the trench to provide good drainage. Add a layer of steer manure about 10 centimeters (4 inches) thick, followed by about 7.5 centimeters (3 inches) of rich soil that has been prepared by thorough mixing with generous quantities of steer manure and bone meal. Place root clusters about 45 centimeters (18 inches) apart in the trench and cover with about 15 centimeters (6 inches) of prepared soil (be sure not to allow root clusters to dry out). As the plants grow, gradually fill in the trench. If one-year-old roots are planted, wait for two years before harvesting tips; if two-year-old roots are planted, some asparagus may be harvested the following year. In all cases, no harvesting should be done after June, so that the plants may build up reserves for the following season. Cut shoots below the surface but well above the crown before the buds begin to expand. Cut all stems to the ground after they have turned yellow later in the season.

Beans

String or Snap Beans
NV (young pods cooked in water): 25 calories; protein 1.6 gm; fats 0.2 gm; vit. A 540 I.U.; vit. B1 0.07 mg; vit. B2 0.09 mg; niacin 0.5 mg; vit. C 12 mg; fiber 1.0 gm; calcium 50 mg; phosphorus 37 mg; iron 0.6 mg; sodium 4 mg; potassium 151 mg.

String or snap beans are warm-weather plants, although they can be grown almost anywhere in the United States. Wait until all danger of frost has passed and the soil is warm. Prepare the soil, preferably the previous winter, by digging to a depth of 30 centimeters (12 inches) and mixing in aged manure and bone meal. Pulverize the soil just before sowing; if soil has a low pH, add lime. Plant seeds thinly in rows about 40 to 50 centimeters (16 to 20 inches) apart; thin plants to 10 centimeters (4 inches) apart when the first true leaves have developed. Beans respond unfavorably to a very wet soil—do not overwater! In areas with hot summers, beans also prefer some light shade, particularly in mid-afternoon. As the bean plants grow, nitrogen-fixing bacteria invade the roots and supplement the nitrogen supply. Early vigorous growth can be enhanced by inoculating the seeds with such bacteria, which are available commercially in a powdered form. To maintain a continuous supply of green beans, plant a new row every two to three weeks during the growing season until two months before the first predicted frost. Cultivate regularly to control weeds, taking care not to damage root systems. Do not harvest or work with beans while the plants are wet, as this may invite disease problems.

Pole Beans
NV similar to those of string beans.

Soil preparation and cultivation are the same as for string beans. Plant beans in hills around poles that are not less than 5 centimeters (2 inches) in diameter and at least 2 meters (6.5 feet) tall. As beans twine around their supports, it helps to tie them to the support with plastic tape as they grow. If harvested before the pods are mature, pole beans will produce over a longer period of time than bush varieties.

Lima Beans
NV (immature seeds cooked in water): 111 calories; protein 7.6 gm; fats 0.5 gm; vit. A 280 I.U.; vit. B1 0.18 mg; vit. B2 0.10 mg; niacin 1.3 mg; vit. C 17 mg; fiber 1.8 gm; calcium 47 mg; phosphorus 121 mg; iron 2.5 mg; sodium 1.0 mg; potassium 422 mg.

Lima beans take longer to mature than other beans and are more sensitive to wet or cool weather. They definitely need warm weather to do well. Prepare soil and cultivate as for string beans.

Soybeans
NV (dry, mature seeds): 403 calories; protein 34.1 gm; fats 17.7 gm; vit. A 80 I.U.; vit. B1 1.10 mg; vit. B2 0.31 mg; niacin 2.2 mg; vit. C (values not available; see also Broad [Fava] Beans); fiber 4.9 gm; calcium 226 mg; phosphorus 554 mg; iron 8.4 mg; sodium 5.0 mg; potassium 1,677 mg.

Prepare soil and cultivate as for string beans.

Broad (Fava) Beans
NV (dry, mature seeds): 338 calories; protein 25.1 gm; fats 1.7 gm; vit. A 70 I.U.; vit. B1 0.5 mg; vit. B2 0.3 mg; niacin 2.5 mg; vit. C (values not available; see also Soybeans); fiber 6.7 gm; calcium 47 mg; phosphorus 121 mg; iron 2.5 mg; sodium 1.0 mg; potassium 422 mg.

Unlike other beans, broad beans need cool weather for their development. Sow as early as possible (in mild climates, they may be sown in the fall, as they can withstand light frosts). Since the plants occupy a little more space than bush beans, plant in rows about 0.9 to 1 meter (3 feet or more) apart and thin to about 20 centimeters (8 inches) apart in the rows. After the first pods mature, pinch out the tips to promote bushier development. To most palates, broad beans do not taste as good as other types of beans.

Beets
NV (cooked in water): 32 calories; protein 1.1 gm; fats 0.1 gm; vit. A 20 I.U.; vit. B1 0.03 mg; vit. B2 0.04 mg; vit. C 6 mg; fiber 0.8 gm; calcium 14 mg; phosphorus 23 mg; iron 0.5 mg; sodium 43 mg; potassium 208 mg.

