NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Establishing pastures - Readers' Note

This document is part of a larger publication. The remaining parts and full version of the publication can be found at:

http://www.dpi.nsw.gov.au/agriculture/livestock/dairy-cattle/feed/publications/establishing-pastures

Updated versions of this document can also be found at the above web address.

Machinery

How to set up and operate your boom spray

Proper boom spray operation is essential for reliable and effective results. The following 8 factors must be considered.

Boom height

Correct height is essential for uniform spray coverage and depends on nozzle spacing, nozzle angle and the height of the target.

Most modern boom sprays have 110˚ flat-fan nozzles spaced 500 mm apart. These nozzles provide the correct double overlap when the boom is set 500mm above the target.

Set the height from the top of the target, not from the ground; to spray seedling weeds, the correct height is 500mm above the ground, but for weeds in an oat crop 150mm tall, the correct height is 650 mm.

Low boom height leads to uneven strips of spray. It is better for the boom to be slightly too high than too low.

Nozzle offsetting

Nozzles must **not** be set parallel to the boom but at an angle of 15˚. This prevents disruption of the spray pattern, which occurs if the sprays from adjacent nozzles hit together.

Some boom spray manufacturers provide a special tool to angle the nozzles. Otherwise, use a spanner, placing the nozzle tip in the jaws and turning the spanner until the shaft of the spanner is parallel with the boom. Some boom sprays have bayonet-type nozzles, which offset automatically.

Operating pressure

A reliable pressure gauge located in the main pressure line to the boom is essential. Operate at about 200–300 kPa (30–40 p.s.i. or 2–3 bars). Reducing operating pressure below this range is not a suitable way to reduce output. Buy a set of smaller aperture nozzles to apply low water volumes. Ensure that all nozzles are the same aperture and the correct size for the required droplet size and are suited to the operating pressure, speed and rate.

Operating speed

Most boom spraying is done at 5–12km/h. Changing the speed changes the application rate. Select a speed to suit the most difficult part of the paddock and operate at that speed over the whole paddock.

Water and chemical rates

Water rates of 60–120L/ha are commonly used. Lower volume spraying (30–50L/ha) requires a higher degree of application accuracy. Read the recommendations on the product label.

If the boom spray is calibrated to apply, say, 80L/ha, then a 600L tank will cover 7.5 ha (600÷ 80). The amount of herbicide to apply at, say, 2L/ha is 15L/tank (2L/ha × 7.5ha).

Mixing chemicals

When using tank mixes of chemicals, always check to ensure compatibility.

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Mixing some chemicals can reduce their effectiveness or increase the risk of pasture damage. Compatibility charts can be found in the NSW Agriculture publication *Weed Control in Lucerne and Pastures*.

Never mix the concentrates. Instead:

1. Fill the tank to one-third with water and start the tank agitation.
2. Add the first chemical.
3. Top up the tank to two-thirds with water.
4. Add the second and subsequent chemicals.
5. Add the final lot of water.
6. Always add wetting agent last.

Check the chemical labels for directions on tank mixing as some chemicals must be added in a particular order. For more information, see Agfact P7.3.1, *How Much Water to Mix with Herbicides?*

Spraying

When spraying, minimise spraying around corners as this leads to under- and oversprayed patches.

Some form of marking is essential for achieving full spray coverage and preventing costly overlaps and spray misses.

Take care and use proper protective clothing, especially when handling the chemical concentrates. Use a tractor with a fan-ventilated cab and appropriate air filters. Avoid spray drift to neighbouring paddocks.

Cleaning and storage

Careful selection of filters and regular cleaning will reduce the likelihood of nozzle blockages.

Always flush the boom spray unit with clean water after use. Do not leave unused chemical mixes in the tank. To prevent contamination between different sprays, always flush the unit with water and then, using a mixture of 2% cloudy ammonia (1L in 50L water), wash down the inside walls of the tank and run about 20L through the lines and nozzles. Finally, flush thoroughly with clean water.

