Building drought tolerance through regenerative farming

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Drought conditions in NSW have put Michael Inwood's focus on sustainable and regenerative agriculture to the test but he is seeing promising signs that a combination of plant diversity, pasture cropping and rotational grazing will carry his farm through the dry spells.

'Engaging nature' is a motto Michael Inwood aims to live and work by on Toulon, his mixed enterprise farm north east of Bathurst in central-west NSW.

It is also the term name he has coined for the natural resource management plan he is implementing on the family property. "It's all about trying to use natural solutions or management decisions that tip the balance in nature's favour to see if we can reduce the cost of production by using nature to the fullest," said Michael.

Third-generation farmers Michael and wife Therese have worked hard to implement sustainable practices on their property, from rock weirs that slow water in creek beds to an electric-powered ute, pumps and electric fencing, all charged by solar energy.

To further his learning about sustainability Michael embarked on a Nuffield Scholarship funded by the Sidney Myer Fund in 2011. His report, 'Sustainable and Regenerative Agriculture: Farming in a world of finite resources', focused on two main issues: how to avoid depleting resources and how to actively build soil organic matter and soil carbon.

"Most people understand what it means to be sustainable but the word I prefer to use is regenerative," Michael said in his 2012 Nuffield presentation at Armidale. "When it comes to being sustainable you might be treading water; things might not be any getting worse but they're not getting better. I think what we need to be doing to be sustainable is to actually build the system; build in some buffer and insurance so in the good times we build and in the bad times we don't necessarily go backwards."

The severe drought experienced across NSW means the past two years are likely to fall into the 'bad times' category for the Inwoods, who run an 800ha superfine Merino grazing and opportunity cropping enterprise. The drought has taken a toll on their energy and financial resources, and since they exhausted their 300 tonne reserve of grain the business has been

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buying in feed, with prices for barley increasing by $200/t in that time. They have also reduced sheep numbers to just fewer than 5,000, scaling down to their core breeders and some replacement ewes.

Despite these constraints, the Inwoods have seen promising signs that their sustainable initiatives are working. In a district that is a sea of gold and brown, a patch of green on the Inwoods' property shows there is hope for the future.

> **Whatever biomass you have above the ground is replicated underground.**

The green is an 8ha paddock in which Michael is experimenting with multi-species pasture cropping, which he defines as sowing a grain crop into an existing multi-species pasture. "It's about retaining the biological function and the value of the pasture but you want the benefit of the increased dry matter and stimulation that having an extra plant species in the system can provide," he said.

The pasture was planted with 16 different species, including radish, turnip, plantain, chicory, lablab, seradella, red clover, vetch, millet, sun hemp and annual ryegrass, with oats sown in after the pasture stand was established.

"I've been trying year on year to foster this type of cropping regime in this particular paddock," said Michael. "Even though last year was an extremely tight year I kept the sheep off that paddock until the pasture species got going.

"I had massive root systems on the turnip and the radish and this year I've got a mat of residue. I grazed it right out at the end with lambs that we ended up selling into the meat trade.

"Driving a motorbike around on it now, one thing I've noticed is that it's so soft.

Part of that is the residue on top, but I've noticed while hoeing Bathurst burrs that the soil structure seems to be very good. It's very protected and it looks dark. If that paddock had been ploughed like we used to it would be quite tight and fairly hard on the surface.

"I just think things are really starting to happen there. The oats we sowed into the pasture is almost to above the tank on the motorbike. Basically, we had feed there when other people in the district were full drought feeding, and with the rest of the district brown it was just phenomenal to have a patch of green up on the hill on my property.

"Plus, when you do get rain, you get much greater water infiltration. It goes in and not away."

Michael is aiming for high levels of biomass above ground, which in turn means a strong root system below ground. "Biomass is a really good indicator for the system," he said. "Whatever biomass you have above the ground is replicated underground and that would be the most amazing amount of soil carbon which becomes humus in the soil.