Beets will grow in a variety of climates but do best in cooler weather. They can tolerate light frosts and can be grown on a variety of soil types, although they prefer a sandy loam supplemented with well-aged organic matter. As with any bulb or root crop, they develop best in soil that is free of rocks and lumps.

Beet "seeds" are really fruits containing several tiny seeds. Plant them in rows 40 to 60 centimeters (16 to 24 inches) or more apart and thin to about 10 centimeters (4 inches) apart in the rows after germination. After harvesting, the beets will keep in cold storage for up to several months. The leaves, if used when first picked, make a good substitute for spinach.

Broccoli
NV (spears cooked in water): 26 calories; protein 3.1 gm; fats 0.3 gm; vit. A 2,500 I.U.; vit. B1 0.09 mg; vit. B2 0.2 mg; niacin 0.8 mg; fiber 1.5 gm; calcium 88 mg; phosphorus 62 mg; iron 0.8 mg; sodium 10 mg; potassium 267 mg.

Broccoli is a cool-weather plant that will thrive in any good prepared soil, providing that it has not been heavily fertilized just prior to planting (fresh fertilizer promotes rank growth). The plants can stand light frosts and are planted in both the spring and fall in areas with mild climate. Although broccoli may continue to produce during the summer, most growers prefer not to keep the plants going during warm seasons because of the large numbers of pest insects they may attract.

Sow seeds indoors and transplant outdoors after danger of killing frosts has passed. Place plants about 0.9 to 1 meter (3 feet or more) apart and keep well watered. Keep area weeded and pests under control. Harvest heads (bundles of spears) while they are still compact. Smaller heads will develop very shortly after the first harvest; if these are removed regularly, the plants will continue to produce for some time, although the heads become smaller as the plants age.

Cabbage
NV (raw): 24 calories; protein 1.3 gm; fats 0.2 gm; vit. A 130 I.U.; vit. B1 0.05 mg; vit. B2 0.05 mg; niacin 0.3 mg; vit. C 47 mg; fiber 1.0 gm; calcium 49 mg; phosphorus 29 mg; iron 0.4 mg; sodium 20 mg; potassium 233 mg.

The growth requirements of cabbage are similar to those of broccoli.

Carrots
NV (raw): 42 calories; protein 1.1 gm; fats 0.2 gm; vit. A 11,000 I.U.; vit. B1 0.6 mg; vit. B2 0.5 mg; niacin 0.6 mg; vit. C 8 mg; fiber 1.0 gm; calcium 37 mg; phosphorus 36 mg; iron 0.7 mg; sodium 47 mg; potassium 341 mg.

Carrots are hardy plants that can tolerate a wide range of climate and soils, but the soil must be well prepared, free of rocks and lumps, and preferably not too acidic. The seeds are slow to germinate. Plant in rows a little more than 30 centimeters (12 inches) apart, and thin seedlings to about 5 centimeters (2 inches) apart in the rows. Weed the rows regularly until harvest. Carrots keep well in below-ground storage containers when freezing weather arrives.

Cauliflower
NV (cooked in water): 22 calories; protein 2.3 gm; fats 0.2 gm; vit. A 60 I.U.; vit. B1 0.09 mg; vit. B2 0.08 mg; niacin 0.6 mg; vit. C 55 mg; fiber 1.0 gm; calcium 21 mg; phosphorus 42 mg; iron 0.7 mg; sodium 9 mg; potassium 206 mg.

Growth requirements of cauliflower are similar to those of broccoli except that heavier fertilizing is required. As cauliflower heads develop, protect them from the sun by tying the larger leaves over the tender heads. Harvest while the heads are still solid.

Corn
NV (cooked sweet corn kernels): 83 calories; protein 3.2 gm; fats 1.0 gm; vit. A 400 I.U. (yellow varieties; white varieties have negligible vit. A content); vit. B1 0.11 mg; vit. B2 0.10 mg; niacin 1.3 mg; vit. C 7 mg; fiber 0.7 gm; calcium 3 mg; phosphorus 89 mg; iron 0.6 mg; sodium trace; potassium 165 mg.

There are several types of corn (e.g., popcorn, flint corn, dent corn), but sweet corn is the only type grown to any extent by home gardeners. It can be grown in any location where there is at least a ten-week growing season and warm summer weather.

Corn does best in a fertile soil, which should be prepared by mixing with compost and liberal amounts of chicken manure or fish meal. Since corn is wind-pollinated, it can be helpful to grow the plants in several short rows at right angles to the prevailing winds rather than in a single long row. For best results, use only fresh seeds and plant in rows 60 centimeters (24 inches) apart for dwarf varieties and 90 centimeters (36 inches) apart for standard varieties. Thin to 20 to 30 centimeters (8 to 12 inches) apart in the rows after the plants have produced three to four leaves. Cultivate frequently to control weeds. The corn is ready to harvest when the silks begin to wither.

