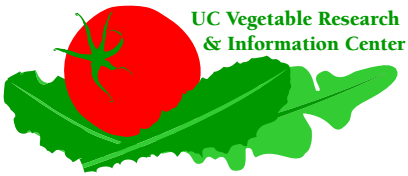

Vegetable
Production Series

ICEBERG LETTUCE PRODUCTION IN CALIFORNIA

THOMAS TURINI, *UC Cooperative Extension Farm Advisor, Fresno County;* **MICHAEL CAHN,** *UC Cooperative Extension Farm Advisor, Monterey, Santa Cruz, and San Benito Counties;* **MARITA CANTWELL,** *Postharvest Extension Specialist, UC Davis;* **LOUISE JACKSON,** *Professor and Cooperative Extension Specialist, Department of Vegetable Crops, University of California, Davis;* **STEVE KOIKE**, *University of California Cooperative Extension Farm Advisor, Monterey County;* **ERIC NATWICK,** *UC Cooperative Extension Farm Advisor, Imperial County;* **RICHARD SMITH,** *UC Cooperative Extension Farm Advisor, Monterey, Santa Cruz, and San Benito Counties;* **KRISHNA SUBBARAO,** *Plant Pathology Extension Specialist, UC Davis;* **ETAFERAHU TAKELE,** *UC Cooperative Extension Area Farm Advisor, Southern California Counties.*

PRODUCTION AREAS AND SEASONS

The major production areas for iceberg (crisphead) lettuce *(Lactuca sativa)* in California are the Central Coast (Monterey, San Luis Obispo, San Benito, Contra Costa, and Santa Clara Counties), the southern coast (Santa Barbara and Ventura Counties), the Central Valley (Fresno and Kings Counties), and the southern deserts (Imperial and Riverside Counties). Production is highest in Monterey County, followed by Imperial County.

Planting to harvest takes 70 to 80 days for midsummer plantings and as long as 130 days for late-fall or winter plantings. In the southern deserts, iceberg lettuce is planted from mid-September to mid-November for harvest from early December to early March. In the lettuce-growing areas of the Central Coast, where temperatures are fairly uniform year-round, lettuce is planted from late December to mid-August for harvest from early April to November. Southern coastal plantings are made from November to August for harvest from April to December. In the Central Valley, iceberg lettuce is planted from mid-August to early September for harvest from late October through November. Spring plantings are made in November for harvest in late March and April.

ICEBERG LETTUCE ACREAGE AND VALUE

Year	Acreage	Average yield (tons/acre)	Gross value/acre
2007	119,000	19.9	$7,810
2008	116,000	19.9	$7,562
2009	114,000	20.7	$7,915

Source: California Agricultural Resource Directory 2010 (Sacramento: California Department of Food and Agriculture, 2009).

CLIMATIC REQUIREMENTS

Lettuce is a cool-season crop with distinct temperature requirements. The optimal growing temperatures are 73ºF (23ºC) during the day and 45ºF (7ºC) at night. Most California growing regions have daytime temperatures from 63º to 83ºF (17º to 28ºC) and night temperatures from 37º to 53ºF (3º to 12ºC). High temperatures may cause bolting, bitterness, poor head formation, and tipburn. At temperatures near freezing, young plants are not damaged, but growth is slow. Freezing can damage the outer leaves of mature lettuce, leading to decay in handling and storage.

VARIETIES AND PLANTING TECHNIQUES

Lettuce varieties are adapted to specific planting periods (slots) in the Southern California deserts. Planting a variety out of slot will result in nonheading, puffiness, and unacceptable core lengths or bolting. Moderately high temperatures can occur in early spring. As the season progresses, temperatures change from extremely hot days to cooler days and freezing nights.