Caution: Do **not** clean with cloudy ammonia after spraying with Ally® or Brush Off® (metsulfuron methyl) or Glean® (chlorsulfuron), as it can cause the release of poisonous chlorine gas. Use household chlorine bleach instead at 300mL in 100L of water.

When storing equipment at the end of the spraying season and after cleaning, run a mixture of water and miscible oil (the type used on lathes) through the pump and nozzles.

Boom spray calibration

Calibration determines boom spray output in litres per hectare. A properly calibrated boom spray is vital for effective weed and pest control. Poorly calibrated sprayers are costly:

Apply too little → Spray failure.

Apply too much → Pasture damage.

Calibration doesn't take long and is easy if you follow these 7 steps:

1. Part fill the tank with water (no chemical).
2. Start the tractor and set the engine revs to PTO speed.
3. Turn on the unit and ensure that all nozzles are spraying correctly (a full even spray in both directions with no drips or squirts).
4. Check that the pressure is in the correct range of 200–300kPa (approx. 30–40p.s.i.).
5. Using a plastic measuring cylinder

Boom spray output (L/ha) (nozzles 500 mm apart)

Speed km/h	Average nozzle output (mL/min)																
	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1100	1200
4	88	103	118	133	148	163	178	191	206								
5			94	106	118	130	142	154	166	177	188	200					
6				89	98	108	118	128	138	148	158	168	178	187	196		
7					84	93	101	110	118	127	135	144	152	160	168	186	202
8						82	89	96	103	111	118	125	132	140	148	160	178
9								85	92	98	105	112	118	124	130	142	154
10									83	89	95	100	106	112	118	130	142

with 20mL graduations, measure the output of each nozzle for one minute. Write down each result measured to the nearest 10mL.

6. Calculate the average nozzle output per minute. (Replace nozzles with an output varying by more than 20mL from the average.)
7. Use this average and the table above to obtain boom spray output in litres per hectare.

For boom sprays with nozzle spacings other than 500mm apart, use a calculator and the following formula to obtain L/ha output:

$$\text{boom spray output (L/ha)} = \frac{600 \times \text{av. nozzle output (mL/min)}}{\text{nozzle spacing (mm)} \times \text{speed (km/h)}}$$

When spraying, tractor speed must be constant for accurate application. Do **not** spray using a tractor without a tachometer. Install one or use another tractor.

Measuring the speed

If the speedometer doesn't work, or if non-standard tyres or wheels are fitted, you need to measure the speed:

1. Start the tractor and adjust the revs to PTO speed.
2. Select a suitable gear to give a comfortable speed of travel over the country to be sprayed. The spray boom shouldn't bounce up and down at this speed.
3. Begin travelling about 20m before a starting mark and start timing using a watch as you pass the start.
4. After 30 seconds, drop out a marker to mark the finishing point.
5. Measure the distance covered in metres.
6. Use a calculator to work out the speed:

$$\text{speed (km/h)} = \text{(distance covered in 30 sec)} \times 0.12$$

Record the speed and gears used on the dash with a spirit pen. It is worthwhile getting the speed for the gears above and below that selected initially.

Remember: Calibrate your spray unit before each major spray operation and after fitting any new equipment.

Setting up and calibrating the seeder

Accurate seed placement is possible only if care and time are taken in setting up the seed drill.

There are 8 steps to follow, although some don't apply to conventional sowing.

Seeder levelling

To ensure that all tines are sowing at the same depth, adjust the machine on a level

surface. If Caldow boots are fitted, ensure that the front tip is 6–8mm lower than the 'heel'.

Coulter alignment

Pull the machine into the ground to check alignment. Poor alignment results in 2 cuts in the undisturbed sod and can leave open furrows. If alignment is out, raise the machine, slightly loosen the nuts on the coulter assembly and reposition using a straight-edge and a heavy hammer. Recheck in the ground.

The next 4 adjustments must be made in the paddock after you have run the machine at the speed at which you propose to sow.