Cucumber
NV (raw, with skin): 15 calories; protein 0.9 gm; fats 0.1 gm; vit. A 250 I.U.; vit. B1 0.03 mg; vit. B2 0.04 mg; niacin 0.2 mg; vit. C 11 mg; fiber 0.6 mg; calcium 25 mg; phosphorus 27 mg; iron 1.1 mg; sodium 6 mg; potassium 160 mg.

Until drought- and disease-resistant varieties were developed in recent years, cucumbers were considered rather temperamental plants to grow. The newer varieties are no more difficult to raise than those of most other common vegetables.

The soil should be a light loam—neither too heavy nor too sandy. It should be mixed with well-aged manure and compost and heaped into small mounds about 2 meters (6.5 feet) apart. Five to six seeds should be planted in each mound about 2.5 centimeters (1 inch) below the surface in the middle of the spring. When the plants are about 1 decimeter (4 inches) tall, thin to three plants per mound. Cultivate regularly, and to promote continued production, pick all cucumbers as soon as they attain eating size.

Eggplant
NV (cooked in water): 19 calories; protein 1.0 gm; fats 0.2 gm; vit. A 10 I.U; vit. B1 0.05 mg; vit. B2 0.04 mg; niacin 0.5 mg; vit. C 3 mg; fiber 0.9 gm; calcium 11 mg; phosphorus 21 mg; iron 0.6 mg; sodium 1 mg; potassium 150 mg.

Eggplant is strictly a hot-weather plant that is sensitive to cold weather or dry periods and needs heavy fertilizing. Since seedling development is initially slow, plant the seeds indoors about two months before the plants will be set out, which should be about five to six weeks after the last average date of frost.

Eggplants do best in enriched sandy soils that are supplemented with additional fertilizer once a month. Never permit them to dry out. Place the seedlings about 70 to 80 centimeters (28 to 32 inches) apart in rows 0.9 to 1 meter (3 feet or more) apart. Some staking of the plants may be desirable. The fruits are ready to harvest when they have a high gloss. They are still edible after greenish streaks appear and the gloss diminishes, but they are not as tender at this stage.

Lettuce

NV (crisp, cabbage-head varieties): 13 calories; protein 0.9 gm; fats 0.1 gm; vit. A 330 I.U.; vit. B1 0.06 mg; vit. B2 0.06 mg; niacin 0.3 mg; vit. C 6 mg; fiber 0.5 gm; calcium 20 mg; phosphorus 22 mg; iron 0.5 mg; sodium 9 mg; potassium 175 mg.

NV (leaf varieties): 18 calories; protein 1.3 gm; fats 0.3 gm; vit. A 1,900 I.U.; vit. B1 0.05 mg; vit. B2 0.08 mg; niacin 0.4 mg; vit. C 18 mg; calcium 68 mg; phosphorus 25 mg; iron 1.4 mg; sodium 9 mg; potassium 264 mg.

This favorite salad plant comes in a wide variety of types and forms, all of which do better in cooler weather, although a few of the leaf types (e.g., oak leaf) can tolerate some hot periods. As long as the individual plants are given room to develop and the soil is not too acid, most varieties can be grown on a wide range of soil types.

Since lettuce can stand some frost, sow the seeds outdoors as early in the spring as the ground can be cultivated. Do not cover the seeds with more than a millimeter or two of soil—they need light to germinate. Mix the soil with a well-aged manure and a general-purpose fertilizer a week or two before sowing. Plant seedlings about 30 centimeters (12 inches) apart in rows 30 to 40 centimeters (12 to 16 inches) apart. For best results, do not allow the soil to dry out, and plant only varieties suited to local conditions. The most common crisp, cabbage-head varieties found in produce markets will not form heads in hot weather, and many others will bolt (begin to flower) during hot weather and longer days. Cultivate weekly between rows to promote rapid growth and to control weeds.

Onion

NV (raw): 38 calories; protein 1.5 gm; fats 0.1 gm; vit. A 40 I.U. (yellow varieties only); vit. B1 0.03 mg; vit. B2 0.04 mg; niacin 0.2 mg; vit. C 10 mg; fiber 0.6 gm; calcium 27 mg; phosphorus 36 mg; iron 0.5 mg; sodium 10 mg; potassium 157 mg.

These easy-to-grow vegetables do best in fertile soils that are free of rocks and lumps, are well drained, and are not too acidic or sandy.

Onions may take several months to mature from seed. The viability of the seed decreases rapidly after the first year. Bulb formation is determined by day length rather than by the total number of hours in the ground. Because of these characteristics of onions, most gardeners prefer to purchase sets (young plants that already have a small bulb) from commercial growers, although green or bunching onions are still easily grown from seed.

Plant the sets upright 6 to 7.5 centimeters (2.5 to 3 inches) apart in rows and firm in place. Except for weeding, watering, and occasional shallow cultivation, they will need little care until harvest about fourteen weeks later. The onions are mature when the tops fall over. After they are pulled from the ground, allow them to dry in the shade for two days. Then remove the tops 2 to 3 centimeters (about 1 inch) above the bulbs, and spread out the bulbs to continue curing for two to three more weeks. After this, store them in sacks or other containers that permit air circulation until needed.