Varieties commonly planted in Southern California include Accolade, Annie, Beacon, Bubba, Cibola, Coolguard, Coyote, Crusader, Del Rio, Del Oro, Desert Queen, Desert Spring, Desert Storm, Diamondback, Gabilan, Gran Max, Heatmaster, Honcho II, Jackal, Javelina, Jupiter, Kofa, Lighthouse, Mid Queen, Prestige, Raider, Sahara, Silverado, Sun Devil, Valley Queen, Winterhaven, Dominguez 67, Red Coach 74, and Wellton.

On the Central Coast, resistance to downy mildew and corky root diseases are important considerations for variety selection. Current varieties are the Salinas types: Bay View, Cannery Row, Durango, El Dorado,

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Hallmark, Laguna Fresca, Legacy, Legend, Liberty, Pybas 251, Sharpshooter, Silverado, Sniper, Sureshot, Target, Telluride, Tiber, and Trojan.

In the Central Valley, the most common fall varieties include Crusader, Diamondback, Raider, Sidewinder, and Sun Devil. Spring-planted varieties include Annie, Bubba, Desert Spring, Desert Storm, Diamond, Grizzly, Headmaster, Lighthouse, Mohawk, Navaho, Red Coach 74, Valley Queen, and Winter King.

Most iceberg lettuce is planted using pelleted seed and a precision planter; very little lettuce is transplanted in California. Seed are planted 1.75 to 3 inches (4.4 to 7.5 cm) apart in rows on 40-inch (102-cm) beds. At a 2-inch (5-cm) spacing there will be 157,000 seed per acre (388,000 seed/ha). Lettuce is thinned to a spacing of 10 to 12 inches (25.4-30.5 cm). The cost of seed varies with variety, coating, spacing, seed enhancement, and priming (osmoconditioning) treatments. Nonprimed, natural lettuce seed may be susceptible to thermodormancy when ambient temperatures are above 90ºF (32ºC) for an extended period. Priming allows the seed to overcome thermodormancy and germinate at higher temperatures. Primed seed is commonly used in low desert production areas. Thermodormancy can also be broken by starting the initial irrigation in the late afternoon so the seed can imbibe water and germinate during the cooler hours of the night.

SOILS

Iceberg lettuce grows best in silt loams and sandy soils in the southern deserts. Lighter-textured soils provide better drainage during cold weather and warm up more readily. In the Central Coast and Central Valley, lettuce can be grown on heavy clay soils as long as there is good soil structure and adequate drainage. Lettuce is moderately salt sensitive: electrical conductivity of the soil extract in excess of 2.5 dS/m may reduce seed germination and/or growth. Irrigation water with salinity levels of less 1 dS/m are considered the most suitable for lettuce.

IRRIGATION

In the southern deserts, most growers use sprinklers for the first 5 to 7 days or until the seedlings emerge. The field is then furrow irrigated for the remainder of the season. In the southern deserts, 3 acre-feet (3,700 m^3) of water per acre is typically used to grow a lettuce crop. The majority of the water is applied in the last 30 days before harvest. Care must be taken not to oversaturate the beds when growing early-season lettuce—excess moisture favors the development of bottom rot. Gated pipe is also used to deliver water, especially near harvest. Gated pipe allows uniform application of water down furrows and maintains a dry head basin so that harvest equipment can turn around on dry soil.

Most Central Coast fields are preirrigated with about 2 to 4 inches (5 to 10 cm) of water, depending on initial conditions, to soften soil for listing and seedbed preparation. Both seeded and transplanted lettuce are sprinkle-irrigated frequently (every 2 to 3 days) until seedlings emerge or are established (usually 6 to 10 days). Both hand-move and solid-set sprinklers are used for stand establishment. After emergence the crop is irrigated less frequently until thinning about 2 to 3 weeks after seeding. Water is usually applied to soften the soil before thinning with hoes and applied again after side-dressing of fertilizer. Sprinklers are continued after thinning and side-dressing on most of the acreage, but furrow irrigation is still used in some areas. In regions with strong winds, a well-managed furrow system may provide better irrigation distribution uniformity than sprinklers. Depending on soil type and terrain, fields may be sprinkled to maturity with hand-move, linear-move, or permanently buried sprinkler systems. In late summer or fall when corky root disease can be a problem, sprinkler irrigation is often used because the plants' root systems are degraded. As the crop approaches maturity, excess water and fertilizer causes heads to become large and puffy, reducing their value. The volume of applied water is typically 1.5 to 2 acre-feet per acre (750 to 1,000 m^3/ha) for a sprinkler-irrigated lettuce crop and 2 to 2.5 acre-feet per acre (1,000 to 1,250 m^3/ha) for a furrow irrigated crop on the central coast. Drip-irrigated lettuce requires approximately 1 to 1.5 acre-feet of water per acre (500 to 750 m^3/ha).

