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This article contains information most relevant to the less than 350 mm rainfall mallee farming region

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Tine Breakout and Narrow Points

What to Consider?

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The Issue

Adopting one-pass cropping into stubble means changing over to low disturbance seeding systems which often have to till deeper furrows to:

- Break-up hard pans
- Control root disease such as Rhizoctonia
- Split band fertiliser away from the seeds.

What do we know?

• **The BOF rating** is the horizontal force, applied at the tip of a common sweep that just moves the tine off its resting position. As the tine assembly reacts to an obstacle, eg. stones or stumps, the jump force increases beyond the BOF.

• Narrow points extend further below the tip of the shank than do standard sweeps (see Figure 1). Depending on tine geometry and narrow point type, this can require up to a 20% stronger **breakout force** (BOF).

• **Narrow point tips** must remain behind the vertical of the shank pivot point, especially in shallow soils to minimise tine and point stresses when breaking out (stump jumping)

• **Some tine geometries** provide an increase in jump force up to a peak which is followed by a decreasing or constant force, thereby limiting stresses to the implement frame and tillage point. These tine characteristics are usually best, but where BOF is limited, (e.g. use of older technology for direct drilling), a **jump force** that decreases as the tine moves away from a stump may limit effective re-entry into the soil following stump-jumping because of friction at the pivot (worsened with poorly maintained, worn bushes or tight assemblies).

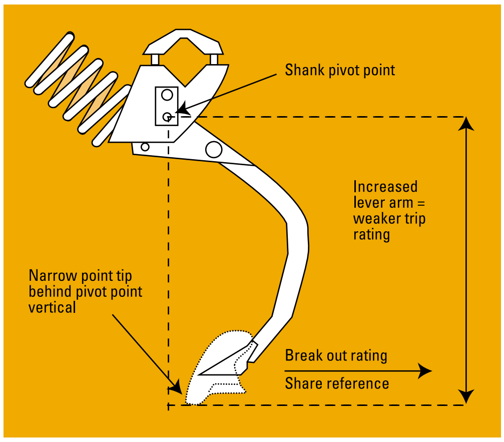

Figure 1. Tine considerations when fitting narrow points

What this means

• **The designs and settings of narrow points** strongly affect the ability of existing tines to be stiff enough (with enough BOF) for direct drill situations and maintain correct working angle.

• **Tillage depth and soil strength** have by far the biggest influence on point draft (and therefore tine breakout requirement). Doubling the tillage depth may quadruple the point draft, or even more if there is a strong tillage pan. In loose soil, point draft is typically proportional to tillage depth (see Table 1).

• **Soil strength** is influenced by soil moisture and compaction (e.g. livestock or traffic induced), and strongly affects point draft requirements. In a shallow grey clay-loam, the soil point draft increased by 50% following a one-year grazing phase, relative to an untrafficked cropped area.

• **The immediate effect of trafficking** depends much on soil moisture and clay

Reference	Ground Opener	Tillage Depth	Mallee sandy soil	Grey Mallee clay - loam
Pre-worked soil	175mm wide share district set-up	50mm	50lbf	80lbf
Direct Drill	100mm wide share	50 - 55mm	80 - 90 lbf	160 - 180 lbf
	Narrow points*	90 -100mm	130 - 170lbf	250 - 280lbf
	Narrow points*	125 - 130mm	210 - 340 lbf	400 lbf

Table 1: Example of tine breakout requirement over two contrasting soil types

* Draft measurements in Mallee soils were influenced little (up to 7%) by point type: 16mm knife < 65mm winged point < 95mm winged point. NB: these values reflect untrafficked conditions in Years 3-4 of trials, a 10km/h operating speed and draft averaged per tine across a 4 rank layout – Up to 50% safety margin should be added for headlands, tines working behind tractor wheels and operating in soils without history of deep tillage.

content, with clay soils having up to double the point draft for tines working behind tractor tyres. Tines positioned at the rear of the machine may sometimes (e.g. narrow row spacings) have lower draft requirements due to interactions with adjacent furrows.

• **Forward speed** has much less effect on draft of narrow points than soil strength and depth (e.g. draft with narrow points increased by only 20–25% between 7–12km/h in a uniform sandy-loam). The speed effect is greater for bigger shares operating deeper (i.e. involving more soil movement) and in clay rather than sandy soils.

• **Point design** influencing the extent and efficiency of soil disturbance can affect point draft, which also evolves as the point wears out (wear protection typically improves point efficiency over its life span).

• **Steeper angle of approach and wider point width** both result in increased draft requirement. Measurements in mallee soils have shown minor draft differences between 16mm knife blades and 65–95mm winged points at equal working depth.

• **Narrow and steep angle knife blades** in particular are more prone to 'critical depth' limitations (i.e. below a critical depth threshold, points create a narrow slot and compact nearby soil rather than loosen it, requiring greater energy).

Actions/options to consider

• **Check existing tine characteristics** against measured draft values of Table 1. This is the first step in seeing if tines are suitable for direct drilling. Include safety margins to allow for compaction related issues including hardpans. District farmer experiences in similar soil types are also a good guide.

• **Get the best out of the existing tine capacity:** target an appropriate tillage depth and set it accurately. The ability to maintain accurate depth across the machine width and over the whole paddock is critical (eg. land contour following ability, depth control to manage leaking hydraulics and tyre sinkage issues in soft sands).

• **Minimise breakout requirements** by selecting low-disturbance efficient point designs and avoiding compacted paddocks in drier soil conditions.

Further information

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