Peas

NV (green, cooked in water): 71 calories; protein 5.4 gm; fats 0.4 gm; vit. A 540 I.U.; vit. B1 0.28 mg; vit. B2 0.11 mg; niacin 2.3 mg; vit. C 20 mg; fiber 2.0 gm; calcium 23 mg; phosphorus 99 mg; iron 1.8 mg; sodium 1 mg; potassium 196 mg.

Peas are strictly cool-weather plants that generally produce poorly when the soil becomes too warm. Seeds should be planted in the fall or very early spring. As is the case with beans, peas receive a better start if the seeds are inoculated with nitrogen-fixing bacteria (see discussion of beans) at planting time. Prepare the soil by mixing thoroughly with liberal amounts of aged manure and bone meal. Plant the seeds about 2.5 centimeters (1 inch) deep in heavy soil or 5 centimeters (2 inches) deep in light, sandy soil, about 2.5 centimeters (1 inch) apart in single rows for dwarf bush varieties or in double files 15 centimeters (6 inches) apart for standard varieties, with intervals of 80 to 90 centimeters (32 to 36 inches) between the rows. After germination, thin the plants to 10 centimeters apart. Place support wires, strings, or chicken wire between the rows at the time of planting; peas will not do well without such support.

Green peas should be picked while still young and cooked or frozen immediately, as the sugars that make them sweet are converted to starch within two to three hours after harvest.

Peppers
NV (raw sweet or bell peppers): 22 calories; protein 1.2 gm; fats 0.2 gm; vit. A 420 I.U.; vit. B1 0.08 mg; vit. B2 0.08 mg; niacin 0.5 mg; vit. C 128 mg; fiber 1.4 gm; calcium 9 mg; phosphorus 22 mg; iron 0.7 mg; sodium 13 mg; potassium 213 mg.

Peppers, like eggplants, are strictly hot-weather plants for most of their growing season, but unlike eggplants they actually do better toward the end of their season if temperatures have moderated somewhat. Sweet or bell peppers are closely related and have similar cultural requirements.

Plant seeds indoors eight to ten weeks before the outdoor planting date, which is generally after the soil has become thoroughly warm. They will grow in almost any sunny location in a wide variety of soils, but to obtain the large fruits seen in produce markets, the plants need to be fertilized heavily and watered regularly. Plant seedlings 50 to 60 centimeters (20 to 24 inches) apart in rows that are 60 to 90 centimeters (24 to 36 inches) apart. Sweet peppers can be harvested at almost any stage and are still perfectly edible after they have turned red.

Potatoes
NV (baked in skin): 93 calories; protein 2.6 gm; fats 0.1 gm; vit. A trace; vit. B1 0.10 mg; vit. B2 0.04 mg; niacin 1.7 mg; vit. C 20 mg; fiber 0.6 gm; calcium 9 mg; phosphorus 65 mg; iron 0.7 mg; sodium 4 mg; potassium 503 mg.

Potatoes grow best in a rich, somewhat acid, well-drained soil that has had compost or well-aged manure added to it. They are subject to several diseases, and it is advisable to use disease-free seed potatoes purchased from a reputable dealer. Two to three weeks before the average date of the last spring frost, plant the seed potatoes whole or cut into several pieces, making sure that each piece has at least one eye. Place the potato pieces about 30 centimeters (12 inches) or more apart at a depth of about 12 to 15 centimeters (5 to 6 inches) in rows 0.9 to 1 meter (about 3 feet) apart. Later plantings are feasible. Spread a thick mulch (e.g., straw) over the area after planting to keep soil temperatures down and to retain soil moisture.

Potatoes are ready for harvest when the tops start turning yellow, but they may be left in the ground for several weeks after that if the soil is not too wet. After harvest, wash the potatoes immediately and place them in a dry, cool, dark place until needed. If left exposed to light, the outer parts of the potato turn green; poisonous substances are produced in these tissues, and such potatoes should be discarded.

Spinach
NV (raw): 26 calories; protein 3.2 gm; fats 0.3 gm; vit. A 8,100 I.U.; vit. B1 0.10 mg; vit. B2 0.20 mg; niacin 0.6 mg; vit. C 51 mg; fiber 0.6 gm; calcium 93 mg; phosphorus 51 mg; iron 3.1 mg; sodium 71 mg; potassium 470 mg.

Spinach is a cool-season crop that goes to seed as soon as the days become long and warm. It should be planted in the fall or early spring. If protected by straw or other mulches, it will overwinter in the ground in most areas and be ready for use early in the spring. Spinach has a high nitrogen requirement and reacts negatively to acid soils. It is otherwise easy to grow. Mix the soil thoroughly with aged manure and bone meal before planting. Plant seedlings 3 to 5 centimeters (1 to 2 inches) apart in rows 40 to

50 centimeters (16 to 20 inches) apart. Keep the plants supplied with adequate moisture and their growing area free of weeds. Harvest the whole plant when a healthy crown of leaves develops.