Surface-placed drip has become a major method of irrigating lettuce on the Central Coast. Drip irrigation was used on 30% of the vegetable acreage in the Salinas Valley in 2006. Surface drip is usually installed after the first cultivation and sidedressing, and it permits growers to water frequently during the phase of rapid vegetative growth. One drip line is installed between 2 plant rows on 40-inch (1-m) beds, or 3 drip lines are installed between 6 or 5 plant rows on 80-inch (2-m) beds. The drip lines are typically retrieved before harvesting and reused for subsequent crops. Drip can potentially distribute water more uniformly than furrow or sprinklers and has helped growers attain uniform growth in fields with variable soil textures by maintaining similar soil moisture levels in all areas of the field. Drip can be managed to minimize leaching of nitrate-nitrogen (NO_3-N) by fertigating weekly with low rates of fertilizer and applying less water more frequently than can be achieved with sprinkler and furrow systems. A subset of growers bury drip tape to a depth from 2 to 3 inches (2.5 to 7.6 cm) before planting. Drip tape is rarely buried deeper than 3

inches for lettuce. Some growers use the shallowly buried drip tape for full-season irrigation, including for germination. High bicarbonate, manganese, or iron levels in groundwater in some areas of the Central Coast can plug drip emitters. Acid is periodically injected to remove bicarbonate and iron precipitates.

The combination of soil moisture monitoring and weather-based irrigation scheduling can help determine the water needs of lettuce. Water use is highest during the 20 days of the crop when vegetative growth is high. Soil moisture tensions are typically targeted for less than 25 to 30 cbars (25 to 30 kPa) during this period. The water extraction of lettuce can be estimated using reference evapotranspiration data adjusted with a crop coefficient, which is closely related to the percentage of ground covered by the canopy. At a maximum canopy cover of 85%, the crop coefficient is nearly 1.0. Because evaporation represents a majority of the water loss during the early stages of growth, a crop coefficient between 0.3 and 0.7 should be used for overhead sprinklers, depending on the irrigation frequency, until the canopy is greater than 30% cover. The California Irrigation Management Information System (CIMIS, http://wwwcimis.water.ca.gov), coordinated by the California Department of Water Resources, provides daily estimates of reference evapotranspiration for most production regions of California.

FERTILIZATION

Soils in the central and south coast regions can have elevated levels of nitrate-nitrogen and phosphorus, which can cause elevated levels of these nutrients in runoff; this makes it difficult for growers to comply with water quality standards established by local regional water quality control boards. As a result, application of these nutrients needs to be carefully managed.

Phosphorus fertilization should be applied based on the soil test level of bicarbonate-extractable phosphorus. Levels above 60 ppm are adequate for lettuce growth; for soils below this level, especially in the winter, preplant applications of 40 to 80 pounds per acre (45 to 90 kg/ha) of P_2O_5 or at-planting applications of 20 pounds per acre (22 kg/ha) of P_2O_5 are recommended. The need for potassium can also be determined from soil tests; soils with greater than 150 ppm of ammonium acetate–exchangeable potassium have sufficient quantities of potassium for the crop. Potassium fertilization presents no environmental risk, and many growers routinely apply potassium even in fields with high levels of exchangeable soil potassium. While fertilizing to replace potassium removal with the harvested crop, approximately 120 pounds per acre (134 kg/ha), is appropriate to maintain soil fertility, fertilization rates above that level are economically wasteful. Zinc fertilization is recommended if the DTPA extractable soil level is less than 1.5 ppm. Zinc fertilization is commonly practiced on the Central Coast due to high soil phosphorus levels, which reduces zinc uptake by plants.

