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LETTUCE GROWING & PREPARATION FOR MARKET

by

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Horticulturist (Vegetable Crops)

Federal Cooperative Extension Service  
Oregon State College  
Corvallis

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## LETTUCE GROWING &amp; PREPARATION FOR MARKET

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Lettuce is the most important salad vegetable crop. The increase in production, marketing, and consumption of this vegetable during the last 25 years or so has been phenomenal. In 1916 lettuce shipments in the United States totaled 4,700 cars, and were exceeded at that time by fifteen other fruits and vegetables. In 1918 the number of cars totaled 6,959, but in 1928 the total was 51,480 cars, or an increase of over 600 per cent. The total number of cars shipped in 1939 was 52,340. Of this amount California shipped over 70 per cent.

In recent years, lettuce has ranked fourth among all fruits and vegetables, now being exceeded in volume of cars shipped only by potatoes, oranges, and apples.

It is interesting to note that in 1917 the per capita consumption of lettuce was less than one head, while in 1939 it was slightly over 13 heads per year.

In Northwestern states, Oregon shipped 127 cars of lettuce in 1924, 9 in 1928 and 268 cars in 1939. The 1939 crop of lettuce came mainly from Nyssa, Ontario and Vale in Malheur County, to the extent of 247 cars. The balance came from Portland, Multnomah County, 12 cars; and 9 cars from Joseph, Wallowa County. A total of 590 cars was shipped from Malheur County in 1940.

In the state of Idaho 537 cars were produced in 1924, only 72 cars in 1928, but the volume reached 842 cars in 1939. Idaho's acreage is mostly in Canyon, Owyhee and Payette Counties.

The state of Washington shipped 648 cars in 1924, 1232 cars in 1928, 2230 cars in 1930, but the total for 1939 was but 560 cars. Washington grows lettuce largely in King, Franklin, Pierce and Walla Walla Counties.

The Malheur County, Oregon, lettuce deal is one that takes place in the fall, shipments being made during the months of October and November. Multnomah County's shipments have been largely in the late spring and summer, while the Wallowa County shipments were made mostly in October.

The majority of the Idaho lettuce is shipped in October and November, some 800 out of 842 cars in 1939 rolling during the fall months.

In the state of Washington, approximately 450 cars of lettuce were shipped during May, June and July out of a total of 560 cars for the year, the remaining number being shipped in October and November.

In California, shipments are made throughout the entire year, but the largest number of shipments come from the central district, beginning about October 1, and extending through the fall and early winter months. From December 1 to April 15, shipments are made from the Imperial Valley. There are four main areas in California in which lettuce is grown; the northern district, central district, southern district and Imperial Valley.

### Climatic Requirements

Lettuce is essentially a cool season crop, and while the young plants in their early stages may grow during times when the temperatures are quite warm, yet it is desirable to have moderately cool temperatures during periods of harvesting, as indicated in the data shown above for the seasons of shipping in the northwestern states. May and June are usually favorable months in the spring while September, October and early November are the best months for the fall crop. In the early stages of the growth of the young plants they can stand slight frosts without injury, but when the heads are about formed, frosts are injurious. During the spring, young plants that are growing outside while light frosts are still prevalent are seldom injured by such frosts, but in the fall, freezes may damage the late crop before it is entirely harvested.

High temperatures cause loose heads, inferior flavor, and formation of seed stalks and, when accompanied by high humidity, increase the tendency for tip-burn and slime to occur. Moderately warm days and cool nights, but frost-free, make good growing weather for head lettuce. Heavy rains are undesirable for they have a tendency to make loose heads and induce stem rot or lettuce "drop."

In Colorado, good lettuce is produced at an altitude of 7000 to 9000 feet where the days are moderately warm and the nights are cool but not frosty.

While California ships lettuce throughout the year, most of the crops from individual localities mature during the cool seasons of the respective areas. The crop may be grown in the summer and fall in the coastal regions such as in Monterey County. Oregon has several counties on the coast where lettuce grows exceedingly well during the summer, and this crop is worthy of greater attention by vegetable growers in those counties.

The fall lettuce deal in the northwest is dependent to a great extent on favorable weather particularly in freedom from early frosts or damaging rains.

