Agriculture Notes

Growing Lettuce

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Lettuce types

There are four main types of lettuce grown in Australia Iceberg (Crisphead), Butterhead, Cos (Romaine) and Loose leaf. Iceberg lettuce is the main lettuce type grown commercially in Victoria. It has a firm, compact head (spherical heart), the leaves are crisp and firmly packed in the head. Outer leaves are dark green and gradually lighten off until in the middle of the heart they are a light green colour.

Cos (Romaine) lettuce is the second most commonly grown lettuce type in Victoria and is distinguished by an elongated head (similar to Chinese cabbage) dark green, long, narrow, crisp, stiff leaves and a coarse texture. Butterhead has a loose heart, soft leaves, green to dark green in colour. All coral, babyleaf and salad mix lettuces belong to the loose leaf lettuce group. This group of lettuce has a great variety of sizes, shapes and colours.

Climatic requirements

Main growing season for lettuce in Southern Victoria is from September to May while lettuce are grown in Northern Victoria from May to October. In some areas of Southern Victoria, lettuce can be grown all year around. It grows best at relatively cool temperatures and does not like extreme heat or cold. The optimal growing temperatures are 25°C during day and 8°C during night. High daytime temperatures greater than 30°C at or near harvest can cause wilting.

Soils

Lettuce can be grown on a wide range of soil types, from light sandy loams through to heavy clay loams. However, the soil must be well drained, regardless of type. Drainage can be improved by raising beds, draining or scooping headlands to remove surplus water, and laying of underground pipe drains. The soil acidity should be somewhere between pH 6.0 and 7.0. If it is less than pH 6.0, apply lime to increase pH.

Fertilisers

Fertiliser requirements depend on a range of factors such as soil type, nutrient status, and previous cropping history. The most important nutrients for lettuce production include nitrogen, potassium, phosphorous, calcium and magnesium.

Nitrogen is essential but excessive nitrogen can also contribute to disorders such as tipburn and soft rot. The rates will depend on previous cropping history and where the soil has been cropped previously lower rates of base fertiliser can be used. This should be based on a soil test to determine fertiliser requirements more accurately. On sandy soils, rates will need to be higher to take into account the greater nitrogen loss through leaching. Leaf sap sampling has indicated that oversupply of nutrients, with the exception of nitrogen, does not result in increased uptake by the plant.

Base fertiliser should be banded at transplanting or seeding and, if broadcast, rates should be doubled. A side dressing should be applied once or twice to transplanted crops and three applications may be required for direct seeded crops. If there are good nutrient reserves in the soil a side dressing may be the only fertiliser application required.

Across the production areas of southern Victoria, lettuce growth rates and the relative level of nutrients within plants have been shown to be consistent in field trials over 3 years. It is very important to maintain an even growth rate and not to over-supply nitrogen which can promote rapid soft growth and lead to disorders such as tipburn. Potassium is also important for hearting and good supplies of calcium are essential. Soils deficient in calcium will create problems with tipburn although high levels of calcium in the soil will not necessarily prevent tipburn, which is related to a broad range of issues (see agnote on tipburn). Foliar applications of calcium or side dressing with calcium has been unable to increase calcium levels within the plant or reduce tipburn.

Planting

Today in Victoria 90% of commercially grown lettuce are grown from seedlings and about 10% are direct sown. The seedlings are most often purchased from commercial nurseries where they have been grown in cell-trays and planted with the aid of transplanting machines. Some growers produce their own seedlings.

If seedlings are being obtained from a commercial nursery they should be ordered in advance as it can take up to 4 to 8 weeks from seeding before seedlings are ready for transplanting. The advantage of using cell grown seedlings is that they should be produced under conditions of even growth and strict disease control. Sterilised potting mix and seedling trays are used which should eliminate the

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likelihood of soil borne diseases. Crops can be grown by direct seeding but seeds should be planted around 4 weeks earlier than transplants to allow for germination and match growth through to maturity.

Irrigation

Lettuce has a shallow root system and to achieve a marketable yield, a constant supply of moisture is required during the growing season. Variation in soil moisture, especially during the late stage of development (from hearting to harvest) may result in loss of yield losses (through weight or quality). It is essential to maintain an even plant growth rate. A variable supply of moisture will result in uneven growth rates and variable uptake of nutrients and lead to increased incidence of disorders such as tipburn. To maintain an even moisture level in the soil, soil moisture levels should be monitored and irrigation requirements scheduled according to need. Sandy soils will require more frequent irrigations than clay soils.

