# Management of blindness in lettuce seedlings

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## What is blindness?

Blindness occurs when the main apical shoot or growing tip of the lettuce is lost during the seedling's early growth. It is also sometimes called multiple heading or apical meristem decline. A similar disorder also occurs in brassicas such as cabbage, and in tomato seedlings. Lettuces seldom recover from blindness, developing into a distorted, unmarketable plant with no proper heart.

## How much of a problem is this disorder?

In bad cases, blindness can affect more than 30% of seedlings. Ideally, affected lettuce should be removed from trays and replaced with healthy plants by the seedling producer. However, this is labour intensive and expensive. Moreover, blind plants are not easy to spot, especially when plants are still small. However, if blind seedlings are planted out, then all the costs of planting and growing are incurred with no saleable crop at harvest.

**Blind lettuce with deformed developing leaves**

The developing or older leaves appear thickened, stunted and distorted. Following transplanting, this seedling is likely to continue to grow. However, it will fail to develop normally and will probably be unmarketable. These lettuces are sometimes referred to as 'mongreled'.

**Blind lettuce lacking apical shoot**

This is the most typical symptom of blindness. Seedlings lacking an apical shoot are unlikely to recover and grow normally.

**Blind lettuce with multiple growing tips**

A number of growing tips develop with no clear dominant shoot. Seedlings with this symptom can develop multiple heads. In varieties such as iceberg or cos this prevents development of a proper heart. Again, the plant is unmarketable.

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Blind lettuce with chemical burn of the apical shoot

Insecticides, and even nutritional sprays such as calcium, can burn the developing apical shoot if applied at too high a rate. This seedling may recover in time, but development will be reduced.

Non-blind lettuce

This seedling has a normal apical shoot and should grow into a healthy, marketable plant.

## What does a blind lettuce look like?

Symptoms of blind lettuce vary. While the lack of a strong central growing point is the key identifier, the apical shoot may be stunted, deformed or there can be multiple, competing central shoots. In a truly blind plant the older leaves are often thickened, stunted and distorted. Chemical burn from sprays applied at too high a rate can cause symptoms similar to blindness, resulting in a plant with a deformed apical shoot that fails to develop normally.

## What is not a blind lettuce?

Plant stress, such as that caused by uneven irrigation, can stunt seedlings resulting in very small apical shoots. While these appear similar to blindness, such plants are more likely to recover and eventually develop into a normal lettuce.

## When does blindness occur?

Blindness is most common during hot summer months, especially if the relative humidity is high. Consecutive days above 35ºC tend to produce the highest incidences of blindness. However, blindness can occur at any time. Development is extremely variable, so it is hard to predict.

## What causes blindness?

There is no single cause for blindness in lettuce. The disorder is likely the result of a number of different stresses on the plant during a critical phase of early growth.

The trigger for blindness most likely occurs at, or soon after, germination. At this stage, the growing tip is soft and delicate, particularly if the plant is growing rapidly. This

Non-blind lettuce with stunted apical shoot

The apical shoot may be stunted due to stresses during early growth. Uneven irrigation is a common cause. This seedling should be able to recover and develop normally, once good growing conditions are restored.

may be why blindness is most likely when the weather is hot and humid. Under these conditions, transport of calcium from the soil to the apical shoot may not be fast enough to keep up with the rate of growth. Calcium is essential for proper formation of plant cell walls and membranes, so any deficiency can result in plant tissues that are particularly delicate and susceptible to damage.

Damage or stress to the soft growing tip can cause it to abort. Insects, rough handling or even high pressure irrigation can cause physical damage. Chemical damage may be caused directly by incorrect applications of chemicals, or accidentally through contaminated irrigation water. Uneven watering or fertilizer application, or difficult growing conditions can cause growing stresses.

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## What can increase blindness?

Trials growing seedlings in a glasshouse as well as results from monitoring nurseries suggest that factors that **can increase** blindness include:

- High temperatures (>35°C during the day and / or >25°C at night), especially during germination
- High humidity (>70% RH)
- Irrigation with saline water (>2000 µS/cm)
- Irrigation with chlorinated water (>100 ppm)
- Water stress, where seedlings dried out due to uneven or insufficient watering
- Growing susceptible varieties.

'Mongrel' lettuce, found growing during mid-summer in Western Sydney (A. Ryland)

## What did not cause blindness?

In our tests, factors that **did not** cause blindness included:

- Strong nutrient concentrations in the fertigation mix (up to 4x normal strength), even if the fertigation solution was left on the plant leaves after application
- Physical damage by brushing
- Irrigation with an overhead spray
- Growing in seedling mixes with different nutritional and physical characteristics
- The size of the cells in seedling trays (198 compared to 112 cells)
- Wetting agents in foliar sprays
- Sodium molybdate foliar sprays
- Low calcium concentration in the fertigation mix
- Low or high boron in the fertigation mix.

## How to control blindness

Blind seedlings occasionally recover and grow normally, but this is rare.

The unpredictable nature of this disorder makes control strategies difficult. There are, however, a number of things seedling producers can do to reduce risk:

- If possible, germinate seeds at lower temperatures (<20°C)
- Avoid growing seedlings at temperatures above 35ºC
- If temperatures are above 35ºC, then use misting to reduce leaf temperature.
- Use good quality (non-saline) irrigation water and make sure the electrical conductivity is below 900 µs/cm after the addition of nutrients
- Grow varieties less susceptible to blindness (see below for evaluating varieties)
- Avoid chemical burn of seedlings by following recommended spray rates; not spraying when plants are stressed under extremely hot or sunny conditions; and only spraying under conditions that will promote drying of the spray.

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Lettuce seedlings in the glasshouse, grown to test factors that increase or reduce incidence of blindness

There is some evidence that applying a foliar spray of chelated calcium twice weekly during early development can reduce susceptibility to blindness. As calcium plays a role in strengthening cell walls and membranes it seems possible that chelated calcium sprays can help strengthen the growing shoot. This in turn can reduce susceptibility to physical or chemical damage that may cause blindness.

## Test for evaluating varieties for blindness

Irrigation of lettuces with saline water (1,200 ppm NaCl, giving an electrical conductivity of approximately 2,000 µs/cm) for 2 weeks from sowing can induce blindness at temperatures of 30ºC or more. To test a variety for susceptibility to blindness:

- Sow a large tray with approximately 200 seeds of a particular variety (ideally, compare multiple varieties at the same time in different trays).
- Make up a 1,200 ppm NaCl solution by adding 1.2g NaCl per litre of water.
- Irrigate daily for two weeks with at least 1L of the saline water per tray.
- From approximately 10 days after sowing or when seedlings reach the 5 true-leaf stage, count how many seedlings are blind and non-blind.
- Calculate % blindness as:

$$\frac{\text{total blind seedlings}}{\text{total non-blind seedlings}} \times 100$$

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