Separate seed and fertiliser to lift yields

Avoiding fertiliser toxicity, achieving accurate sowing depth and keeping stubble residue off the seed row are three critical factors in successful canola establishment. This article details how matching sowing rates to soil conditions, fertiliser input and sowing system technology can lift canola establishment rates and seed yields.

Separate fertiliser and canola seed improves seedling emergence and lifts crop yields particularly on lighter soils, according to joint research by CSIRO and the University of South Australia.

Small seed size makes canola vulnerable to fertiliser toxicity, especially when sown into dry soils.

But fertiliser toxicity can be reduced by sowing into moist soil when possible and choosing a sowing system that maintains a uniform sowing depth, achieves an effective vertical separation of seed and fertiliser and maximises the lateral spread of seeds across the seedbed.

Move toward minimum tillage

Many farmers are now using minimum tillage to achieve more timely sowing of canola and to reduce possible land degradation caused by over-cultivation.

Achieving adequate plant densities is important given the trend to reduce canola sowing rates to lower establishment costs and control diseases such as blackleg.

Separating fertiliser and canola seed helps to optimise plant establishment rates and becomes especially important as row spacing increases under direct drilling.

Researchers assessed the impact of several sowing systems on fertiliser toxicity in canola sown into either ideal- or marginal-moisture sandy soil.

Karoo canola was sown into marginal moisture conditions at 3.1 kilograms per hectare to achieve a sowing rate of 95–100 seeds per square metre. Growing season rainfall was below the district average (at decile 3.5).

Fertiliser rates were above average, to determine the limits of the sowing systems and applied as di-ammonium phosphate plus urea (DAP + urea) with 42kg/ha nitrogen and 17kg/ha phosphorus.

Sowing system

Two sowing systems were used — a standard narrow spread system which spread seed across 25–35 millimetres (15% seedbed utilisation) and a wide ribbon sowing system, which spread seed across 150–170mm (65% seedbed utilisation). Seedbed utilisation is the proportion of row spacing occupied by the crop.

As the amount of fertiliser sown with seeds increased, canola emergence decreased significantly (see Figure 1).

Narrow spread system higher risk

Seedling emergence was particularly affected by fertiliser placement in the narrow spread sowing system, achieving only 15 plants/m² when the lowest fertiliser proportion (20% or 8kg/ha nitrogen and 3kg/ha phosphorus) was applied with the seeds.

The ribbon sowing system, with wider seed spread, reduced the impact of fertiliser toxicity on emerging plants. Even seeds mixed with 80% of the fertiliser achieved relatively good emergence rates at 27 plants/m². Grain yield was correlated with

Both sowing systems included press wheels and were capable of banding separate fertilisers at the bottom of the furrow.

The same amount of fertiliser was applied to each plot but with various nutrient proportions (0%, 20%, 40%, 60% and 80%) applied with the seed and the balance banded at the bottom of the furrow.

Because of the dry conditions, the sowing depth was set at 40–45mm for the narrow sowing system and 55–60mm for the wide sowing system.

Vertical separation of seed and fertiliser was 30–35mm and row spacing at 250mm.

For both methods, the highest emergence rate of 36–41% (35–40 plants/m²) was achieved when no fertiliser was applied with the seeds but this was well below the optimum plant density of 50–70 plants/m² due to the dry soil conditions.

As the amount of fertiliser sown with seeds increased, canola emergence decreased significantly (see Figure 1).

FIGURE 1 Effect of fertiliser placement and sowing system on canola yield

Bar chart: Emerged seedlings (plants/m²)

Line graph: Crop yield (t/ha)

Separating fertiliser and seed, maximising lateral seed spread and sowing into moist soil can reduce fertiliser toxicity.

At a glance

- Maximising lateral spread of seed across the seedbed also reduces fertiliser toxicity.
- Choose a sowing system that maintains a uniform sowing depth and enables vertical separation of canola seed and fertiliser.
- Where possible, sow canola into moist soil conditions.

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Separating fertiliser and seed, maximising lateral seed spread and sowing into moist soil can reduce fertiliser toxicity.
plant emergence and plots with the lowest emergence rates yielded the least (see Figure 1).

Control plots, in which no fertiliser was applied with the seed, achieved the highest seed yield at 1.5 tonnes/ha.

Seed yields fell by more than 40% in the narrow spread sowing system when 80% of the fertiliser was applied near the seed.

In contrast, seed yields were maintained across all fertiliser treatments when the ribbon sowing method was used.