Fall application of nitrogen is not recommended due to the risk of nitrate-nitrogen leaching beyond the root zone by the winter rains. Small quantities of nitrogen, 20 pounds per acre (22 kg/ha), are applied preplant or at planting. At thinning, 50 to 80 pounds per acre (56 to 90 kg/ha) of nitrogen is sidedressed into the beds. One or more additional sidedressings are common, typically several weeks apart. Seasonal nitrogen application to the first lettuce crop of the year on the Central Coast range from 150 to 180 pounds per acre (168 to 202 kg/ha) of nitrogen. Due to residual nitrogen from prior crops and mineralization of nitrogen from soil organic matter the fertilization rates for the second crop of lettuce typically range from 100 to 150 pounds per acre (112 to 168 kg/ha) of nitrogen. The sidedress nitrogen requirement can be estimated by pre-sidedress soil nitrate testing (PSNT). Soil nitrate levels greater than 20 ppm in the top 12 inches (30 cm) are adequate for crop growth; the test can be repeated later in the season to ensure continuing nitrogen sufficiency. A small quantity of nitrogen, 10 to 15 pounds per acre (11 to 17 kg/ha), is often applied 7 to 10 days prior to harvest to assure that the crop color and growth rate are acceptable. In drip-irrigated fields nitrogen can be applied through the drip system as well. Typically, drip systems are more efficient at managing water and delivering nitrogen fertilizer, and therefore fertilizer application rates are often 20 to 30% lower than in conventionally irrigated fields.

In the southern deserts and the Central Valley, where soil test phosphorus is usually lower than on the Central coast, growers apply preplant P_2O_5 at rates as high as 250 pounds per acre (280 kg/ha). Nitrogen can be applied preplant at rates as high as 50 pounds per acre (56 kg/ha); it is sidedressed just after thinning and during later growth. Early, warm-season lettuce has a shorter growing season than a crop grown in January and February, and it usually receives less nitrogen fertilization. A seasonal total of approximately 150 pounds of nitrogen per acre (168 kg/ha) is typical for early-season crops, while 200 to 250 pounds per acre (224 to 280 kg/ha) is applied during cold weather.

Lettuce is sensitive to high levels of ammonium in the soil. Ammonium toxicity typically occurs in the early spring (March-April) when soils are cool and the transformation from ammonium to nitrate is slow. Injured roots may have the tip of the root browned off and may also develop a hollow, reddish, brown cavity on the inside of the upper part of the root.

Ammonium toxicity can also occur later in the season (June-July) on heavier soils.

Due to food safety concerns manures are not used in lettuce production; composted manures and yard wastes are used by some growers. Application rates are typically 4 tons per acre (9 t/ha) and are primarily applied to maintain good soil structure.

INTEGRATED PEST MANAGEMENT

Contact the UC Davis IPM Web site at http://www.ipm.ucdavis.edu or your local UCCE Farm Advisor for current pest management information (see the UC IPM Pest Management Guidelines for Lettuce, http://www.ipm.ucdavis.edu/PMG/selectnewpest.lettuce.html, ANR Communication Services Publication 3450, October 2010).