Squash
NV (cooked zucchini): 12 calories; protein 1.0 gm; fats 0.1 gm; vit. A 300 I.U.; vit. B1 0.05 mg; vit. B2 0.08 mg; niacin 0.8 mg; vit. C 9 mg; fiber 0.6 gm; calcium 25 mg; phosphorus 25 mg; iron 0.4 mg; sodium 1 mg; potassium 141 mg.

All varieties of squash are warm-weather plants, and all are targets of a variety of pests. Thorough preparation of the soil before planting pays dividends in production and in the health of the plants. Mix compost and aged manure with the soil and heap the soil in small hills about 1.2 meters (4 feet) apart from one another. Plant four to five seeds in each hill and thin the seedlings to three after they are about 10 centimeters (4 inches) tall. Summer squashes (e.g., zucchini) mature in about two months, while winter squashes (e.g., acorn) can take twice as long to mature. Summer squashes should be harvested while very young—they can balloon, seemingly overnight, into huge fruits. Winter squashes should be harvested before the first frost; only clean, undamaged fruits will store well. Keep such squashes laid out in a cool, dry place until use and not piled on top of one another. Check them occasionally for the development of surface fungi.

Tomatoes
NV (raw, ripe): 22 calories; protein 1.1 gm; fats 0.2 gm; vit. A 900 I.U.; vit. B1 0.06 mg; vit. B2 0.04 mg; niacin 0.7 mg; vit. C 23 mg; fiber 0.5 gm; calcium 13 mg; phosphorus 27 mg; iron 0.5 mg; sodium 3 mg; potassium 244 mg.

These almost universally used fruits are easy to grow providing one understands a few basic aspects of their cultural requirements:

1. Many tomato plants normally will not initiate fruit development from their flowers when night temperatures drop below 14°C (57°F) or day temperatures climb above 40°C (104°F). For the earliest yields, seeds may be germinated indoors several weeks before the plants are to be placed outside, but little is accomplished by transplanting before the night temperatures begin to remain above 14°C (57°F); in addition, some growers insist that plants given an early start indoors do not always do as well later as those germinated outdoors.

2. Tomatoes require considerably more phosphorus than nitrogen from any fertilizers added to the soil where they are to be grown. Many inexperienced gardeners make the mistake of giving the plants lawn or general-purpose fertilizers that are proportionately high in nitrogen. As a result, the plants may grow vigorously but produce very few tomatoes. Give tomatoes bone meal, tomato food (Magamp is an excellent commercial slow-release preparation), or steer manure mixed with superphosphate.

3. Tomato plants seem more susceptible than most to soil fungi and to root-knot nematodes. The damage caused by these organisms may not become evident until the plants begin to bear. Then the lower leaves begin to wither, and yellowing progresses up the plant or there seems to be a general loss of vigor and productivity. Using disease- and nematode-resistant varieties (usually indicated by the letters V, F, and N on seed packets) is by far the simplest method of controlling these problems. Another effective control involves dipping the seedling roots in an emulsion of 0.25% corn oil in water when transplanting; experiments have shown that the corn oil greatly reduces root-knot nematode infestation.

4. Many garden varieties of tomatoes need to be staked to keep fruits off the ground where snails and other organisms can gain easy access to them. When using wooden stakes, be sure they have a diameter of 5 centimeters (2 inches) or more, and tie the plants securely to the stakes with plastic tape. Thinner stakes are likely to break or collapse when the plants grow to a height of 2 meters (6.5 feet) or more. Some growers prefer to use heavy wire tomato towers instead of stakes.

5. Hornworms and tomato worms almost invariably appear on tomato plants during the growing season. They can virtually strip a plant and ruin the fruits if not controlled. Fortunately, control is simple and highly effective with the use of *Bacillus thuringiensis*, which is discussed in Biological Controls.

6. The eating season for garden tomatoes can be extended for about two months past the first frost if all the green tomatoes are picked before frost occurs. Place the tomatoes on sheets of newspaper on a flat surface in a cool, dry place, where they will

ripen slowly a few at a time. Generally, the taste of tomatoes ripened this way is superior to that of hothouse tomatoes sold in produce markets. Be sure when picking the green tomatoes to handle them very gently, as they bruise very easily and molds quickly develop in the bruised areas.

PRUNING

A good gardener or orchardist makes a habit of pruning trees, shrubs, and other plants regularly for a variety of reasons. He or she may wish to improve the quality and size of the fruits and flowers, restrict the size of the plants, keep the plants healthy, shape the shrubbery, or generally get more from the plants.

Except for spring-flowering ornamental shrubs, which should be pruned right after flowering, most maintenance pruning is done in the winter when active growth is not taking place. It usually involves removing portions of stems, but it can also involve roots. When a terminal bud is removed, the axillary or lateral bud just below the cut will usually develop into a branch, and a bushier growth will result. Some gardeners pinch off terminal buds routinely to encourage such growth. The following sections provide a few generalities and specifics pertaining to several types of plants.

