

LETTUCE

INTRODUCTION

Lettuce, *Lactuca sativa*, belongs to the family Compositae. Other useful members of this family include artichokes, chicory, endive and many ornamentals. It also includes a very wide range of weed species.

ENVIRONMENTAL REQUIREMENTS

Climate

Lettuce is a cool-weather annual crop which is not badly damaged by winter cold and light frosts, although differences in tolerance to cold (or heat) may vary appreciably among cultivars. Heavy frosts will, however, severely scorch the leaves, especially mature heads. It grows best under short-day conditions, but the greatest demand is for use in salads during the summer. The most favourable temperatures for optimum growth and development are daily means between 15°C and 18°C, with monthly means between 7°C and 24°C. Day temperatures ranging from about 17°C to 27°C, and night temperatures between 2°C and 12°C, are most suitable. Many cultivars will produce only small, inferior heads under hot summer conditions. Certain diseases are more prevalent in hot weather. High temperatures, especially with young plants, may also induce this annual crop to bolt, i.e. run to seed prematurely. Any growth stress, such as that caused by a lack of water, will intensify the problem of bolting. When a seed stalk starts to form in a head - it need not necessarily be visible - the leaves tend to develop a bitter taste.

Temperature and soil moisture, together with cultivar, are probably the most important factors affecting the success of lettuce production.

Soils

The crop is fairly tolerant of soil type, and will do well on soils varying from light sand to heavy clay, provided the nutritional and water status is good. Best results are obtained on fertile loams, well supplied with organic matter. Soils which crust badly are less suitable, particularly when the crop is direct-seeded. The most favourable pH (KC1) appears to be between 5,0 and 6,5. Whereas the deep, well-drained soils are suitable for most crops, including lettuce, the latter, with its shallow root system, can be grown quite successfully on relatively shallow soils, provided a favourable soil moisture regime can be maintained.

CULTURAL ASPECTS

Sowing times

Cold areas	(heavy frost)	Jan - Apr, Jul - Dec
Warm areas	(light frost)	All year
Hot areas	(no frost)	Feb - Aug/Sept

Plant establishment

In many areas of the country, and particularly when grown on a large scale under good growing conditions, lettuce is often sown directly in the production field. The seeding rate is generally

about 1,5 kg per hectare, but is sometimes as high as 3 kg. Sowing depth varies between 10 and 15 mm. The seedlings are later thinned out to the desired spacing - a time-consuming and labour-intensive operation. Such thinnings are occasionally used for transplanting, where necessary, but these transplants tend to extend the harvesting season unduly. The practice of direct seeding should be considered only under cooler, more favourable climatic conditions, where frequent, light irrigations can be applied, and on relatively weed-free lands. As lettuce seed is small, the soil should not be subject to crusting. It should be worked to a fine tilth, without clods. It should also be as level as possible, to ensure a more even plant emergence. The seedlings may be transplanted, and may thus be raised in seedbeds, but seedbeds are seldom used in commercial practice. In KZN the most common method is to use seedlings raised in seedtrays. Roughly 500 g of seed is needed to raise sufficient plants for one hectare when using seedbeds, whereas about 300 g is generally adequate when seedtrays are used. Plants are normally ready for transplanting after about 5 weeks.

Seedlings will emerge within 2 to 7 days at soil temperatures of between 10°C and 30°C, above which the seed is subject to a temperature-induced dormancy period, and plants will emerge poorly, or not at all. At temperatures approaching freezing-point, germination is greatly delayed.

Spacing and plant populations

Spacing and plant populations can have a marked effect on total yield and on head size. The total yield tends to increase with an increase in plant population. However, as the inter-plant competition increases with higher density plantings, head size becomes smaller. Head size is a very important quality factor, with the larger heads normally commanding the higher prices. Plant spacings vary from about 250 mm to 350 mm apart in rows drawn 350 mm to 450 mm apart, rarely up to 600 mm. Plant populations vary from about 60 000 to 100 000 plants per hectare.

