

Lettuce

Best production management practices

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Introduction

This brochure outlines way to improve lettuce quality by improving management practices and by reducing the incidence of disorders and crop damage. A major issue for Australian growers is Tipburn and, whilst it may not be completely eliminated its occurrence and severity can be reduced through improved production practices.

Growth Rate is Critical!

Consistent crop growth rate is critical for quality. A consistent growth rate can be maintained by a continual supply of nutrients and water throughout the growth of the crop, but particularly after hearting. Growth rate can be controlled by reducing excessive application of nutrients such as nitrogen and by providing consistent, even soil moisture levels.



Nutrition Management Practices

- Nitrogen, potassium and calcium leaf sap levels vary between cultivars at different sites and growth stages and have the potential to affect quality.
- Trials have shown that a reduction of fertiliser application following a previous crop such as brassicas does not restrict growth rate or yield. Consequently there is an opportunity to reduce fertiliser applications. (Soil type, amount of fertiliser applied to brassica crop and season should be taken to consideration when deciding amount of reduction).
- Plant sap calcium levels follow consistent patterns and were lower than recommended despite more than adequate calcium soil levels.
- Foliar calcium supplement sprays do not increase sap calcium levels in the plant. Consequently there is little benefit in foliar applications of calcium.
- Calcium nitrate side dressings do not increase calcium uptake by the plant.
- The total concentration of a nutrient in a plant was shown to increase with dry matter yield and the supply of that nutrient. It appears that non-nitrogen sap nutrient concentrations, such as calcium and potassium, are regulated by the plant throughout development even if they are oversupplied.

These recommendations are supported by experimental data from the project "Lettuce - best management production practice to meet the market requirements of consistent product quality and shelf life" funded by HAL, NRE and Australian Vegetable growers.

Irrigation Practices



- Irrigating at night (or early morning) will improve the supply of nutrients to the heart leaves and reduce leaf burn due to poor quality bore water.
 - To minimise the impact on disease development and maximise the supply of nutrients to the heart leaves the best time to irrigate is from 4.00 am (in mid-summer under extremely warm night conditions there would be little impact of irrigating at night on disease).
 - Iceberg and Cos lettuce have different water requirements and are best grown in separate irrigation blocks over the summer season.
- Avoid over- and under-watering to prevent variation in soil moisture levels.

Pest Monitoring (Crop Monitoring) Practices

- By monitoring your crop you will be able to identify the presence of crop pests, diseases and some disorders caused by weather, environment or other factors.
- Crop monitoring is especially important given the increased use of more selective pesticides which may give effective control of one pest or disease but allow another pest to become a problem.
- Scentry®, pheromone traps are effective monitoring tools for *Helicoverpa* species but must be supported by effective crop scouting. A separate trap and different pheromone lure is needed for each *Helicoverpa* species (these are two species found in lettuce crop).
- Crop scouting for pests and beneficial insects has proven to be of great value to growers worldwide.



Helicoverpa egg (1mm)



Scentry® trap

Lettuce Quality in Storage

Cultivar or type has a major impact on the storage life of cos or crisp head lettuce whether it is whole, fresh cut or shredded.

- Whole lettuce: the iceberg cultivars Raider, Casino and Ponderosa and the Cos cultivars Cosmic and Verdi had better keeping qualities and were the least susceptible to pink rib.
- Shredded iceberg lettuce: the iceberg cultivar Ponderosa lasted the longest in shelf life trials at 0°C, Silverado, Raider and Kingsway also performed well.
- Shredded Cos lettuce: Lionheart was the cultivar with the longest shelf life at 0°C when chopped. Verdi and Cosmic also performed well.

It is important to discuss appropriate cultivar selection with your seed supplier and lettuce processor.

Further information is available at the Institute for Horticultural Development web site <http://www.nre.vic.gov.au/agvic/ihd/projects/lettuce.htm>. The project report "Lettuce – best management production practice to meet the market requirements of consistent product quality and shelf life" is also available at the IHD web site as well as from Horticulture Australia.

Tipburn Management

What is Tipburn?

Tipburn in lettuce is recognised as a calcium deficiency disorder, which is seen as a necrosis (tissue death) at the margins of young developing leaves.

What Tipburn does?

Tipburn is a critical defect in lettuce which limits the appearance, marketability and shelf life of lettuce (fresh market lettuce and minimally processed salad mixes). External tipburn is easily seen and can be excluded at harvest but any internal tipburn may not be noticeable unless the plant is pulled apart. Internal tipburn is a major problem for summer lettuce growers because it affects some plantings more than others and it may not be visible at harvest. Bacteria can enter the lettuce plant through tipburn damaged areas resulting in further defects in storage.

What causes Tipburn?

Tipburn is the visible result of the inability of lettuce plants to supply sufficient calcium to developing leaves during periods of rapid growth.