To minimise the impact of poor water quality and maximise the uptake and translocation of nutrients around the plant, particularly calcium, irrigation should preferably be applied at evening or night. Where water containing high salt or sodium levels is used then late watering will minimise the impact on the crop.

However, it is also important to take into account the impact on disease in the crop of irrigating at night since prolonged leaf wetness can lead to an increased incidence of diseases such as Downy Mildew and Anthracnose. On warm or hot nights this will not be an issue as the leaves will not remain wet for an extended period.

Taking these factors into account the best time to irrigate is from 4.00 am to 8.00 am. If earlier, there will be longer periods of leaf wetness and slightly higher disease problems but better uptake of nutrients. If later, uptake and movement of nutrients around the plant will not be as effective. This will be a management decision based on time of the year, cultivar used and climatic conditions.

A range of irrigation methods are used in lettuce production: fixed sprinkler irrigation, trickle, travelling spray irrigators, moveable pipes, guns and furrow irrigation.

Good irrigation practice requires attention to several important criteria:

1. Design the system to suit the soil, terrain and crop.
2. Apply water only when the crop needs it.
3. The entire root system should be wetted during each irrigation.
4. Avoid over-irrigation.
5. Irrigation must not cause soil degradation, including soil structure decline, salinity, acidification or raising water tables over time.

The most efficient method of irrigation is trickle but when using trickle seedlings may need to be watered in at establishment. Trickle irrigation more accurately controls the amount of water delivered to plants and waters the roots not the leaves of the plants. It will provide improved disease control by not wetting the leaves of the plants.

Fixed sprinkler irrigation also may provide some advantages on sandy soils by preventing sand blasting of crops by wetting down the total soil area.

Both systems lend themselves to scheduling and automation and allow crops to be watered often and for varying amounts of time as needed. Travelling irrigators and moveable pipes are restricted by how quickly they can be moved around the crops to be irrigated.

Pest and diseases

Pest control

Crop monitoring is an important part of farming practice. By monitoring your crop you will be able to identify crop pests (their presence and numbers), diseases, presence of beneficial insects and disorders that may be caused by weather, environment or combination of factors. This is vital in deciding whether or not to spray and the appropriate control method to be used.

Pest monitoring is especially important given the increased use of softer (less harmful to beneficial insects) and more targeted pesticides where while effective control of one pest or disease may be achieved, there could be an unforeseen impact with failure to control another pest.

The main pests of lettuce crops are caterpillars such as Heliothis (*Helicoverpa armigera and Helicoverpa punctigera*), Loopers (*Chrysodeixis* spp.), Bogong moth (*Agrotis infusa*) and Cluster Caterpillar (*Spodoptera litura),* which can all seriously damage crops. Pheromone traps are very useful for assessing moth numbers of *Heliothis* spp and the Scentry® traps have proven to be the most effective of these in Victoria. Separate pheromones are required for the two species of Heliothis.

Aphids cause damage to lettuce by direct feeding (sucking sap) or indirectly by transmitting viruses and phytoplasma diseases. Aphids that can be found in lettuce include: Green Peach aphid, Sowthistle aphid, Rose aphid, Potato aphid, Brown Sowthistle aphid *(Uroleucon sonchi).* Lettuce aphid (*Nasonovia ribis-nigri*) has now arrived in Australia and is present in Tasmania and Victoria and at time of publication is not known to be present in other states. Consequently there are restrictions on movement for lettuce and other host crops between states. For the latest information contact your local DPI office or Plant Standards Victoria.

Lettuce aphid has the potential to cause significant damage to crops, is difficult to control with chemicals and is an effective virus vector for tomato spotted wilt. There are varieties of lettuce that are resistant to this particular aphid and there are some limited chemical controls. For the latest information on varieties contact seed companies and for chemical control options contact the Department of Primary Industries.

Other insects that can affect lettuce are thrips, leafhoppers, white flies, rutherglen bug, green vegetable bug, wireworm, false wireworm and vegetable weevil.

Helicoverpa armigera is potentially the most important pest of the lettuce crop. This pest can be difficult to control, for it has developed resistance to the traditional

pesticides used such as organochlorines, synthetic pyrethroids and carbamates registered for use in lettuce. However there are several new groups of chemicals and some biological insecticides. These new controls are soft, targeted insecticides and can provide effective control but an appropriate strategy must be used to prevent resistance developing and maximise the control (see the control strategy for *Helicoverpa* in lettuce).

