Growing Cereal Rye to Increase Carbon and Prevent Wind Erosion

Lilly Martin, Liebe Group, March 2015

Fast Facts

- Cereal rye has established well on poor windblown sand.
- It has been successful in preventing further erosion.
- Approximately 80% of land cropped to rye has recovered sufficiently to return to normal rotation.
- Disease has become an issue after 3 years of continuous rye.

Farm Details

FARM NAME	Bwlch Hendreff
FARMERS	Graham, Helen & Jeff Pearse
LOCATION	West Wubin
AVERAGE RAINFALL	300mm
FARM SIZE	3500ha
ENTERPRISE MIX	90% cropping, 10% Fallow
SOIL TYPES	75% Sand, 25% Loam/Clay

Aim

- Build soil carbon in an effort to rehabilitate poor performing windblown sands.

Farmers Perception of Using Cereal Rye to Rehabilitate Windblown Sands

The Pearse family has been growing cereal rye on their farm since 2012 and feels that the rye has accomplished what they set out to do after having been grown for three successive seasons. The ground cover produced by the cereal rye is significantly "better than wheat has been able to provide and it will outperform both wheat and barley on poor acid soils" another factor to consider is "it's cheaper to sow rye than wheat so financially it is beneficial as your losing less on inputs".

Farmers Prediction of the Future of Cereal Rye

Jeff believes that out of the 150 hectares sown to cereal rye there is the potential for 80% to be rehabilitated and the other 20% may have to eventually be cut out of the cropping program and planted to trees or scrub.

Currently if Jeff wants to sell the grain it has to be organised a year in advance with distributors in Perth and he needs to know how many tonnes he will produce. The grain then has to be delivered to Perth for a price of "approximately $260/t which is little better than feed wheat". With these constraints in mind Jeff feels that "cereal rye will never replace barley or wheat on good soil" but it does have its place in their current situation.

If there were alternate options available that had a more accessible market such as acid tolerant varieties like Litmus barley, they would consider using these cereals instead of rye as it would have the added benefits of local delivery to the bins and would not have to be mouldboard ploughed or clayed, which are expensive and risky in the case of mouldboarding.

Background

Cultivated rye (*Secale cereale*) is related to wheat and barley but is a hardier variety, which was first cultivated in Northern Europe. Rye has a similar growing season to other winter-spring cereals. Cereal rye is mainly grown in South Australia which represents 70% of rye grain production in Australia. It is mainly produced for the milling industry for multi grain breads (Department of Primary Industries, VIC, 2013).

Spring rainfall is a big factor for low yielding rye crops as rye is generally planted on sandy soils with a low water holding capacity. Another factor is unlike other cereals rye needs to be cross pollinated, this can result in low yields as often hot temperatures results in the pollen drying out before it can fertilise neighbouring plants. When

the plants remain unfertilised the grain is unable to set properly. A third reason for low yields is that most rye varieties require a long time for grain formation which means that the grain is often small and shrivelled (Department of Primary Industries, VIC, 2013).

Cereal rye has multiple environmental benefits as it can be used for ground cover, reducing wind erosion, and increasing soil water retention. Rye can withstand sandblasting and is more tolerant of drought and frost than other cereals. The crop must be sown early in winter if the grain is to be harvested (Carter, 2006).

Cereal rye straw and grain are the least preferred fodder for sheep; this aids in the recovery of wind eroded soils as sheep will graze other stubbles before turning to rye stubble. Rye is resistant to cereal cyst nematodes and is a poor host to the root lesion nematode (*Pratylenchus neglectus*) providing an alternative management approach for these diseases (Department of Primary Industries, VIC, 2013).

Rye has four primary roots that originate from the seed and can send out roots and tillers from the second, third and fourth node. This extensive root system within the first 30cm of soil is more developed than other cereals; it can withstand deeper sowing depths which are useful when sowing over eroded or disturbed sites, where depth is hard to control and makes the plant more drought resistant (Carter, 2006 & Department of Primary Industries, VIC, 2013).

Despite having no tap root, its quick growing, fibrous root system can take up and hold as much as 45 kg of nitrogen, however 12-23 kg is more typical (Clark, 2007).