Fruit Trees

When young fruit trees are first planted, all except four or five stems and any damaged roots should be pruned off. The remaining stems should be cut back so that there is one central leader about 1 meter (3 feet) tall, with shorter side branches facing in different directions (Figure 1). When the stems are cut, one should be careful to cut in such a way that the axillary or lateral bud just below the cut is facing outward. Each succeeding year, new growth should be pruned back to within a few centimeters of the previous year's cut. Any dead or diseased branches should be removed, and stems that have grown so that they are rubbing against each other should be pruned. The central leader should be cut out the second year in peach trees so that the interior of the tree is left relatively open. Any sucker shoots that develop from the base or along the trunk of the tree should be regularly removed.

Grapevines

There are several methods of pruning grapevines, depending on the type of vine and the circumstances under which the vines are being grown. In general, grapevines should be pruned heavily in late winter for best fruit production. After a central trunk has been allowed to develop, each shoot, regardless of its length, should be cut back so that no more than three axillary buds remain. Exceptions to this rule involve situations in which the vines are trained on arbors or wires, when the shoots initially may be allowed to grow longer. Even then, however, after the desired training has taken place (Figure 2), pruning should be heavy for best results.

Roses

Rose bushes should be pruned heavily—they will recover! In general, new stems should be cut back to within 10 to 20 centimeters (4 to 8 inches) of their point of origin, with care taken that the top remaining axillary bud of each stem is pointing outward. This promotes growth that leaves the center open for better air circulation. Any dead or diseased canes should be removed and the number of remaining canes limited to three or four per plant.

Raspberries, Blackberries, and Their Relatives

Berry canes are biennial. They are produced from the base the first year, branch during the summer, and usually produce fruit on the branches the second year, although in milder climates they may also produce fruit on the first year's growth. The canes die after the second year.

Old, dead canes should be removed, and all but three or four canes developing from each crown should be pulled out when the ground is soft. New canes should be cut back to lengths of 1 meter (3 feet) or less in the spring. Branches of one-year-old canes should be cut back in early spring to lengths of about 30 centimeters (12 inches) for larger fruits.

Bonsai

Container-grown trees that are dwarfed through the constant careful pruning of both roots and stems, the manipulation of soil mixtures, and the weighting of branches are called "bonsai" (Figure 3). Some of these dwarfed trees attain ages of 50 to 75 years or more and may be less than 1 meter (3 feet) tall. Bonsai is an art that requires knowledge of the environmental requirements and tolerances of individual species.

In general, bonsai growers pinch out new growth above a bud every few days during a growing season but never prune when a plant is dormant. See Additional Reading on Houseplants and Gardening for more information on the subject.

GRAFTING

Whip or Tongue Grafting

Whip, or tongue, grafting is widely used for relatively small material—that is, wood between 0.7 and 1.25 centimeters (0.25 and 0.5 inch) in diameter. The stock and scion (rooted portion and aerial portion, respectively) should be nearly identical in diameter to bring about maximum contact between the cambia. The scion should contain two or three buds, and the cuts on both the stock and scion should be made in an internode. As shown in Figure 4, a smooth, tangential cut about 5 centimeters (2 inches) long is made with a sharp, sterilized knife at the bottom of the scion and at the top of the stock. The angles of both cuts should also be as nearly identical as possible, and there should be no irregularities or undulations in the surfaces (such as those caused by a dull cutting instrument). A second cut is then made in both the stock and scion about one-third of the distance from the tip of the cut surfaces. This cut is made back into the wood, nearly parallel to the first cut so that it forms a little tongue. The scion is then inserted into the stock as tightly as possible, taking care not to force a split. In addition, the bottom edge of the scion should not protrude past the bottom of the cut of the stock. The process is completed by binding the materials and adding grafting wax.

If the stock and scion are not identical in diameter, it is still possible to obtain a graft if care is taken to bring the cambia in close contact along one edge of the cuts (Figure 5).

Splice Grafting

Splice grafting is sometimes used with plants where the pith is extensive. It is essentially the same as whip grafting, except that no second cut is made to form a tongue.

Cleft Grafting

Cleft grafting is a widespread method of grafting used routinely when the stock has a considerably greater diameter than that of the scion or scions. The stock branch or trunk is first cut at right angles, making sure the bark is not torn. If some bark is pulled loose by the saw, a new cut should be made. Commercial growers often minimize detachment of the bark by making a cut one-third of the way in on one side and then making a cut slightly lower on the opposite side. This usually leaves a surface with clean edges. Next, a meat cleaver or heavy knife is hammered 5.0 to 7.5 centimeters (2 to 3 inches) into the wood to make a vertical cut or shallow split. A wedge is then temporarily inserted into the cut to keep it open. Scions, usually 7.5 to 10 centimeters (3 to 4 inches) long, are inserted on each side of the cut toward the outer parts so that as much of the cambia as possible are in contact. When the wedge is removed, the fit should be tight enough to prevent the scions from being easily pulled out by hand. Finally, any exposed surface is sealed with grafting wax (Figure 6).