### Soil Requirements and Fertilizers

In the commercial production of lettuce there are possibly three types of soil which are more widely used than others, sandy loam, silt loam, and peat lands. The lighter irrigated soils are useful in producing early spring and fall lettuce. The value of the peat land lies largely in its high content of humus and its ability to hold a consistent amount of moisture. Any lettuce-growing soil should have at least a fair percentage of organic matter. Drainage is particularly important for the spring and fall crops. Organic soil such as peat land is more useful for mid-summer. Any lettuce soil must be of such character that it can be worked down to a fine seedbed, for the crop is commercially grown by sowing seed in rows close together. Clay loam soils when well fertilized produce good hard lettuce but are sometimes too coarse and cloddy to be worked down to a fine seedbed.

Soils irrigated by gravity or furrow must be leveled to a grade so as to permit economical watering. Rolling land can be watered by overhead systems.

Fundamentally, the best fertilizer for lettuce is barnyard manure, which will increase the organic matter in the soil as well as provide plant food for the crop. While peat lands are high in organic matter, the lighter sandy and silt

loam soils are often deficient in this respect and applications of barnyard manure or plantings of a cover crop must therefore be made. Rotted barnyard manure is easily incorporated with the soil and does not interfere with planting and cultivation. Heavy applications of manure, however, may cause heads to be leafy, loose, and comparatively soft. In the Imperial Valley of California an application of 10 tons per acre of barnyard manure increased the total yield 54% and caused the lettuce to be earlier, larger and of better quality than the unmanured plots. Lettuce fields can be supplied with organic matter by turning under a cover crop such as discussed in Extension bulletin 524, "Fertilizers for Vegetable Crops." In some cases manure is applied to the crop preceding the lettuce although this would not be true where early potatoes preceded lettuce such as in Malheur County.

Commercial fertilizers, used in many lettuce-growing areas, are apt to be more efficient if the soil is well supplied with organic matter.

In Washington state a 4-8-8 complete fertilizer is recommended at the rate of 1000 pounds per acre, all of which is broadcasted before planting or 500 pounds broadcasted before planting and the remainder used as a side dressing to the plants in the rows. If the land is in a good state of fertility it may not be necessary to use more than 500 pounds of commercial fertilizer per acre.

Experiments in growing lettuce in soils having various pH values indicate that it will grow well on soils that are slightly acid. If superphosphate is used as a fertilizer it does not seem desirable in most cases to use lime.

Fertilizer tests on lettuce at the Arizona Experiment Station indicated that superphosphate alone hastened maturity of the lettuce plants and at the same time slightly increased the size and compactness of the heads. Ammoniated phosphorus 11-48 was superior to 16-20.

In the Imperial Valley of California, phosphate fertilizer applied before planting seemed to result in earlier maturity, larger heads and higher yields. Applications are made by broadcasting the phosphate on the soil before the land is finally disked and floated. Recommendations in California also include a complete fertilizer broadcast in the final preparation of the soil before planting or drilled in at the time the beds are made. Some growers drill the fertilizer in at planting time, putting it one or two inches below the seeds and to one side of the row by using special attachments on the seeders.

In recent tests by the Arizona Experiment Station the most effective placement of 11-48 ammoniated phosphate was in a single band applied  $1\frac{1}{2}$  inches laterally toward irrigation furrow at time of planting. Band placement gave higher yields, a week's earlier maturity, and more uniform sizes and evenness of maturity than broadcast applications.

In most instances a carefully fertilized field will outyield land that has not been fertilized liberally. The grower should apply fertilizer with two objectives in mind, first, to increase the quality of the lettuce, particularly solidity, and secondly, to increase the percentage of No. 1 grade heads.

In most cases individual farm tests are necessary to determine what fertilizers are most suitable for the particular soil in question. In some parts of Oregon a 3-10-10 complete fertilizer has been used to advantage. Where the soil

is low in nitrogen it is probable that an application of nitrogen fertilizer may be expected to be beneficial, but where the soil is high in nitrate nitrogen, the plants may not head so solidly and may be more susceptible to tip-burn.

### Varieties and Seed Strains

The most widely grown variety of head lettuce is the New York. The produce trade calls it Iceberg, but it is not the Iceberg variety which is separate and distinct from New York. There are several strains of New York, including Nos. 12 and 515. New York 12 produces large heads, particularly adapted to spring and early summer heading. New York 515 is an early variety adapted for summer and early fall production. The latter seems to resist tip-burn quite well in warm weather and in California is used principally for summer lettuce near the Pacific Ocean. It is not adapted everywhere for fall harvest, due to its tendency to bolt under unfavorable conditions. The habit of growth and head formation is similar to New York 12, but the color is brighter green and the heads somewhat better formed and smoother.

