

# Deep incorporation of lime

## What

Incorporation of lime into the soil after spreading helps ameliorate subsurface acidity faster and also helps the lime dissolve more rapidly by improving its contact with acid soil.

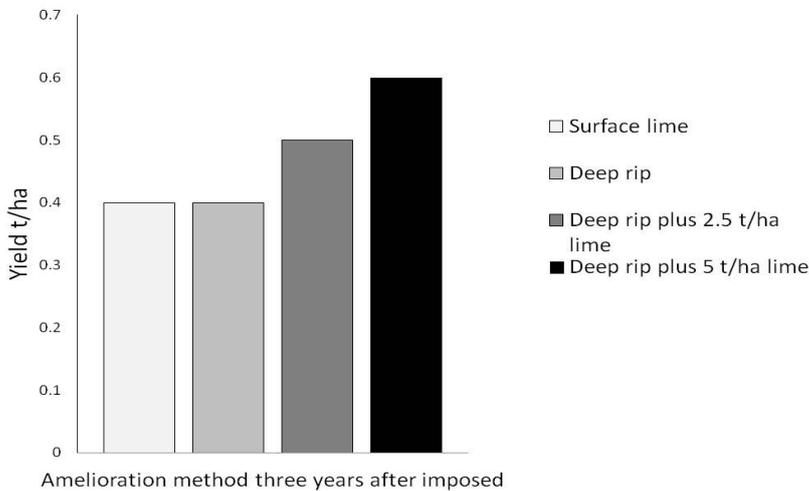
## Key Points

- Soil test subsoil before and after in 10cm increments to depth of 50cm
- A range of machines have been used to try and get lime deeper into soil including deep rippers, disc ploughs and mouldboard ploughs
- Apply as much lime as budget will allow

## Benefits

Where subsurface soil has become acidic incorporating lime into the subsoil can rapidly improve the pH profile.

Deep placed lime that has partially or fully fixed a subsoil acidity problem has been shown to improve crop growth and yield. Yield benefits range from 0.1 to 0.8 t/ha and can last for up to 5 years, (Figure 1).



**Figure 1:** Wheat yields at Latham in 2007 three years after lime was incorporated using a deep ripper.

## Tips from farmers who have tried it

- Make lime rate as high the budget will allow, even if it means delaying liming of other paddocks
- Apply Trifluralin ahead of the plough, this gives a good result though it can be a bit damaging if there are heavy rains.
- The deeper the plough can 'dig' the better.

(Editors note: Use a lime calculator to determine appropriate quantity of lime required for soil pH conditions.)

## Where it works

The largest benefits from deep incorporation of lime are likely to occur where the subsoil acidity occurs in a distinct layer, typically between 15-35cm rather than down the whole profile. Therefore once the subsurface acidity layer is fixed the crop roots have unrestricted access to soil and can grow to their maximum potential.

Lower benefits occur if soils are inherently acidic to depth as is the case with Wodjil sands. Deep lime incorporation in these soils will only improve root growth to the depth of amelioration and beyond this depth root growth will still be restricted. Similarly other deeper subsoil constraints, such as hardpans, can restrict root growth in the subsoil even if a subsurface acidity layer is fixed.



**Above:** Keith Carter, Farmer Wubin, soil testing his soil after ploughing in lime

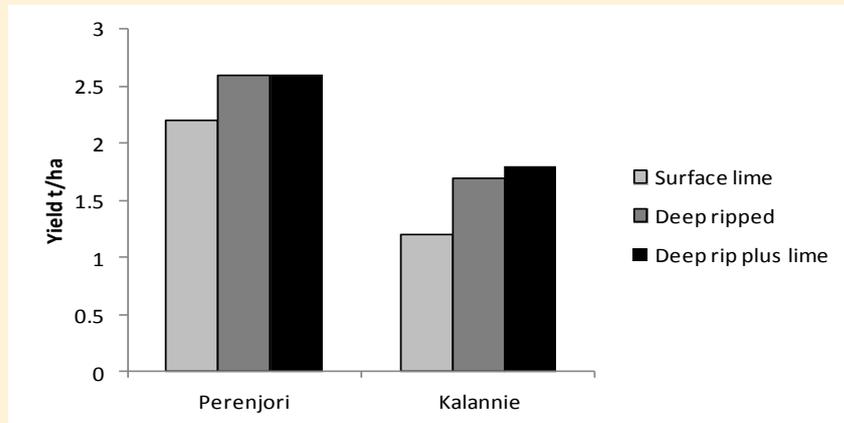


**Above:** A offset disk plough used for lime incorporation at Wubin

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## It might take a while

Incorporating lime to depth does not guarantee a instant yield response. First year yield gains could be due to tillage removing soil compaction not solely because the lime fixed the acidity. As is the case in figure 2.



**Figure 2:** Grain yields in 2005, the first season after 2.5t/ha of lime had been applied to surface or incorporated via deep ripping. In order to check yield gains were the result of pH changes and not the deep ripping effect some plots were deep ripped but not limed.

## How

It is vital to test the pH of the soil to depth prior to planning any liming and cultivation strategy to fix subsoil acidity. Testing needs to be done in 10cm increments to a minimum depth of 30cm but ideally soils should be tested to a depth of 50 cm so it can be determined whether the soil pH is increasing below the acidification layer. Understanding the pH profile is critical to determining how much lime is required to fully fix the problem.

The depth of pH amelioration will depend on the maximum cultivation depth that can be achieved. Currently rotary spaders and mouldboard ploughs offer the deepest cultivation depths, followed by, one way ploughs, offset discs and other conventional tillage equipment.

Tillage Implement	Typical working depth (cm)	Approximate estimated cost (\$/ha)
Offset discs	15	35
One-way plough	15-25	35
Rotary spader	30-40	100-150
Mouldboard plough	35-45	100-150
Deep ripper	30-40	30-50

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## Risks

Cultivation has numerous consequences that go well beyond simply incorporating lime. In essence the risks associated with deep incorporation of lime are those associated with any form of cultivation that disturbs the soil.

- Wind erosion and associated sandblasting and furrow infill.
- Increased evaporation in year one from newly cultivated surface.
- Loss of soil organic matter
- Break up of residual root systems and destruction of macropores within the cultivation depth.
- Re-compaction of loosened soil
- Seed depth control is more difficult on cultivated soil

## Have I done it right?

After the lime has had time to react, say 1-2 years, the soil pH profile should be soil tested again in 10cm increments. Preferably to 60 cm in order to determined whether or not the lime has moved beyond the ploughs working depth. Many of the deep working tools such as deep ripping, rotary spading and mouldboard ploughing will result in uneven mixing which can make soil sampling difficult. Having a good mix of lime vertically from the surface layers down into the subsoil is important for providing a pathway of amended soil that roots can grow through into the subsoil below.

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