Weed management. Several herbicides are used for lettuce weed control. Consult your UCCE Farm Advisor or the UC IPM Web site for more details on the best approach to controlling weeds under your conditions. Preemergence herbicides are typically applied in a band 5 to 6 inches (12.7 to 15.2 cm) wide over the seedlines after planting prior to the first irrigation. Cultural weed control methods used by both conventional and organic growers include the use of preirrigation followed by shallow cultivation. Burndown herbicides or propane flaming also provides significant weed control and can be repeated to provide additional control. Other important cultural weed control tools include mechanical cultivation and control of weeds before they go to seed both in and around the field. Lettuce is thinned and weeded approximately 30 days following planting. An additional hand weeding is carried out 2 to 3 weeks later.

Insect identification and control. The most important insect pests of lettuce in California are aphids, leafminers, caterpillars, thrips, and whiteflies. Pest problems vary according to the growing region and time of year.

The lettuce aphid *(Nasonovia ribisnigri)* became established on the Central Coast in 1998 and has since become the most important insect pest of lettuce in that area. Lettuce aphid infests the inner leaves of the lettuce head, making it unmarketable. Foxglove aphid *(Aulocorthum solani)* also infests the inner leaves of lettuce. Green peach aphid *(Myzus persicae)* and potato aphid *(Macrosiphum euphorbiae)* can be significant pests of Central Coast lettuce, although they tend to build up on the outer leaves, making them easier to treat with insecticides. Since lettuce aphid and foxglove aphid become protected within the lettuce head as more leaves develop, detection and treatment of incipient populations is essential. Lettuce aphid and foxglove aphid may not be adequately controlled with neonicotinoid insecticide treatments via soil injection or foliar sprays. Aphid pests of lettuce have many natural enemies, including fungal pathogens that are common during cool, wet spring weather. Parasitic wasps help suppress aphids species that colonize outer leaves of lettuce. Syrphid fly larvae and other aphid predators such as ladybird beetles can help suppress aphid species that infest inner leaves. Predation of lettuce aphid by syrphid fly larvae is essential for organic production of leaf lettuce on the Central Coast. A variety of *Nasonovia*-resistant romaine lettuce called Nirvanus is available, but it is not resistant to other species of aphid.

The primary damage from leafminers is caused by the larvae, which form tunnels between the upper and lower leaf surface, feeding on the mesophyll tissue. In addition, female leafminer flies puncture leaf surfaces with their ovipositor in order to extract fluid on which to feed, and causing stippling damage in the process. Leafminer larvae are highly susceptible to parasitism by parasitic wasps, especially those in the genus *Diglyphus.* Parasitic wasps can help suppress leafminer populations if insecticides do not interfere with their activity. In coastal areas, the pea leafminer *(Liriomyza langei)* is the most common leafminer. The serpentine leafminer *(Liriomyza trifolii)* is the prevalent species in the southern region, and the vegetable leafminer *(Liriomyza sativae)* is also found in coastal areas. Insecticide treatments should be applied to manage larvae rather than the more mobile, insecticide-resistant adults.

Beet armyworm, cabbage loopers, and other caterpillars cause sporadic problems throughout lettuce-growing regions. Beet armyworm and cabbage looper larvae are susceptible to several natural enemies, including diseases, predators, and parasitoids. Beet armyworm, cabbage loopers, and other caterpillars should be treated with selective insecticides whenever possible.

In Southern California, the sweetpotato whitefly (*Bemisia tabaci* Biotype B), also known as silverleaf whitefly *(Bemisia argentifolii)*, has slowed growth and delayed maturity of the crop. Although this pest can be controlled with registered materials, it may become resistant if one chemical is used too heavily.

Disease identification and management. Downy mildew *(Bremia lactucae)*, lettuce drop *(Sclerotinia minor* and *S. sclerotiorum)* and lettuce big vein (*Mirafiori lettuce big-vein virus* and *lettuce big-vein associated virus*) may cause damage in all California production areas. Fusarium wilt *(Fusarium oxysporum* f. sp. *lactucum)* is most common in Fresno County, but it was recently reported in eastern Imperial and in coastal Santa Cruz and Monterey Counties. Corky root *(Sphinomonas suberifaciens)* may cause damage in

coastal and desert production areas. Lettuce mosaic virus and bacterial leaf spot can also be a problem in coastal areas. In desert production areas, fungicide applications may be needed to prevent powdery mildew *(Golovinomyces cichoracearum)* from covering the cap leaf when temperatures are high and lettuce is mature, but control is not recommended in other production areas.