More recently, strains of lettuce called Imperial have been developed. Among the most promising of these is Imperial 847 and 850, which seem to be particularly useful in the growing of summer lettuce in the coastal areas. Imperial 44 has been developed for the growing of a New York type in the East and Southeast, where it seems to head pretty well in warm weather. However, in Oregon, this variety has slimed rather badly. Imperial 152 is now used almost exclusively for fall lettuce in Malheur County. Imperial 847 is used a little and 615 is apparently best for spring lettuce.

### Growing the Crop

There are two ways of growing lettuce for market, one by sowing the seed directly in the ground where the crop is to grow, and the other by transplanting the young plants to the field from a cold frame or cool greenhouse. The greater part of the commercial head lettuce grown throughout the country is produced by direct seeding, but some early lettuce is grown on a small scale by the transplanting method, in which hotbeds or small greenhouses are used for growing the young plants. Seed is sown during January or February and the plants are transplanted to the field during March or April, according to when weather conditions are favorable. Details of growing such plants are contained in the circular on "Growing Early Vegetable Plants," Extension Circular 342.

When the seed is drilled directly in the field, one to two pounds of seed per acre will be used, depending on the distance between rows, and the soil must be finely prepared in order to make it possible for the seeder to do good work in dropping and covering the seed. Thick seeding is wasteful of seed and makes expensive thinning. It is desirable to plant seed that is at least one year old. Lettuce seed will not germinate well if the temperature of the soil is above 90° F.

In California, where a large amount of lettuce is grown, the land is ridged or made up into beds which are formed by the use of a double or triple lister, which is followed later by a harrow or sled to prepare a fine seedbed. The distance between the two rows of lettuce on each bed is about 14 inches from center to center, the beds themselves being about 20 inches wide and a space of 22 inches being left between the beds to provide for the running of the irrigation water.

In other cases, where the crop is not grown on beds, the distance between the rows is usually from 18 to 24 inches, and the plants are thinned to stand 12 to 15 inches in the row.

Head lettuce requires about 90 to 100 days to grow from seed to maturity, depending upon the time of the year when it is produced, consequently it is necessary to sow the seed about three months before it is desired to cut the crop. In areas, such as the coastal counties, where the temperature seldom becomes warm, seeding can be made at regular intervals beginning in the spring. The main crop of lettuce which is harvested in eastern Oregon is commonly started during the last few days of July or the first days of August.

If lettuce is grown as a crop for local marketing, some late vegetable crops may follow the early head lettuce crop such as late cabbage, cauliflower, spinach, celery, etc. If lettuce is grown for a fall crop, early vegetables may precede it, such as early peas, spinach and early potatoes.

#### Thinning and Cultivation

As previously mentioned, it will be necessary to thin lettuce plants so that they stand approximately 12 to 14 inches apart in the row. This is best done when the plants are about three to four weeks old, or are approximately two inches tall. It is especially important that two plants be not left together so as to cause what is known as "doubles."

The main object of cultivation is weed eradication. It is also useful in providing a proper soil mulch and good soil texture. Shallow cultivation is best for lettuce, such an operation killing the weeds and stirring the soil around the plants. It is especially desirable to keep a dry mulch about the stems of the plants so as to prevent the possibility of lettuce drop, which is a disease affecting the stem of the plant. This disease thrives particularly when the soil is moist and compact under the large, flat outside leaves.

#### Irrigation

For the spring crop of lettuce, it may not be necessary to use any supplementary watering. Nevertheless, there are times when plants could benefit well by an application of water. Investigations regarding the need of water by lettuce indicate that the highest yield of the best quality lettuce is produced from a soil with a uniformly high moisture content throughout the growing season. An abundance of soil moisture at or near the water-holding capacity of the soil seems to produce the highest percentage of No. 1 heads. From investigations carried on in Arizona, the percentage of bursted heads is least under conditions of uniformly high soil moisture and the compactness of the head is directly affected by irrigation, the more solid heads being produced with a sustained high water content.

Naturally, small plants need less water than ones that are developing toward maturity. Likewise, variation in weather conditions will markedly affect the number of times necessary to water and the amount of water to be applied.