Crop rotation

A two-, or preferably three-year rotation is advocated to reduce disease build-up. Few of the organisms causing diseases of lettuce attack other vegetable crops, so most other vegetables can be included in a rotation with lettuce. However, Sclerotinia rot can affect many vegetable crops and, should this be a problem, the choice of suitable rotational crops is more limited.

Types and cultivars

The proper selection of cultivar, for various planting times, in different areas, is very important. Frequent testing of newly-released cultivars should become a routine practice for the serious producer.

The so-called head, or crisphead, lettuce is by far the most important type of lettuce grown in South Africa. This type produces firm heads, and has crisp leaves. Cultivars such as Del Rio, Del Oro, Frosty, Wintercrisp and Winter Supreme are relatively cold-tolerant, whereas Aviram, Commander, Tropical Emperor, Empire 2000, Summer Gold and Victory are better-adapted to warmer conditions.

Butter-head or Boston lettuce tends to form smaller, less firm heads, with soft, waxy leaves. It is less well-adapted to hot weather conditions.

Loose-leaf, or bunching lettuce does not form heads. The loose leaves are bunched for sale.

Cos, or Romaine lettuce forms a more upright, loose head. It is much more resistant to cold than the other types, and can withstand temperatures as low as -5°C without being damaged.

The last three types mentioned, as well as red lettuce, have a more limited demand, and are grown on a small scale for local markets or in home gardens. These less common lettuces lend variety in salad bars and in home entertainment, and demand is growing.

Fertilization

The crop is sensitive to soil acidity. Liming is generally advisable with a pH (KC1) of less than 5. The acid saturation should be less than 5, preferably less than 2.

It is not possible to make accurate fertilizer recommendations without a soil analysis. However, the approximate absorption of nutrients by a very good crop of 40 tons per hectare are 110 kg nitrogen (N), 14 kg phosphorus (P) and 190 kg potassium (K). Care should be taken not to over-apply nitrogen, because it tends to make the crop more susceptible to various diseases or disorders. This shallow-rooted crop responds well to organic manuring.

As a general guide, use a fertilizer mixture such as 2:3:4 (30) at a rate of 500 to 1000 kg per hectare, depending on soil fertility. Follow this with a side-dressing of 150 to 250 kg LAN/ha at 4 weeks.

Irrigation

Soil moisture is one of the most important factors that determine the success of lettuce production. The moisture requirements of the crop are high, and no more than 50% of the available water in the root-zone should be depleted before an irrigation.

The greater proportion of the roots penetrates the soil to a depth of only 300 mm, which infers that the nutrient and water requirements of the crop should be confined to this relatively small volume of soil. Wetting the soil to a greater depth is wasteful of water, and will also lead to higher losses of nutrients by leaching.

The amount of available soil moisture to a depth of 300 mm is relatively small, and varies from about 18 mm, on very sandy soils, to about 50 mm, on very heavy clay soils. This implies that more frequent, but lighter, irrigations are necessary for lettuce than for many other vegetable crops.

Such frequent irrigation favours the development, especially in summer, of several of the diseases mentioned later.

Weed control

Weed control, particularly when the crop has been direct seeded, but also in the early stages of growth after transplanting, is very important for this short-statured crop. Due to the close spacings adopted, mechanical weed control is generally confined to the period before planting, and in the very early growth stages. Reliance needs to be placed on hand-hoeing or hand-pulling of weeds, especially between plants in the rows.

The only herbicide registered for use on lettuce is propyzamide, which is sold as Kerb or Kerb 50. Propyzamide has a long residual effect in the soil - up to 12 months and longer - and can harm susceptible follow-up crops. It is not used in any intensive vegetable enterprise.

Pests and diseases

Lettuce is susceptible to attacks by nematodes, of which the root-knot nematodes, *Meloidogyne* spp., are the most important. Fumigation of heavily-infested soils is recommended.