Tine tension

Correct tension allows the tine to vibrate, creating loose soil (tilth) while maintaining the correct point angle. Tine tension should be in the range 260–400N (60–90 lbs). Use lower tensions on sandy friable soils. Too much tension results in excessive point wear.

Depth

Sowing depth is not as critical as the amount of loose soil over the seed. Check the depth to the bottom of the furrow after travelling at least 200m. The rule of thumb for depth is: 'to the first knuckle of your index finger'. For early autumn or spring sowings, when warm, dry conditions after sowing are likely, this depth is necessary. In cold, wet winter conditions, sow more shallowly.

Tilth and speed

The amount of loose soil covering the seed is critical, regardless of the depth of the furrows. Aim for only 5–10mm of loose soil over the seed.

Warning: More seed fails to emerge by being buried under too much soil than by any other cause.

There is too much tilth if less than 5% of the seed and fertiliser is visible in the furrow. Speed must be increased (up to 12km/h) to throw more loose soil out of the furrow.

There is too little tilth if a high percentage of seed and fertiliser is visible in the bottom of the furrow. A single loop of heavy chain attached at either side of the seeder can be used to sweep soil from the edges into the furrow. Whatever device you use must follow the contour of the ground and not bulldoze loose soil on top of the seed.

In conventional seedbeds, deep seed burial is also likely, especially where the seedbed is loose and fluffy.

- Rolling to firm the seedbed before sowing is recommended for loose seedbeds.
- If using harrows, try to direct the seed tubes back so the seed lands in the last row of the harrows.
- When direct-drilling, a good rule of thumb is that 5% of the seed and fertiliser should be visible in the furrow.

Soil types and moisture

Often both soil type and moisture will vary within a paddock and as sowing proceeds. Try to sow different soil types in separate blocks and check the soil cover over the seed with changes in soil type. Pasture sowing is shallow, so large changes in moisture can occur throughout the day, necessitating constant checking of the cover.

Calibration

The simplest method of calibrating sowing rate when seed and fertiliser are mixed is to put a bag of fertiliser (50kg)

in the box, sow one fifth of a hectare, check the amount used and make adjustments if necessary.

When seed and fertiliser are sown from separate boxes, calibrate the seeder in the workshop using a jack and rotating the drive wheel. **Always calibrate the seed first and isolate the drive to the fertiliser box,** even if it is apparently empty.

1. Determine the number of wheel revolutions to travel 100m using the formula:

   revolutions = 16 ÷ wheel radius (m)
2. Turn the drive wheel a few turns to ensure that the seed or fertiliser is flowing down all tubes.
3. Place a tarpaulin under the seeder (or buckets under the hoses), then rotate the wheel the number of revolutions you calculated in step 1.
4. Check to see that all tubes have delivered similar amounts, then collect and weigh the total amount of material.
5. Compare the result with the amount required, which is easily calculated using this simple formula:

   amount required (kg) = sowing rate (kg/ha) × machine width (m) ÷ 100

Point maintenance

Seed placement and furrow profile can be adversely affected using worn points. Attention to point wear is essential, particularly when you are direct-drilling with narrow points that have to carve a channel through undisturbed soil. Expensive steel points can quickly become irretrievably ruined if they are not regularly hard-faced and maintained. An alternative in abrasive soils is the cast points produced by Primary Sales (Australia) Pty Ltd at Dubbo and referred to below under ‘Points for direct-drill pasture establishment’.

Direct-drill pasture sowing

Machines for direct-drilling small pasture seeds must be able to place seed accurately on moisture at a given depth and place a shallow cover of loose soil over the seed. Sowing when the soil is dry is not recommended as germination has to rely on follow-up rain, which may not fall.

The machines available for pasture sowing are many and varied.

Under good conditions, with proper attention to seed placement, most machines can be successfully used to sow pasture. However, when seasonal conditions are not ideal, some machines are far superior.

The ability of individual tines to follow the ground surface places all machines into one of two classes:

Machines with ground-following capability: These include triple discs, single disc seeders (and their conversions) and drills with trailing tines. All these machines can give a more precise sowing depth than the rigid-frame seeders and are preferred for sowing small pasture seeds.