**Sowing into moist soil**

In the following season, Karoo canola was sown into moist soil at 4.2kg/ha (120–125 seeds/m²).

Fertiliser was applied as DAP + urea (39kg/ha nitrogen and 9kg/ha phosphorus) either deep banded in full below the seed or applied in full with the seeds.

Ten double-shoot sowing systems were used which included discs and points set on 250mm row spacing and press wheels.

The 10 sowing systems were designed to achieve narrow and wide seed spread and varying degrees of vertical separation of seed and fertiliser (16–62mm).

Crop establishment rates were higher than the previous trial with most plots achieving establishment rates beyond the optimum 50–70 plants/m².

**Fertiliser placement**

Crop establishment was optimised when the vertical separation of seed and fertiliser was maximised. When all the fertiliser was applied with the seeds, crop establishment dropped significantly.

The narrow seed spread system experienced a larger drop in establishment rate (109 plants/m² to 64 plants/m²) than the ribbon sowing system (104 plants/m² to 73 plants/m²). Despite this, all fertiliser treatments achieved satisfactory plant densities. Above average rainfall enabled all plots to yield well, with no significant differences between treatments.

**Mallee clay loam trial**

In a further trial, Ag-outback canola was sown at 3.2kg/ha (85 seeds/m²) into a moist grey Mallee clay loam which received 38mm of follow-up rainfall 2–6 days after sowing.

Narrow and wide seed-spread sowing systems were used to achieve low and high seedbed utilisation. Row spacing was set at 250mm and seed sown using either a double-or single-shoot sowing system.

Fertiliser was applied as DAP + urea at the district rate of 40kg/ha nitrogen + 14kg/ha phosphorus. For the double-shoot system, fertiliser was banded 40mm (low seedbed utilisation) or 15mm (high seedbed utilisation) away from the seeds.

For the single-shoot system, 13kg/ha nitrogen and 14kg/ha phosphorus were applied with the seeds with the remaining 27kg/ha nitrogen broadcast before sowing.

Under the favourable season, all treatments established well within the optimum of 50–70 plants/m² and with only a minor reduction in establishment rate when part of the fertiliser was placed with the seed (see Figure 2).

Using double shot and a wide sowing bed utilisation sowing system achieved the best crop establishment rate.

Under drier soil conditions, it is possible fertiliser toxicity could have been a problem under the single-shot, low seedbed utilisation system.

The results highlight the importance of matching canola sowing rates correctly to sowing conditions, fertiliser input and sowing system technology to optimise crop establishment rate.

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**Five steps to establish canola**

Quality seed is the first and most important step in successful canola establishment.

Using new, quality-assured seed is best because it has been germination-tested and cleaned of weed seeds.

When using seed grown on-farm ensure it is graded to larger than 1.8 millimetres in diameter and have it germination-tested.

**Retain stubble**

Stubble protects the soil surface from wind and sand-blasting. After sowing, ensure there is about 30 per cent of the soil surface covered by stubble.

**Separate fertiliser and seed**

Place fertiliser away from the seed to avoid toxicity, particularly with nitrogen fertilisers. Fertilisers also can damage the seed through the salt concentration effect, which is worse in drying soil.

Fertiliser placed below the seed allows for better uptake in a dry finish as the soil is more moist at depth. This also effectively reduces soil strength below the seed and allows for faster root development.

**Use press wheels**

Press wheels firm the soil onto the seed enabling moisture to migrate to the seed. Press wheels also form a water-harvesting V-shaped channel above the seed.

**Ensure soil above seed is loose**

Loose soil above the seed slows the drying rate of soil by reducing the capillary rise of water. Creating loose soil also reduces soil strength or crustling, allowing the seedling to emerge more easily and can also guide pre-emergent herbicide back into the row to reduce weed growth.

Department of Agriculture trials on Wongan sand at Merredin, Western Australia, showed the most effective way to loosen soil above the seed was to attach a ring to the press wheel using a 10mm link chain (pictured).

The chain length was long enough to keep the ring in contact with the soil even when the press wheels jumped over stubble. In addition, the chain was long enough to keep the D-shackle above the soil.

The ring was made from 16mm mild steel rod bent around a 102mm water pipe for a 115mm inside diameter. This followed a 76mm-wide press wheel to create about 10–20mm of loose soil above the seed.

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FIGURE 2 Canola establishment

![Graph showing canola establishment](source: University of Adelaide and CSIRO Land and Water)

An effective way to loosen soil above canola seed is to attach a ring to the press wheel using a 10mm link chain.