The greater part of the commercial head lettuce acreage is irrigated by the gravity or furrow system. Particularly is this true where the land lies in such a

way as to permit a ready flow of the water. In market gardens, lettuce is often irrigated satisfactorily by overhead systems such as rotary sprinklers or the mist-spray method. In other cases, such as on black organic soil, the land may be sufficiently sub-irrigated so as to provide ample moisture for the development of the plants and heads.

### Lettuce Drop

There are several important diseases affecting head lettuce. One of the worst is lettuce "drop." About the time that the plant is beginning to make a head or even at the time of heading, it will suddenly wilt and later entirely collapse. Examination of the stem at the surface of the ground shows that it is partially or completely rotted. This rot is caused by a fungus, Sclerotinia, which lives in the soil and thrives particularly well at the area about the stem of the plant where the outside leaves shade the soil and keep it moist. If the soil can be stirred about the plants so that it will be dry at the surface, there will be less danger of the disease thriving. Also, less damage by the fungus may be caused if the crop is not grown continually on the same land. According to experiments carried on in California, 700 to 1000 pounds of sulfur broadcasted over the land helps considerably in controlling this disease, but it cannot be used where such would acidify the land to excess. Tests in attempting to control this disease in Arizona indicate that a six to ten per cent red copper oxide dust of which talc is the carrier, applied twice, gave a marked reduction in the loss of plants through lettuce drop. Fifteen to 20 pounds of this dust were used per acre, the first application being made about three weeks after thinning and the second just before the bottom and outer leaves were large enough to touch the ground. The estimated cost for these applications was about \$5.50 per acre. It was figured that it might take not more than five crates of lettuce to pay for the dusting. Apparently, the disease thrives best at a temperature of 55 to 60° F. with a humidity of 50% or more.

### Tip-Burn

This is a common disease occurring in fields of lettuce and apparently this trouble is not caused by any parasitic organism. Plants which are growing with a very vigorous leaf development where there is abundant soil moisture and a high water content of the plants are quite subject to tip-burn, especially if temperature conditions are above normal. It was formerly believed that tip-burn was caused by a rapid transpiration of moisture from the tips of the leaves, but field trials indicate that high temperatures encourage tip-burn and that the trouble may occur when the relative humidity is high and the transpiration below normal. It is true that tip-burn seldom occurs during cool weather even though the humidity is high, and from experimental evidence it has been advanced that the trouble is due to an extensive accumulation of respiration products of the leaves. Apparently tip-burn may be most abundant when a light rain is followed by a hot, humid day. Plants which are growing very fast or succulently are liable to suffer more from this trouble than those which have made a slower, steady and less vegetative growth. Some strains of lettuce, such as New York 515 and Imperial 847 seem to be fairly resistant to tip-burn.

### Slime

The slime disease which often accompanies tip-burn is caused by a fungus,

Botrytis, causing a slimy condition of the inner leaves of the head. Oftentimes, heads of lettuce having slime cannot be detected from the outside because of the fact that the disease is prevalent in the inner leaves. Slime is usually associated with tip-burn and seems to be worse on plants which are quite succulent and vegetative. It develops quickly during warm, humid weather, and may spread in the transit of lettuce. Good soil drainage seems to aid in preventing slime. Plants should be grown in such a manner as to have no excessive leafy development.

Damping-off sometimes affects young lettuce plants in their early growth but compared with other vegetable seedlings, lettuce plants seem to be more immune to damping-off than such plants as tomato and cabbage. If young plants are being grown in the greenhouse or hotbed the soil can be readily treated by using the formaldehyde drench or by sterilizing the soil with hot water or by means of an electrical pasteurizer. Such methods of soil treatment are discussed in Extension Circular No. 342 on "Growing Early Vegetable Plants Under Glass."

Some common insects often attack lettuce plants, including cutworms, green cabbage worms and twelve-spotted beetles. Control measures for these pests are discussed in Extension Bulletin 523 "Vegetable Garden Insect Pest Control," obtainable from any County Agricultural Agent or from Oregon State College at Corvallis, Oregon.

#### Harvesting and Preparation for Market

When to cut lettuce in the field is one of the most important factors in getting profits from this crop. Soft stock invariably sells at a lower price, so that the heads should not be cut until they have reached proper solidity. Sometimes market conditions warrant the shipping of soft-headed lettuce but these occasions are rare. Mature heads can be identified in two ways: first, they will feel solid to the hand; and second, the tops of the mature heads are more lightly colored and stand out more plainly than those of the immature heads. The heads are severed just below the top of the ground and the operations from there on depend on whether the lettuce is to be marketed dry, that is, without ice, or whether it is to be taken to the packing house and trimmed, iced, and shipped.