External tipburn of Cos lettuce



Internal tipburn of Iceberg lettuce

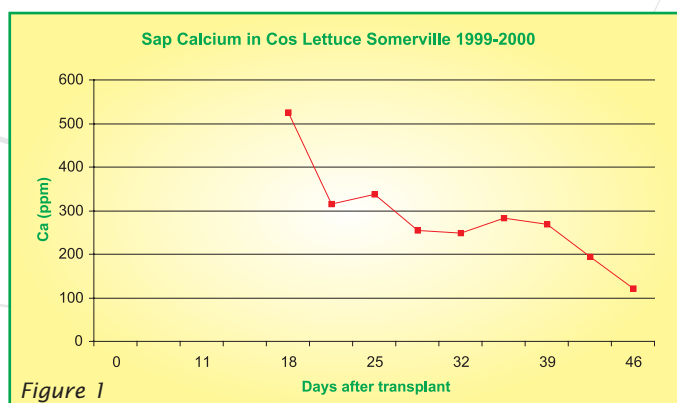
Calcium moves from the roots to the leaves of the plant along with water drawn by the transpiration process. Rapidly transpiring outer leaves draw most of the water and so accumulate most of the calcium. Enclosed lettuce heart leaves have a much lower transpiration rate and so draw less water and calcium. With less calcium available, the rapidly growing heart leaves form weaker cell walls which may collapse and die as the leaves expand close to harvest. This is seen as internal Tipburn.

Tipburn is not so much a shortage of available calcium in the soil as the inability of plants to supply sufficient calcium to the developing leaves. Concentrations of leaf-sap calcium in iceberg lettuce generally fell below the desirable range (400-600 ppm) within 3 weeks of transplanting (*Figure 1*).

When does Tipburn occur?

Tipburn is associated with high plant growth rates usually in summer (but can occur at any time of the year) when temperatures are high and growth rates in the week prior to harvest are greatest.

- High growth rates place great demands on the plants water and nutrient uptake and distribution systems to supply the rapidly growing leaves.
- High summer growth rates are clearly one of the major factors leading to tipburn in lettuce (plant weight can double in the week prior to harvest).



How can the incidence of Tipburn be reduced?

Climatic conditions have a significant impact on crop growth rate and at times tipburn will be more difficult to control. However, some practices can reduce the potential for high growth rates and the potential for tipburn.

Management Practices

Crop management is vital from the heart formation which is the critical point for the first onset of tipburn. After heart formation, internal tipburn becomes invisible. The only way to inspect your crop is to physically open the lettuce. The following practice may help.

- It is important not to delay harvesting the crop as Tipburn severity continues to increase.
- Do not intercrop Cos with Iceberg lettuce.
- Maintain an even growth rate.
- Maintain constant soil moisture.
- Cultivars had the most significant effect of any individual factor on the incidence of tipburn.
- Cultivars differed in their susceptibility to tipburn throughout the season.
- The iceberg cultivars Raider, Casino, Toronto, Ponderosa and Kingsway showed good tolerance to tipburn while Silverado was consistently tolerant at all three sites.
- The Cos varieties Verdi, Donatus, and Cosmic showed the best tolerance to tipburn.

Early external tipburn on iceberg lettuce (see right) usually disappears after a few weeks. This tipburn will not affect marketability of lettuce even if it stays. Those outer leaves will be removed at harvest

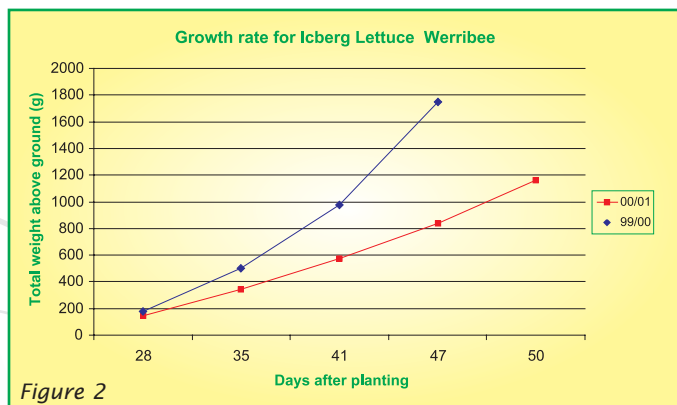


Figure 2

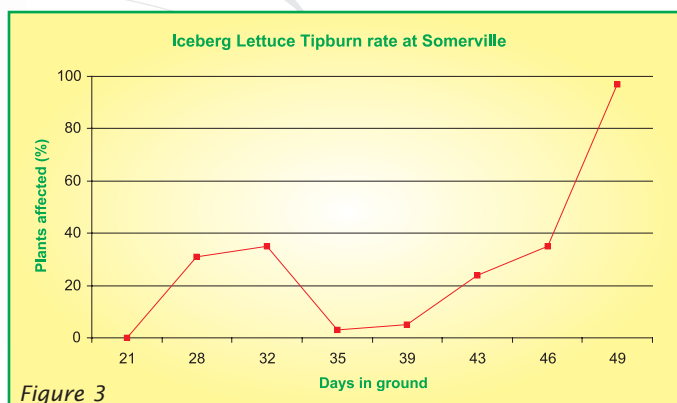


Figure 3

In well fertilised soils, harvesting 3 days earlier can reduce tipburn by as much as 30 – 50%



Best Options

The most promising opportunities for reducing tipburn in “summer” lettuce lie with the development and selection of more tipburn tolerant cultivars, early harvesting and ensuring adequate irrigation to optimise the movement of water and sap-nutrients to developing leaves enclosed in the lettuce heart.

Our efforts to manipulate the concentrations of major leaf-sap nutrients through foliar and fertiliser application have been ineffective except for preventing “luxury” accumulation of nitrate close to harvest. It appears that concentrations of non-nitrogen nutrients are regulated by the plant and were not influenced by higher nutrient applications.

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