Side Grafting

Side grafting is often used with stocks that are about 2.5 centimeters (1 inch) in diameter. A cut about 2.5 centimeters (1 inch) deep is made with a heavy knife or chisel at an angle of 20 to 30 degrees to the surface of the stock. The bottom end of the scion, which should be 7.5 to 10.0 centimeters (3 to 4 inches) long and about 0.75 centimeter (0.25 inch) in diameter, is cut into a smooth wedge about 2.5 centimeters (1 inch) long. The stock is then bent slightly to open up the cut, and the scion is inserted, making certain that the maximum contact between each cambium is obtained; the pressure is then released to ensure a tight fit (Figure 7). This is followed by sealing with grafting wax. Side grafting may be used to replace limbs lost through storm or other damage or for cosmetic purposes, such as improving the symmetry of the plant.

A variation of this graft, the side tongue graft, is often used with small, broad-leaved evergreen plants. This graft involves slicing about 2.5 to 3.25 centimeters (1 to 1.5 inches) of stem out of the side toward the base to a depth of 0.75 centimeter (0.25 inch), followed by a second, smaller cut to form a tongue within the original cut. A scion, prepared in similar fashion to the side-grafted scion, is then inserted, and the graft is tied and sealed.

Approach Grafting

If two related plants tend not to form grafts very well by other means, approach grafting can be tried. Two independently growing plants, at least one of which is usually in a container, are prepared by making smooth cuts identical in length and depth at the same height on both stems. A tongue sometimes also is cut in both exposed areas, and then the two parts are fitted together, tied, and sealed (Figure 8). This can be done at any time of the year but is most likely to be successful during periods of active growth. After union is achieved, the top of one plant may be cut off above the graft and the bottom of the other removed below the graft.

Inarching is a variation of approach grafting sometimes used to save a valuable tree whose root system has been damaged. Young seedlings or trees of the same kind are planted around the base of the tree. When they have become established, the tip of each seedling, which should be 0.75 to 1.25 centimeters (0.25 to 0.5 inch) thick, is cut vertically for about 15 centimeters (6 inches) on the side nearest the main tree. Then vertical cuts of similar length should be made on the tree to the exact width of the prepared seedling tip and deep enough to expose the cambium; a small flap of bark should be left at the top to cover the tip of the seedling. Next, the prepared seedling tips are fit into the slots and nailed in with four to six flat-headed nails, and the entire area is sealed with grafting wax. If any side shoots appear from the seedlings after the grafting union has developed, they should be pruned off. Because the larger tree will be producing a considerable amount of food, the seedlings often grow very rapidly after successful inarching (Figure 9).

Bridge Grafting

Sometimes in temperate and colder regions, a particularly deep snowpack may prevent rodents and other animals from reaching their usual winter food. When this occurs, they may turn to the bark of trees and gnaw off a band of tissue, sometimes a decimeter or two wide. The damage usually extends through the phloem and cambium, as these tissues are the most palatable to the animals. This stripping of tissues is frequently referred to as girdling a tree and, if left untreated, will probably result in its death through starvation of the roots, since the phloem cannot conduct food past the damaged area.

The tree can often be saved, however, through bridge grafting, particularly if it is done in the early spring just as new growth is beginning. The scions should be cut from dormant twigs of the same tree and kept in a refrigerator until needed. The damaged area should be cleaned and prepared by cutting out any remaining dead or tattered tissues. The scions are then inserted above and below the girdle, about 5.0 to 7.5 centimeters (2 to 3 inches) apart, with the natural bottom ends facing down and the tip ends up (Figure 10). The graft will not succeed if a scion is put in upside down.

Bud Grafting (Budding)

Bud grafting, or budding, is a form of grafting that utilizes a single bud. The method is widely used in commercial nurseries, partly because a single team of two to three workers can produce over a thousand such grafts a day and also because frequently better than 95% of the grafts are successful.

Budding is usually done in the summer when the season's axillary buds are mature and while the sap of the stocks is flowing freely. Budding is generally most successful when plump leaf buds (not flower or mixed buds) of the current season's growth are grafted to healthy stocks that are two to three years old.

The stock is prepared by removing all the leaves and side branches below and in the vicinity of the point at which the graft is to be made. Then a T-shaped incision is made through the bark with the aid of a sterilized, razor-sharp knife. The transverse cut should be roughly 1.25 centimeters (0.5 inch) wide and the vertical cut about 2.5 to 3.0 centimeters (1 to 1.2 inches) long. Both cuts should be no deeper than the cambium, and the bark should peel back easily at the junction of the two cuts.

A bud stick is prepared by removing all leaf material except for 1.25 centimeters (0.5 inch) of the petioles, which are left to serve as handles. Then a bud is carefully cut from the stick so that an oval piece of tissue about 1.75 centimeters (0.75 inch) in diameter surrounds it. If the bud separates from the tissue, it should be discarded and another one cut. The bud and its oval shield are next inserted into the T-shaped cut of the stock, and the flaps of bark are folded over the shield, leaving the bud exposed. Flat rubber strips are used to tie the T shut so that only the bud remains visible. After growth begins, the stock is cut off just above the bud. The stock should not be cut off any earlier because the bud derives benefit from the transport of substances up and down the stock (Figure 11).