Lettuce mosaic *(Lettuce mosaic virus*, LMV*)*, big vein, beet western yellows *(Beet western yellows virus)*, and turnip mosaic *(Turnip mosaic virus)* are viral diseases that affect lettuce. With the exception of LMV, these viruses are of moderate concern, and control measures are rarely needed. LMV can be controlled by using mosaic-free seed (i.e., no virus in 30,000 seed). Other management steps include selecting resistant cultivars, controlling aphid vectors, removing weed hosts, and plowing down harvested fields that can harbor viruses. A lettuce-free period, which creates a break in the virus cycle during the winter, is mandated by county ordinance in some coastal areas.

Lettuce drop is a serious soilborne fungal disease that can affect crops from rosette stage until harvest. Rotate crops and use registered fungicides immediately after thinning according to the pesticide label. Lettuce drop caused by *S. sclerotiorum* can also be airborne, and fungicide applications may be needed to minimize economic loss under the wet, cool conditions that favor disease development.

Bottom rot *(Rhizoctonia solani)* can cause serious losses in the San Joaquin Valley and the southern desert areas; it is rarely seen elsewhere in the state. The disease is most prevalent on early-season lettuce that matures between the end of November and mid-January. Use fungicidal sprays to control this disease.

Downy mildew *(Bremia lactucae)* is managed by planting resistant cultivars and applying protectant fungicides. However, the genetic variability of this pathogen results in some strains that cannot be controlled by fungicides or resistant cultivars.

Bacterial leaf spot *(Xanthomonas campestris* pv. *vitians)*, varnish spot *(Pseudomonas cichorii)*, and anthracnose *(Microdochium panattonianum)* are foliar diseases that can affect developing lettuce. Favored by the wet, cool conditions of spring, bacterial leaf spot can be only partially controlled by copper fungicides; other control options are not yet available. Because the varnish spot bacterium is found in reservoir water, avoiding sprinkler irrigation usually eliminates this disease. Anthracnose is found only in fields where the resting fungal structure is present in soil during rainy spring weather. Application of protectant fungicides controls this pathogen; avoid planting lettuce in fields with a history of the disease.

Corky root is caused by the soilborne bacterium *Rhizomonas suberifaciens*. Rotate crops so that lettuce is not planted consecutively in the same fields and avoid overfertilizing with nitrogen. However, for infected crops, growers may need to add supplemental fertilizer and water to achieve satisfactory crop yields. Some resistant cultivars are now available.

Verticillium wilt caused by *Verticillium dahliae* appeared suddenly on lettuce in 1995 and affects every type of lettuce. The disease is currently restricted to Salinas and Pajaro Valley fields. Losses from the disease on affected crops can be near-total. The fungus produces microsclerotia, long-term resting structures, that lie dormant in the soil for 10 to 15 years. Hence, growers should clean the equipment from affected fields before using it in other fields. Two races of the pathogens exist, and sources of resistance to both are being developed. Fumigation or rotations with broccoli remain the only effective options against this disease until resistant cultivars are commercially available.

Fusarium wilt of lettuce is best controlled by avoiding movement of infested soil to clean fields. Risk of loss is lower at lower soil temperatures. Therefore, reduce the likelihood of losses by avoiding planting lettuce when soil temperatures are high in fields known to be infested.

Abiotic disorders. Freezing injury on mature lettuce is expressed as blistering and peeling of the epidermis followed by browning of the tissues. Normally, freezing injury is confined to the cap and wrapper leaves. Tipburn is a physiological disorder caused by the lack of mobility of calcium in the heads during warm weather and rapid growing conditions. There is presently no control for lettuce tipburn.