Cutworms, *Agrotis* spp., may also be a problem, particularly during the seedling stage. Various cutworm baits or chemical sprays are registered for the control of this pest.

Slugs or snails may also be troublesome, especially during moist weather. Various baits or chemical sprays may be used for their control.

Aphids can be a serious pest, not so much because of any direct damage caused, although heavy populations can stunt the growth of young plants, but because of contamination of the heads by their very presence, and as vectors of various virus diseases. American bollworm and cutworms attacking the head can be controlled with deltamethrin (Decis).

Various other insect pests, such as American bollworm, Plusia looper, thrips, springtails and whitefly, may attack lettuce. No chemicals are registered for their control.

Lettuce is also affected by several diseases, with Septoria leafspot, Sclerotinia rot, bacterial rot complex, downy mildew, powdery mildew and various virus diseases being the most important.

Copper hydroxide (Kocide, Funguroa-OH, Champion, Hydrox, or Supacop) is registered for the control of leafspots, including Septoria leafspot and bacterial leafspot. Dichlorophen (Xanbac D) is registered against basal soft rot. No chemicals are registered for use against the other diseases mentioned. Field sanitation, crop rotation and avoidance of conditions conducive to infection are measures of which the grower has to be conscious.

These measures are especially important during the warmer months.

HARVESTING AND MARKETING

Head lettuce is harvested when the heads are fully grown and firm. The loose-leaf types are harvested when the leaves have attained the required size.

Under warm growing conditions the crop may be ready for harvest within 11 to 13 weeks when direct seeded, or at 7 to 9 weeks from transplanting. Under cooler growing conditions, or with late-maturing cultivars, the growing season may be extended for a further 4 or 5 weeks. In harvesting, the plants are cut off just above the soil surface to retain most of the wrapper leaves around the head. Loose, discoloured, damaged or diseased leaves are removed, and the butt ends cut cleanly for packing. To obviate damage by excessive handling, they are often packed into the marketing crates or cartons directly on the land, but they may be transported to a packing shed for packing. They should in any event be moved into a cool, shady spot as soon as possible after picking.

Usually 2 to 4 picks, over a period of 10 to 20 days, are necessary to gather the crop. It is most important to grade the heads by size, with each size grouping being packed separately.

The crop is usually packed in either 2 or, occasionally, 4 layered crates or cartons. The lowest layer is packed with the cut ends down, the next with the cut ends facing up, and so on. This results in the butt ends facing outwards, with the heads being better protected. Care must be taken in packing not to damage the wrapper leaves, as this detracts from the appearance of the consignment, and can result in lower prices. In KZN, lettuce is often packed into either the lids or bases of banana boxes, where a count of 12 - two layers of six - is ideal.

It is advisable not to harvest directly after rain, or while the plants are still wet, because leaves that have absorbed much water are particularly crisp and brittle, and thus break easily. Wet foliage is also more likely to commence rotting in transit.

Lettuce is highly perishable and wilts easily under hot or windy conditions, thus

detracting from its appearance. Harvesting early in the day before the product has built up field heat, and then keeping it as cool as possible, will contribute towards its keeping quality. Directly after harvest the product should be moved into a cool, airy, shady spot protected from strong winds.

In transporting the crop to market, travelling should preferably be done in the evening (lower temperatures) and the crop must be protected from the drying breezes caused by movement.

Lettuce of good quality is firm, fresh, clean and crisp, and free of any signs of wilting, seeding or bitter taste.

A mean yield of 20 tons to 25 tons per hectare can be expected under normal growing conditions.

Table 26.

Total tonnages sold on the Durban National Market per year from 1993 to 1997, and mean annual prices R per ton obtained).

	1993	1994	1995	1996	1997
Tons sold p.a.	2.537	2.365	2.256	2.146	2.215
Ave R/ton	807	792	940	874	1038