"When you terminate a crop its roots become soil carbon and recycled nutrients. You then sow your next species and that crop takes advantage of the higher nutrient availability and enhanced soil characteristics.

"You've really got a composting system in your paddock and that's the ideal for me. Can we start to turn some of our soil quality issues, like compaction, around with some of these massive-rooted plants like tillage radish? They call it that because it busts up the plough pan and it can go a metre down into the soil.

"It's about using a wide variety of plant species to do what we might be doing if we deep rip and then bring compost in. Maybe we can do it in the one operation, just with cover crops."

What excites Michael about plant diversity is the increased nutrient efficiency that can be achieved. With single-species cropping a large proportion of nutrients are locked up in the soil. Increasing plant species stimulates biological activity, leading to nutrient benefits for subsequent crops and for animals.

"In our cropping systems only about 25% of the fertiliser we put out is actually used by the crop. So what's going on? Where has the other 75% gone? It's become unavailable, but the bacteria and fungi can get in there and make it plant available again. They can break the complexes open and make the nutrients available for the next crop that's coming through.

"The more humus you build in the soil,

the more soil carbon there is and the more nutrients are absorbed into the system. The bugs, bacteria and the fungi are living and dying and re-releasing the nutrients and at the same time improving the moisture-holding capacity of the soil, which also helps nutrient availability."

The Inwoods use their livestock to manage pastures and keep on top of weeds.

"Some of the storms we've had recently have provided good opportunities to shut up a paddock like the one with our multi-species pasture and let it do what it wants to, although I'm pretty big on trying to control weeds," Michael said.

"There are a lot of different plants in the mix that people might consider weed species but our animals graze them happily. They're not toxic; they're just not plants you would usually sow.

"It's much harder for croppers. They've got to stop everything growing to try and get another completely different species in there. It's much easier if you can utilise pastures and livestock."

Michael and Therese crop about 120ha a year, with about half that area pasture cropped and the balance just cropping, which includes use of spray fallow to keep on top of weeds.

"I'm pragmatic about how we control weeds, particularly this season when we've had summer storms come through that are generating significant weed growth in some of the paddocks I've set aside for cropping," Michael said.

"I've spray fallowed those paddocks twice, just a typical chemical fallow. There are people who say I shouldn't be doing that, but if I want to be sure that I get some grain for winter feed I need to have clean paddocks.

"The good weed growth means they have a really good residue on top, so I've got a great mulch layer, but I have to control the weeds because they're in the paddocks we'll harvest for grain.

I crimp roll to shut the large plants down before the stand becomes too thick and unmanageable,

"The pasture cropping is mainly about trying to increase our dry matter for winter, not grain.

"Instead of cropping 80 or 120ha we tick all the boxes on 60ha, then if the season works out for us we'll take a punt on the other 60ha with pasture cropping, which when it works, works very well.

"If it stays dry, crops in paddocks that are pasture cropped have an uphill battle because the cereal has been sown into a living pasture, but we haven't destroyed the pasture. At some point when it rains we'll get the benefit of that. We might not be able to harvest grain, but we've still got a pasture."

Oats are Michael's go-to crop for planting into pasture.

"I have sown dual-purpose wheat but I don't think it's aggressive enough to compete," he said. "That's why we've gone with oats. Oats is conducive to mycorrhizal fungi and is an aggressive plant. I go for older varieties of oats because they were bred at a time when a plant had to be more competitive against weeds. I think some of the newer varieties require more herbicides to take the competition out.

"And if all the ducks line up, if the stars align, if you crossed your fingers and toes, then you can double your winter dry matter in those paddocks, which is great. If I've got 1,500kg/ha of dry matter and an oat crop sown into that paddock gives me another 1,500kg/ha, then I double my dry matter levels, which means I can double my stocking rate."

