healthy soils case study

VETCH

Reducing Fertiliser Costs with Vetch

A Merah North case study

The background

Decisions about cotton rotations can have a significant effect on a range of issues, including the amount of nitrogen fixed in the soil, the amount of organic matter in the soil prior to planting cotton and the effect of the rotation crop on a subsequent cotton crop's ability to take up a range of important nutrients.

These factors, in turn, are important for the farmer's financial bottom line, affecting both yield and the amount of fertiliser needed.

Jono Phelps and family have been farming at Merah North, near Wee Waa since the 1950s and won the Australian Cotton Grower of the Year Award in 2007. The Phelps planted their first irrigated cotton crop in 1980 and have grown cotton, a variety of irrigated grain crops and lucerne as part of their mixed farming operation.

Why act?

The Phelps observed that cotton following lucerne in particular fields always looked and yielded better than cotton following cotton or grain rotations. The proof was in their yield increase, with cotton that followed lucerne winning the Lower Namoi valley crop competition. The only problem with lucerne was that it was grown for four years, meaning that it was not an economic option across the entire farm. However, this set the Phelps thinking seriously about legume rotations and their potential benefits – so they ventured into vetch.

What is science saying?

Vetch is an autumn–winter–spring growing legume crop recognised for its ability to grow rapidly in cold weather and fix significant amounts of nitrogen.

Vetch increases the nitrogen and organic matter status of the soil. Most of this nitrogen becomes available during the following summer. There is then a delay typical of legume nitrogen that slowly mineralises into plant-available nitrogen over subsequent seasons.

"Our soil is in better condition. It is easier to work and plant crops, and our water management has benefited as well. The cost of growing vetch is more than offset by increased yields and reduced fertiliser application costs."

Jono Phelps *(above)* and family have been using vetch as a 'green manure' rotation crop since 2001

A ten year CSIRO Plant Industry study by Dr Ian Rochester has shown that vetch planted as a rotation crop increases cotton yields up to 15 per cent, substantially reduces the need for nitrogen fertiliser and improves soil quality.

Declining soil organic matter is an issue across all cotton growing regions. Incorporating vetch stubble adds organic matter to the soil: over the last eight years of the CSIRO Plant Industry trials the organic matter levels in cotton fields in rotation with vetch increased by 14 per cent.

Dr Rochester's team compared vetch in a cotton rotation with other legumes commonly used in rotation with cotton, including faba beans, field peas, clovers and medics. Vetch's ability to fix nitrogen far exceeded all the other legumes, commonly fixing up to 200 kilograms of nitrogen per hectare

Figure 1 shows the higher yields obtained when vetch was used in various cotton rotations. Note the greater need for nitrogen fertiliser with the continuous cotton and wheat rotation systems, especially where vetch was not grown.

Another important advantage observed by Dr Rochester and his team was that cotton grown after vetch was better at taking up important nutrients such as nitrogen, phosphorus, potassium, zinc and copper, while sodium uptake was reduced, to the crop's benefit.

Soil structure was improved after vetch, making cultivation easier, as well as improving root penetration and growth. This, coupled with increased water holding capacity of the soil, aids the cotton crop to access more water.

Vetch is also an excellent break crop that reduces the incidence of Black Root Rot in those areas where the fungal disease occurs.

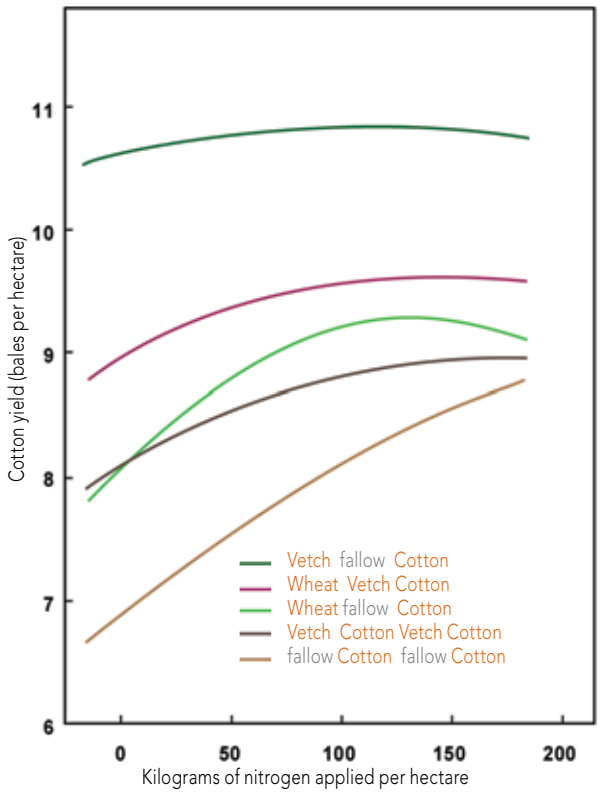
Vetch, like most other rotation crops, may increase Fusarium wilt, so fields should be assessed carefully before it is used.