Good farm hygiene is also vital in pest control. Rapid removal of old crop residues is important, otherwise these will act as a reservoir for pests and allow pest populations to build up making control more difficult.

Disease control

There are ranges of fungal, bacterial and virus diseases, which may affect lettuce crops. The main fungal diseases in lettuce are anthracnose, downy mildew, fusarium wilt, gray mould, bottom rot, powdery mildew, septoria leaf spot, pythium wilt and leaf blight. Bacterial leaf spot, corky root, soft rot and varnish spot are some of the diseases in lettuce caused by bacteria. The main diseases caused by viruses in lettuce are cucumber mosaic, lettuce big-vein, lettuce mosaic, lettuce necrotic yellows, tomato spotted wilt and turnip mosaic. Disease control is achieved by good crop health, using resistant cultivars and pesticides where appropriate.

The impact of irrigation timing is an important factor in the development of disease, periods of prolonged leaf wetness influencing the incidence of diseases such as downy mildew and anthracnose.

For control of viruses in lettuce crops it is most important to control weeds within the crop and around headlands. For example, lettuce necrotic yellows is transmitted by aphids that feed on sowthistle. (Controlling the sowthistle will help control the disease by reducing aphids and removing sources of virus). Aphids will also travel from old crops to new crops transmitting virus. Old crops should be removed as soon as possible and any aphids on them and in headlands controlled.

Disorders

Tipburn is the major disorder that occurs in lettuce and can be internal or on the external leaves. External tipburn often occurs on the tips of the exposed leaves under hot, dry windy conditions. It does not affect the internal quality of the heart or the rest of the leaf but can be unsightly and render the plants unmarketable.

Internal tipburn is due to localised deficiency of calcium due to poor distribution around the plant. It is significantly affected by growing conditions and the rate of plant growth. It is generally not due to poor supply of calcium in the soil. For more information on managing tipburn in lettuce see the agnote.

The other disorder that can occur in lettuce is Jelly Butt which is due to ammonia toxicity. It can be a problem in crops where heavy applications of fowl manure have been applied in winter. Ammonia released from the manure can cause toxic levels in the soil resulting in stunting of seedlings.

Windbreaks

Windbreaks are recommended in areas where there is a danger of wind damage or soil erosion. Permanent windbreaks are usually constructed using rows of pine trees or nylon netting. Semi-permanent (for the season, life of the crop) windbreaks can be rows of ryecorn and sweetcorn preferably planted at right-angles to prevailing winds. Both are designed to protect plants from wind damage and to prevent soil erosion especially on sandy soils.

Weed control

Weeds compete with lettuce for space (land), water and nutrients. They can also harbour insect pest and diseases, which can result, in loss of yields. Controlling weeds is good management practice in all phases of lettuce productions. Weeds can be controlled mechanically and chemically (using herbicides).

Mechanical cultivation must be shallow to avoid damage to the root system.

Chemical weed control, when understood and used at the correct times, is a great cost-saving tool. The three basic methods of chemical weed control in lettuce are:

-Incorporation of a herbicide into the soil before direct seeding or transplanting;

-Applied immediately after seeding (pre-emergence to crop);

-Applied after crop emergence or after transplanting of the seedlings (post emergence to the crop).

Harvesting, packing and storage

Lettuce are hand harvested usually in the cool early hours of the morning. It is important not to delay harvesting because this can result in rapid fall in quality, particularly during summer production. Solid lettuce heads are cut, trimmed to 4 to 5 wrapped leaves and packed into waxed cartons, 12 to 16 heads per carton. Most of the lettuce is field-packed using a harvest aid as they are harvested or may be packed immediately after harvest. Lettuce should be precooled to as close to 1°C as possible within 1 to 2 hours of harvest. After pre-cooling they should be stored at 4°C and 95 to 100% RH. Some lettuces are bulk packed and delivered to packing sheds where they are vacuum cooled, trimmed and packed for the fresh market or for processing. Lettuce are harvested for fresh market or to be processed as salad mixes.

There are significant differences between cultivars in their ability to be cool stored and in their storage ability in salad mixes. In trials carried out with whole heads, iceberg cultivars showing good keeping qualities were Raider, Casino and Ponderosa while some Cos cultivars were Cosmic and Verdi.

The previous version of this note was published in September 2003.