Generally, tined seeders achieve precise placement and coverage better than disc seeders. The single disc seeder, in particular, produces poor results when direct-drilling is used in a moist seedbed soon after spraying. In these conditions, either the slot is left open and exposed or the sod falls back, burying the seed. Single disc seeders can be converted to fit Caldow points quite cheaply; conversion is recommended for these machines.

Rigid-frame machines: This class includes most combines, coil-tine, spring-tine or springrelease tine drills, and chisel seeders. The significance of a rigid frame is that, in selecting a sowing depth, a compromise is necessary to account for

localised ground variations, because all tines have a fixed position in relation to the frame. Average sowing depth is set at 25mm, but ground variations can produce furrows varying in depth from 10 to 40mm. It is important that the furrow walls don't cave in as the seed will be buried too deeply. Heavy rain soon after sowing can be a major problem for this reason.

Points for direct-drill pasture establishment

Burying pasture seed under large clods or too much soil is a major cause of sowing failure. Burial is particularly common in conventional seedbeds, and is the reason why seed is often simply dropped on the surface and 'covered' by light harrows or a roller. However, seed sown into a dry surface soil or, worse still, exposed on the soil surface, is still at risk. The type of sowing point is thus an important element in accurate seed placement. Narrow points with the leading edge only 6–10mm wide are preferred. A high wear rate is a problem with most narrow soil openers.

Triple disc soil openers have relatively low wear rates and accurate sowing depth. Operate the coulter disc 5–10cm below the sowing discs. In heavier wet clay soils the discs cause smearing and compact the soil at the bottom of the furrow or leave the furrow open with the seed exposed.

Single disc soil openers are generally not recommended for direct-drill pasture sowing as it is difficult to get a tilth for seed coverage until the sod has died and the soil is dry.

Chisel points are 50mm wide and fracture the sod along both sides of the point, forming an open furrow and leaving the seed exposed. Long strips of sod are peeled out and thrown in all directions, some going back in the furrows, burying the seed. Trailing chains behind each tine are essential.

Steel lucerne points are less expensive but must be hard-faced. Wear and maintenance are excessive in most soils. These points perform best on light spring tines, where plenty of vibration can produce a good tilth.

Baker boots (inverted 'T' soil openers). These points were designed to permit sowing in slightly less than ideal sowing conditions. The Baker boot produces a flat-bottomed, inverted 'T' (⊥) furrow, protecting the seedling from moisture stress if dry conditions occur after sowing. In many low-clay Australian soils, the side walls fall back, burying the seed, and the large blade becomes quickly worn.

Caldow 'T' boots are a development of the Baker boot but are designed to reduce the amount of wearing surface, to produce a 'V' shape at the bottom of the furrow and to throw more soil out of the furrow. The 'V' bottom is achieved by pitching the point forward so the leading tungsten-protected tip is 6–8mm lower than the rear of the wings. The wings then produce tilth scraped from the sides of the furrow.

The Caldow 'T' boot is a great improvement, but wear rates are still a problem in abrasive soils. Extra tungsten can be applied to the wings but cost escalates. Regular hard-facing maintenance is still required to preserve the unprotected parts of the blades.

Cast points. These hard-wearing alloy points are available in Baker boot and Caldow 'T' boot designs. NSW Agriculture found that the cast points cost 50% less and were 65% more hard-wearing than triple-tungsten-protected steel Caldow points, and required no maintenance (hard-facing). More than 250ha of abrasive granite soils have been sown with cast Caldows.

Super seeder points are made of the same cast alloy as the cast Caldow point. They were originally developed for direct-drilling crops. Their cross-section is similar in shape to an inverted ‘T’. As well as having good wear rates, these points can be bolted directly to most tines, thus doing away with the need for the expensive adaptor needed for ‘T’ boots.

Band-seeders are strongly recommended in ploughed seedbeds.