The Solution

Since 2001, the Phelps family have planted vetch as a green manure crop following every cotton harvest. There are a number of vetch varieties, with Capello the variety preferred by Jono Phelps as it produces more soft seed and helps prevent the vetch from becoming a weed on the farm.

The vetch seed is inoculated and planted at 13 kilograms per hectare. The vetch can be planted dry and disced in with the pupae busting operation, but this depends on soil moisture at the time. The Phelps used to slash the vetch, but these days it is just ploughed in with a set of discs, usually in September before seed set. The vetch fields are then long fallowed until cotton planting in October the following year.

Figure 1 Cotton yields obtained in differing crop rotations



Source: Dr Ian Rochester

The economics of sowing vetch

The cost of sowing the vetch is basically the cost of the seed and applying it:

- Jono Phelps sows 13 kilograms of vetch seed per hectare. At $2.50 per kilogram, his seed cost is $32.50 per hectare.
- Sowing cost is $15.00 per hectare. This is sometimes combined with pupae control but in the last two years Jono has spread the seed and worked it in with discing. He points out that a saving of $50.00 worth of nitrogen per hectare will pay the vetch costs.

According to Jono Phelps, the vetch rotations have resulted in better soil condition, which is more friable, easier to plant, work and irrigate. Vetch has improved soil structure and is helping improvements in water use efficiency.

Nitrogen application rates were reduced from 180 units to 140 units per hectare. More recently, with growing confidence, 110 units per hectare is becoming the more typical rate of fertiliser application for the following high yielding cotton crop".

Normally, the first nitrogen is applied with the irrigation water in November; however, in 2007–08, earlier rainfall meant the first application was applied with the irrigation water in December and January: 80 kilograms per hectare on 29 December and 30 kilograms on 11 January.

Importantly, cotton yields have risen, averaging 10.4 bales per hectare (4.2 bales per acre) in the last three seasons, with yields around 11.1 bales per hectare (4.5 bales per acre) achieved in some fields.

The Phelps have tried other legume crops such as Faba beans but these have not been as successful as the vetch, mostly due to disease problems. The vetch has had an additional benefit of reducing the impact of any black root rot.

The cost of growing vetch is more than offset by increased yields and reduced fertiliser application.

"Nitrogen rates were reduced from 180 units to 140 units per hectare. More recently, with growing confidence, 110 units per hectare is becoming the more typical rate of fertiliser application for the following high yielding cotton. At the same time our cotton yields have been increasing."

Jono Phelps

Top

Closeup of the vetch crop during flowering

Bottom

The vetch crop is ploughed into the soil in September using discs and the field was then long fallowed until cotton was planted in October of the following year

The Future

With the current high grain prices, wheat is being planted in many fields instead of cotton and vetch this winter. No nitrogen will be applied to the wheat, thanks to the vetch grown the previous winter. Depending on how the season and crop develops, a small amount of nitrogen may be added with the irrigation water.

Thus, in future, the vetch strategy will need to change to accommodate more winter wheat plantings. Some of the cotton fields have now had three vetch crops in the rotation over the last six years and may miss out on a vetch crop for a year to take advantage of the strong grain prices.

The Phelps are also investigating the application of fungi onto the vetch, grain and cotton stubble, aiming to keep as much carbon as possible in the soil.

Acknowledgements

Jono Phelps, for sharing his experience and expertise in using vetch as a rotation crop.

Dr Ian Rochester, of CSIRO Plant Industry, for his decade-long commitment to research on vetch.

Reference

Dr Ian Rochester, *Vetch – the legume that increases cotton profits*, CSIRO Plant Industry, Narrabri. (This information sheet can be downloaded from www.csiro.au/resources/vetch.html)

For further information, contact:

Cotton Catchment Communities CRC
Phone: 02 6799 1500
Locked Bag 1001
Narrabri NSW 2390

www.cottoncrc.org.au

PROJECT PARTNERS

Australian Government
Cotton Research and Development Corporation

Namoi CMA

Border Rivers-Gwydir CMA
CATCHMENT MANAGEMENT AUTHORITY

Condamine Alliance
COMPLETE CATCHMENT CARE

Queensland Murray Darling Committee Inc.

NSW DEPARTMENT OF PRIMARY INDUSTRIES