

Zonal tillage



Queensland Government

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In a sugarcane farming system, zonal tillage is when only the row area is cultivated in preparation for planting the sugarcane sett and the inter-row area remains undisturbed. By maintaining the inter-row as a traffic zone, farmers gain a number of benefits.

Research and field trials show that zonal tillage significantly reduces tillage costs, saves time, and preserves soil moisture. The crop establishment using zonal tillage is comparable to results using conventional tillage. Zonal tillage is also likely to reduce erosion.

Zonal tillage effects on cane yields

Sugar Yield Decline Joint Venture (SYDJV) trials showed that cane yields were unaffected when zonal tillage was used instead of conventional tillage, both in the plant crop and ratoons. Many growers are investigating the system and are achieving excellent establishment and comparable yields to conventional tillage.

Pest and disease risks

Planting cane back into the old stool area without a fallow break is not advisable as pest and disease levels are likely to be high. If you replant into the same row area, select a variety with a high pachymetra tolerance, with a low numerical rating. Legume and bare fallows both have a similar effect on the cane pest and disease levels in the soil.

Conventional tillage has the advantage of 'diluting' the disease load throughout the paddock. However to achieve this effect growers need to cultivate the paddock many times. This excessive tillage, damages the soil structure, kills beneficial soil organisms (e.g. earthworms) and destroys organic matter. These disadvantages far outweigh the diluting effect on soil-borne diseases.

Erosion risks

In a fallow situation, a zero-tilled legume crop or spray-out bare fallow gives good soil protection through the wet season when the erosion risk is greatest. If planting the legume with zonal tillage there is obviously more erosion risk than zero-tillage but

significantly less risk than a fully tilled paddock with the legume planted on hills.

Savings using zonal tillage methods

This will depend on the amount of cultivation you normally use, the size of equipment, the soil type and the moisture conditions at the time of cultivation. SYDJV scientists used metering equipment attached to a tractor and measured the following differences:

	Conventional tillage (1)	Zonal tillage (2)
Fuel usage (L/ha)	140-180	25-45
Tractor usage (hours/ha)	20-35	5-10

1 = Fallow followed by two passes with a rotary hoe and four passes with offset discs

2 = Fallow followed by one pass with a shallow rotary hoe and two passes with a tined implement

Source: M. Braunack, SYDJV (Manual of Cane Growing).

Most growers adopting a zonal tillage system have achieved significant time and fuel savings giving them time to concentrate on other farm tasks.

Other advantages to zonal tillage

Excessive aggressive tillage is bad for the soil. By only tilling the uncompacted soil in the stool areas the number of passes can be greatly reduced.

This has other advantages such as:

- Encouraging the build up of beneficial soil organisms. Organisms such as the fungus *Metarhizium* and a single-celled animal, *Adelina*, quickly die out with tillage. These organisms can help with natural grub control.
- Improved timeliness of operations because of a reduced number of passes required and less delays from wet weather.

- Improved moisture retention because the soil is not exposed by excessive cultivation.
- Less destruction of natural structure and less organic matter loss. Maintaining higher organic matter levels improves soil structure, assists with water and nutrient retention and promotes biological activity in the soil.

Cane roots access to nutrients and water

Research shows that the inter-row area becomes very compacted in all cane systems. Even with loose, uncompacted soil, one pass of a tractor will cause 75% of compaction. Further passes on the same tracks will pack it harder and deeper.

In a conventional system where the whole paddock is cultivated there are often eight or more machinery passes down the inter-rows before the wet season. Harvester and haul-out gear cause further compaction.

Very few cane roots will penetrate the inter-row in the conventional system, meaning that zonal tillage is likely to be no worse.

Best implements to use

Most growers implementing the zonal tillage system use rippers and rotary hoes. The ideal size of implement depends on the existing cane row width. The combination of rippers and rotary hoes will produce a good seedbed.

While a rotary hoe is an acceptable implement for the zonal tillage system it is an aggressive cultivation tool that destroys natural soil structure.

When your rotary hoe needs replacing, consider purchasing less aggressive, low maintenance implements such as discs and tines. These implements are more economic and soil-friendly. A zonal tillage implement built in the Mulgrave area consisting of rippers, discs and a roller has been used to prepare a seedbed with two passes in a spray-out bare fallow paddock.

The number of passes required will depend on the soil type, moisture content and degree of compaction.

Centre busting with a coultter ripper

This operation allows some excess surface water to penetrate into the soil. This can be useful for lighter rainfall events. In the wet north the slot made by the ripper is soon filled and water sits on the surface anyway.

Despite being a popular practice in the wet parts of north Queensland, trials have never shown coultter ripping to be beneficial, either in plant or ratoon crops. The sub-surface drainage, soil type and weather in a particular year have an over-riding effect.

In a zonal tillage system the idea is to maintain a hard inter-row for easy and efficient tractor access. Centre busting could make the wheel track wet and boggy, reducing many of the benefits of the zonal tillage system as well as encouraging weed growth and, in some soil types, large clods are left on the soil surface. This can make rough driving conditions for spraying as well as the harvester and haul-out operators.

Loose dirt at the filling-in stage

There will be enough loose dirt at the filling-in stage. The soil removed by the drill plough on the planter is returned at hilling up.

Off-farm benefits

There is generally more trash left on the soil surface and the wheel track area remains firm. This results in less soil and nutrient movement off the paddock so the water entering streams and rivers is not carrying high loads of sediment and nutrients such as phosphorus.