Adoption Process

The initial idea came about after Jeff had gone to help fight a fire near Clint Hunt's farm in Marchagee. When Jeff got to the fire, volunteers where struggling to create a clean fire break with a plough in some thick cereal rye stubble. This prompted Jeff to make enquiries about the cereal rye and Clint confirmed that it had a great ability to establish on poor ground. The Hunt family has been cultivating cereal rye since the 1950's as a tool for stabilising wind eroded areas and providing fodder for livestock.

Why?

The Pearse farm has had issues over the years with areas in paddocks that are consistently producing an average of <0.5 t/ha. They came to the conclusion that these low production areas would work out better in the long run if they were sown to a lower input crop such as cereal rye (could potentially reduce their inputs by 50%), as rye is cheaper to sow than most cereals and therefore they would lose less. Currently the farm does not have variable rate technology so the poor country gets the same inputs as the better ground. There has been no chemical on the affected areas, and thus far the only savings have been from the reduced inputs.
Keeping in mind that Jeff is aiming to recuperate the majority of these areas to come back into their normal cropping rotation.

Benefits of cropping cereal rye

- Lower input cost than other cereal crops
- Provides good ground cover
- Establishes well on poor sands
- Extensive root system
- Requires less water than wheat crops
- Can fix up to 45 kg of excess nitrogen
- Increases the availability of exchangeable potassium in the topsoil

Disadvantages of cropping cereal rye

- Low yielding
- Difficult to get grain to markets
- Lots of trash, making it difficult to seed through

How?
In the first season of growing cereal rye Jeff ordered 0.5 tonne of seed through Landmark. The second year it was left to self sow and on the third year it was again self sown then Jeff also ran over it with the seeder bar to topdress some additional seed. There was no great out lay in cost as there were no changes to equipment required.

Figure 1: Photos taken in July 2013 of an area of the paddock prone to wind erosion cropped to wheat (A) and an area sown to cereal rye (B).

Future
After three years of continuous rye, disease is beginning to become an issue. “The first two years were good but we neglected it in the third year and it got full of turnip” This was due to the nil chemical input. Jeff raked up the turnip and seeded in a crop at a high rate but it was still a poor yield come harvest. “The crop looked thick from the ground but up on the header it was thin, with nothing coming in”. “The way to recover that land now maybe to brown or green manure lupins, fix some nitrogen and let it recover”. In an effort to reduce inputs on the poor sands that were sown to cereal rye no chemicals were sprayed and as a result Jeff plans on sowing Clearfield varieties to get good control on the brome and ryegrass when the ground has been rehabilitated.

Another option that Jeff and Graham are considering for the future is; if the majority of this poor windblown sand is underperforming (consistently yielding under 1 t/ha) that they would consider something more drastic and would potentially lime and mouldboard the entire area and plant cereal rye in the first year to stabilise the soil followed by normal cropping but with a lower chemical input or deep rip over the cereal rye. If this drastic and expensive measure didn’t impact the problem areas significantly Jeff would then be prepared to cut them out of the program totally with a view to planting trees in the affected areas.

“For the sake of an easy option we will crop these areas if they are in the middle of the paddock because variable rate won’t work as if you decrease inputs you’ll have an even worse crop and increasing inputs by 50% won’t give the required yield benefit”.

Results
Soil sample results show that the soil organic carbon (SOC) has improved in the affected areas. Since 2012 the SOC% has increased in the topsoil by 27.8% in 2013 and 16.7% in 2014. This represents a total improvement of 47% since 2012, see Figure 2.

In Figure 3, SOC % was measured in the High (2.2 t/ha), Medium (1.8 t/ha) and Low (0.5 t/ha) production zone’s of the paddock in 2012, and SOC% was measured in the Low production zone again in 2014. These results show that the SOC% in the Low production zone is now almost at the Medium production zone levels (samples taken in 2012).