Michael grazes his pastures judiciously and tries to ensure dry matter levels don't drop below 1,500kg/ha. "That means I know I've got 100% ground cover. Once you get below 70% ground cover – so you can see 30% dirt – you start to see an exponential increase in run-off when you get rain. I've seen paddocks, particularly those suffering from livestock compaction, where at least half and sometimes more of the rain runs off."

When necessary he establishes a 'sacrifice paddock' to maintain livestock while reducing grazing pressure on his other pastures so they can regenerate or to allow them to run to head and set seed.

"The temptation is always to get in and graze, to utilise all the feed that's there. Not using what's there is a really hard thing to do, especially when you're tight on feed, but if you can let those pastures run to seed and preserves some sort of productive capacity, then when the rain does come you're very quickly back in a situation to graze," said Michael.

"That's one lesson I've learnt; maintain ground cover, get out of those paddocks and pull the stock back to a sacrifice paddock."

Michael's sacrifice paddocks have good access to water and easy access to and from multiple other paddocks so the

MIXED COVER CROPS
FOR SUSTAINABLE FARMING

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stock don't have to walk long distances, which is good for the animals and minimises compaction, and can be easily run into nearby paddocks to graze for short periods when that is appropriate.

"Being able to graze nearby paddocks for a while is one way to provide a little bit of roughage for the livestock without having to feed hay, which is expensive. Having a cropping paddock next to a sacrifice paddock is great because you can run the sheep in and out of the stubble, which is better than just putting them in and leaving them because they'll eat it out pretty quickly if they're left there full time. They can also go into a nearby pasture paddock that isn't ready for extended grazing just for an hour or two to give them some green feed to add a bit more diversity in their diet."

The Inwoods use electric fencing to quickly and cost-effectively divide larger paddocks into smaller grazing zones. "We haven't done much strip grazing where we move fences but we very easily split some of our bigger paddocks into three or four stock paddocks," said Michael.

They have about 50 grazing paddocks that are grazed rotationally to ensure good pasture recovery, with the sheep moved to fresh pasture every one to three days depending on pasture quantity, quality and growth rate. Grazing pressure, tracked using Dry Sheep Equivalent (DSE) grazing days per hectare, is logged in grazing charts Michael has set up in a spreadsheet format.

"The way it works is that if I have 50 paddocks and get a couple of days grazing out of each paddock, then with a half-decent autumn that's 100 days of feed, and that's my winter grazing. That way I know exactly where the stock are going. Generally the paddocks have been grazed in sequence before so they're all at a different stage of recovery, which I also take into account when deciding the grazing sequence and how long to leave the stock on each paddock.

I go for older varieties of oats because they were bred at a time when a plant had to be more competitive.

"The idea is to never take a paddock below a certain level because you impact on the recovery rate. If a paddock isn't ready for grazing I'll know that 30, 40 or even 100 days ahead of time so I know I'm going to need to feed, adjust my numbers or start getting a sacrifice paddock ready with feed on hand."

Michael's experimentation with pasture cropping into multi-species pastures, especially those with species like sun hemp and tillage radish in the mix, has recently included use of a crimp roller.

"I crimp roll to shut the large plants down before the stand becomes too thick and unmanageable, then sow the cereal in with discs, because you'll never get through that sort of residue with tines," he said.

The Inwoods' roller is a self-built trailed unit Michael says requires modification. "It's at the workable prototype stage at the moment. It looks pretty rough, but it's working.

"The aim is to shut down whatever you've grown. In a strict cropping sense, where a cash crop is planned, people will sow a mixed stand simply to stimulate biological activity in the soil to get things really humming and bust out those nutrients that are unavailable to the plants.

"The first thing people say is that you're going to have a nitrogen-deficient paddock, or the biology will compete with your crop while it's trying to break that stuff down.

"The thing is, if you're doing it every year, you're building a composting layer then a residue layer and it's a system. I t's like Permaculture; it will keep rolling on and that's what I think I'm starting to get in this one paddock that I'm experimenting with."