In many parts of California, as soon as the heads are cut, they are placed directly in large steel-framed baskets loaded on trucks for hauling to the packing sheds. The baskets are usually about three feet wide and about as long as the width of the truck. They are steel framed with wooden slats and are equipped with four small wheels to facilitate rolling from the truck to the packing sheds. If the trailer system of handling head lettuce is employed in the district, these are drawn into the packing sheds and the trimmers either trim the heads directly from the trailers or from steel aprons upon which the heads are dumped.

If lettuce is to be crated in the field and sold dry, some trimming is done to remove undesirable leaves and the crate is immediately packed.

In packing houses employing the basket system, the baskets equipped with roller wheels are rolled into the packing sheds before the trimmers. The baskets are lifted by individual hoists and a hinged side is dropped, allowing the trimmers to reach into the baskets for the lettuce.



Trimmers remove the wrapper leaves or those that are discolored or show damage. Soft heads are discarded. The trimmed heads are then ready for packing and are placed on the bench near the packer. Usually three trimmers are necessary to keep one packer supplied with lettuce.

Each packer has two standards upon which crates are resting so that two sizes can be packed at one time. The crates are lined with the usual waxed or parchment paper which covers the bottom, sides and ends, and folds over the top when packed.

Lettuce is packed with the stems up and usually 12 to 15 heads in a layer. Between layers a scoop-shovelful of machine-crushed ice is spread.

Recent developments in protecting the lettuce from actual contact with the ice consist in the use of waxed or parchment paper between the heads and the crushed ice. Another recent development is the use of a pad dipped in non-oxidizing material in order to prevent the discoloration of the butts of the heads in transit. White butts are to be preferred over those that turn red through oxidation.

When the crate is packed, it is put on a roller conveyor leading to the lidding press. A final layer of ice is put on the top layer, the paper folded over and the lid automatically put in position.

Most of the western states are using lettuce crates having inside dimensions of 13 inches deep, 18 inches wide, and 21 5/8 inches long.

Refrigeration for lettuce consists of package icing, bunker icing, and top icing. Of these, package icing is invariably used and likewise top icing, but in cooler weather it may not be necessary to ice the bunkers.

### Grades

The standards in effect for head lettuce provide requirements for U. S. Fancy, U. S. No. 1, U. S. Commercial and U. S. No. 2 grades. Grade factors that are taken into consideration in U. S. No. 1 grade include varietal characters, freshness, firmness, shape, and trimming of heads, freedom from split or burst heads and heads affected by damage caused by discoloration, disease and insects.

Copies of "Oregon Standards for Lettuce" are obtainable from the Division of Plant Industry, Department of Agriculture, Salem, Oregon.

### The Consumer's Lettuce Dollar

A report of the Federal Trade Commission concerning investigations regarding the distribution of the consumer's dollar among the various parties interested in the growing and handling of lettuce indicates the following distribution:

Growing and harvesting	19.89¢
Packing and loading	14.41
Carriers	26.41

Distributors:

Broker	.58	
Wholesaler	4.40	
Intermediate	.80	
Retailer	<u>33.51</u>	<u>39.29</u>
		100.00¢

### Cost of Production and Packing

Published statements from California have indicated that the average f.o.b. cost per car of 310 crates of lettuce totals \$468.50, or an average of \$1.51 per crate. Of this total \$201.50 is for production, and \$267.00 for harvesting and packing costs. Of the \$201.50, the items included soil preparation, cost of seed, planting, thinning and hoeing, irrigation costs and fertilizer. The items concerned in preparation for market included cutting and hauling, shed labor, ice, shooks or crates, car strips, paper liners, labels and paste.

Growers in some Oregon lettuce areas claim they can produce a crate of lettuce and deliver it to the packing house platform for 75¢ a crate, others figure a cost of 90¢ and a few at 50¢ a crate. It is probable that the 75¢ figure is nearer the average of growers. Another 75¢ is absorbed in packing and loading.

### Yields

These will vary according to conditions under which the crop is being grown, but over a period years it would appear that yields in districts where lettuce is widely grown would vary from 150 to 330 crates per acre. Many factors enter into the question of crate yields, including type of weather, prevalence of disease, influence of fertilizers and water.