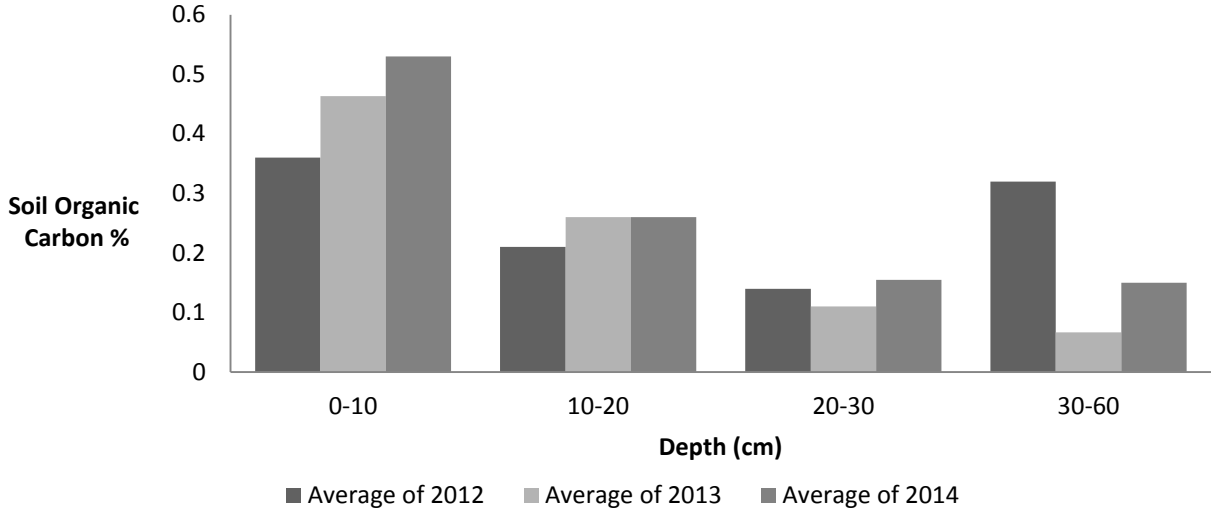

Figure 2: Percentage Average Organic Carbon from 2014, 2013 and 2012 taken from four depths.

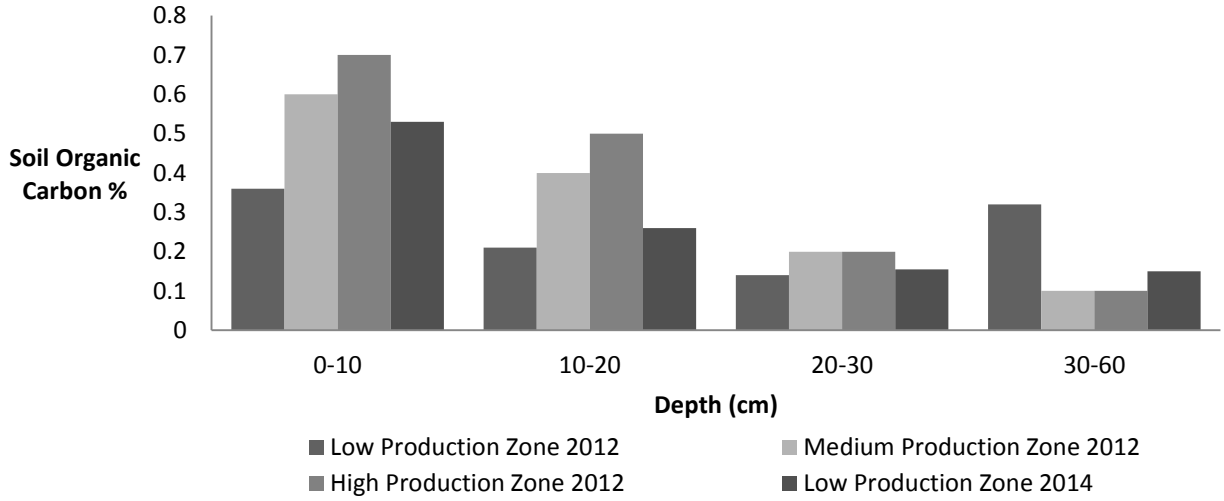

Figure 3: Percentage Average Soil Organic Carbon taken from Low, Medium and High Production Zone's from 2012 compared to the Low Production Zone in 2014, taken from four depths.

Comments/Summary

On the whole Jeff believes that the cereal rye has performed in the way they expected on the poor windblown sand. The areas have recovered significantly but Jeff is worried that when they come back into the normal paddock rotation they will quickly go backwards again and eventually it maybe more beneficial to cut them out of their program and plant to trees.

In hindsight Jeff says that in the third year they should have been more proactive on their weed control within the cereal rye crop and should not have neglected this aspect as there is now a weed control issue. However, Jeff also feels that if he uses high chemical rates it will impact his margins on these low production areas by a significant percentage making it an uneconomical decision.

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