Bud grafting can also be done in the spring, as soon as possible after growth of the stock begins but before the bud sticks become active. The bud material is frequently cut and stored in a refrigerator before growth begins. In areas with long growing seasons, bud grafting may also be done in early summer if the bark still peels back easily, but it should not be done any later because a young tree needs to produce sufficient growth before fall to be healthy and vigorous the following season.

In thick-barked trees, such as the Para rubber tree and some of the nut trees, a rectangular patch of bark is cut out of the stock and replaced with a similar patch containing a bud. Normally, the patch is not more than 5 centimeters (2 inches) in diameter. This method is slower than the other budding methods described but generally gives much better results in species with thick bark.

Root Grafting

Whip, or tongue, grafts with roots or pieces of roots used for stocks are sometimes used in the propagation of apple, pear, and other fruit trees. After the grafts have been made, they are usually stored in a cool, damp place for about two months and then refrigerated until early spring, when they are planted before growth starts. After growth begins, they are checked to make sure the scion is not producing its own roots, or the advantages of the original rootstock will be lost. These advantages may include disease resistance or dwarfing.

Double-Working

In double-working grafts, an interstock consisting of a stem segment varying in length from 2.5 centimeters to 30 centimeters (1 to 12 inches) or more is grafted between the stock and scion (i.e., three sections of stem are used for two grafts). Double-working grafts are used for special purposes. One such purpose is dwarfing, usually achieved by using special combinations of materials, but sometimes by this method of grafting. A young tree is cut off above the ground, an additional segment is cut to serve as the interstock, and the stock, interstock, and top (scion) are grafted together with the interstock inverted. This method will work only with certain varieties, as inversion normally effectively blocks the flow of materials up and down the stem. Other purposes of double-working grafts—in which the interstock is not inverted—include the influencing of growth so as to promote greater flower production than would otherwise occur, providing a disease- or cold-resistant trunk, or circumventing graft incompatibility (the failure of grafts to form permanent unions). With regard to this last purpose, if scions of certain varieties will not produce permanent unions when grafted to stocks of another variety but will form good grafts with a third variety, it may be possible to graft the third variety to the stock so that it can function as an interstock, thereby circumventing the problem.

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FIGURE LEGENDS FOR THIS SECTION

Figure 1 A young peach tree. (A) Before pruning. (B) After pruning.

Figure 2 A grapevine. (A) Before pruning. (B) After pruning.

Figure 3 A bonsai plant. This Sitka spruce tree is little more than 30 centimeters (1 foot) tall and is over 40 years old. (Courtesy Guy Downing.)

Figure 4 Stages in whip, or tongue, grafting. (A) A smooth tangential cut is made at the bottom of the scion and at the top of the stock. (B) Vertical cuts are made back into the centers of the stock and scion. (C) The cuts are slightly widened to form a little tongue on each portion. (D) The scion is inserted into the stock as tightly a possible without forcing a split. The graft is then bound with rubber strips and sealed with grafting wax.

Figure 5 A whip, or tongue, graft in which the stock and scion are of different diameters.

Figure 6 Stages in cleft grafting. (A) The stock is cut transversely and a meat cleaver or heavy knife is driven into the wood to make a vertical cut or split. (B) A wedge is temporarily inserted into the vertical cut to keep it open. (C) Scions are inserted into the cut in the vicinity of the cambium, and the wedge is removed. (D) The exposed surfaces are sealed with grafting wax.

Figure 7 How a side graft is made. A tangential cut is made on the side of the stock, and a prepared scion is inserted.

Figure 8 An approach graft. Two independently growing plants are prepared and grafted together as shown. (A) Smooth slanting vertical cuts identical in length and depth and at the same height are made on both stems; the cuts, however, go in opposite directions. (B) The two parts are wedged together. (C) The united area is tied and sealed.

Figure 9 Inarching. (A) Established seedlings, which had previously been planted around the base of the tree, are cut vertically at their tips. Vertical slots of similar length are made in the tree adjacent to the seedling tips. (B) The seedling tips are nailed into the slots. (C) Growth of the seedling bases may be very rapid if the inarching is successful.

Figure 10 Bridge grafting. Scions of small diameter are cut at an angle at each end and inserted into prepared slots cut above and below the girdled area.

Figure 11 Budding (bud grafting). Leaves and side branches are removed from the stock below the point at which the graft is to be made. A bud stick is prepared by removing all leaf material except a short portion of each petiole. (A) A bud, with an oval patch of tissue surround it, is cut from the bud stick. (B) A T-shaped incision is made in the bark of the stock. (C) The bark is pried up slightly at the corners. (D) The bud and its surrounding tissue are inserted into the T-shaped incision on the stock. (E) The flaps of bark are folded over the tissue, leaving the bud exposed, and the T is tied shut with flat rubber strips. (F) After growth begins, the stock is cut off just above the bud.