HARVEST AND HANDLING

Iceberg lettuce is field-packed into cartons. About 60 percent of lettuce is harvested by ground packing (naked packed, as opposed to wrapped). In ground packing, crews of approximately 20 to 30 are split into units (trios) that consist of two cutters and a packer. Trio members often rotate jobs and are normally paid by the number of cartons packed. The solid lettuce heads are cut, trimmed to 4 to 5 wrapper leaves, and packed 24 per carton. A carton has a minimum gross weight of 50 pounds (22.7 kg). About 40 percent of lettuce is wrapped at harvest. Cut and trimmed heads (wrapper leaves removed) are stacked on a table, and workers then wrap and seal each head in film or a plastic bag. The wrapped heads are packed with either 24 or 30 heads per carton. Lettuce in cartons is vacuum cooled prior to storage in a cold room. Vacuum cooling removes field heat in roughly 15 minutes.

Some companies contract, grow, and handle bulk lettuce as their primary product. At harvest, all wrapper leaves are removed in the field. Heads are packed in bins approximately 1 cubic yard (0.75 m^3) in volume for precooling and transport. At the processing plant, heads can be further trimmed, cored, cooled, washed, and precut into various types of retail packages for the food-service industry. The entire processing plant is maintained at 35° to 40°F (1.7° to 4.5°C) to help maintain crispness and freshness.

POSTHARVEST HANDLING

Lettuce is highly perishable and should be cooled as soon as possible after harvesting. Vacuum cooling reduces product temperature to 34°F (1°C); it should then be stored just above freezing at 98% relative humidity. Lettuce harvested at prime maturity with no major defects may be held for 2 to 3 weeks at 34°F. At 37°F (3°C), shelf life is reduced to 1 to 2 weeks. Russet spotting is a disorder caused by storing lettuce in containers or cold rooms where ethylene gas, which can be generated by ripening fruits and gasoline engines, is present. Brown stain is a storage disorder caused by high carbon dioxide levels in the cold room.

Iceberg lettuce is sold in many types of packages. Fifty-pound (22.7-kg) cartons containing 24 or 30 wrapped or naked-packed heads are common. Processed iceberg lettuce (chopped, cleaned, or cored) is shipped in 1,000-pound (454-kg) bins. Food-service packs include one 20-pound (9-kg), four 5-pound (2.25-kg), or two 10-pound (4.5-kg) cartons. There are also packages containing 6 heads that are cleaned and trimmed or cored and trimmed.

MARKETING

California produces iceberg lettuce year-round. Supplies peak in May and June and are lowest in December, January, and February. California's lower volume during the winter is due to large supplies coming from western Arizona; the overall national supply is nearly static. Most of California's iceberg lettuce is shipped by refrigerated truck to markets throughout the United States and Canada. Limited quantities are shipped by air, mostly to export markets in Europe. Iceberg lettuce products are used by fast-food outlets, restaurants, institutions, airlines, and schools.

COST OF PRODUCTION

Costs of production of lettuce vary with location; for example, the costs of water, land lease, and inputs (fertilizer, pesticides, etc.) depend on weather and soil. Generally, lettuce production is labor intensive, especially in harvesting and postharvest handling. See *Sample Production Costs for Wrapped Iceberg Lettuce, Monterey and Santa Cruz Counties (2000–2001)*, http://coststudies.ucdavis.edu/files/lethead2001.pdf; and *Sample Cost to Establish and Produce Iceberg Lettuce (2004)*, http://ucce.ucdavis.edu/files/filelibrary/5600/42658.pdf.

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University of California
Agriculture and Natural Resources
Communication Services
1301 S. 46th Street
Building 478 – MC 3580
Richmond, CA 94804-4600

Telephone 1-800-994-8849
510-665-2195
FAX 510-665-3427
E-mail: anrcatalog@ucdavis.edu

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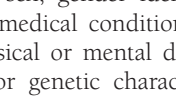

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