

## Soil regeneration unearths sustainable agriculture

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American conservation farmer Gabe Brown would 'bet the ranch' that his soil regeneration approach to agriculture could be just as effective in Australia.

"I would be willing to bet my ranch that on the majority of places in Australia, you can get this system to work," was his confident response to one farmer during question time at SANTFA's conference in Tanunda on March 2.

Echoing others' concerns, the SANTFA member questioned whether the system Gabe is using on his property in Bismarck, North Dakota, could translate to Australia's severe soil conditions.

"Our soils must be harsher and drier than yours are," said the audience member. "I can't see farmers in Australia making that work 12 months of the year."

As the conference's key note speaker, Gabe had delivered two presentations about his mixed farming operation, which uses high stock density grazing, diverse cover crops and permanent ground cover to achieve maximum soil health.

It is a system he has full confidence in, but cautions that it requires a long-term commitment. "The first years, when we seeded a cover crop following a cash crop, we got very little production," he said. "Some would germinate, some wouldn't, but I was growing organic matter, increasing my water holding capacity and putting some residue on the soil surface. The next year it got a little better, and while in some years it didn't work, it progressively improved. Now I'm growing cover crops all the time, where most people can't, because I've improved my soils that much."

Gabe began regenerating his 2,500 hectare farm 15 years ago, after a series of hail storms and a year of drought almost crippled his business.

The first hail storm occurred in 1995, just two years after the Browns adopted a no-till system to save time and conserve moisture.

"No-till was absolutely fantastic in that first year and I thought; boy, this is easy. It's going to be no problem because we're no-till," said Gabe.

Hail wiped out their crops in 1995 and again the following year. In 1997, drought prevented harvest for a third year in a row and only 80% was harvested in 1998, when a third hail storm devastated the farm. With pressure from the banks, Gabe said he "was really questioning whether he wanted to be a farmer".

The setbacks also made him re-think how he was farming, leading to a more sustainable system centred on soil health and regeneration. "Four years of hardship was absolutely the best thing that could have happened to our operation. We didn't think so at the time, but it forced me to think outside the box."

Gabe's first priority was grazing production to ensure survival of his livestock. He needed a pasture crop that didn't require costly inputs and that could survive the summer heat and lack of moisture, which can persist for 90 to 120 days in North Dakota. He first planted a combination of winter triticale and hairy vetch, which was, "an absolute slam dunk, no-brainer". It not only produced feed for the livestock but taught him that the right plant combination can organically produce nutrients for optimum crop health. "One thing I learnt from planting winter triticale and hairy vetch was that things were happening under the ground. To my surprise, those vetch plants were feeding the triticale nitrogen and the triticale was giving phosphorous to the vetch, so there was some interaction going on."

It was a timely discovery, as "the banker wasn't going to loan me money for inputs. I had to change or else I was going to lose the operation".

By introducing new plant species into his cropping rotation Gabe had hit on a key factor: diversity. He believes native vegetation is a prime example of how soils thrive with plant diversity.

"I came to the conclusion that monocultures are an absolute detriment to soil health," he said. "Where in nature do we find monocultures? Only where Man puts them. Why do we think we're smarter than nature? We're not.

"Let's use nature as the template and imitate it as best we can."



When Gabe first started farming his property with wife Shelly in 1991 he grew mainly cool-season crops, including wheat and barley, following the approach taken by the previous owner for 35 years. In diversifying his cropping operation he added peas, corn and alfalfa (lucerne), so his cropping program was a mixture of cool and warm-season cash crops.

Gabe advised the conference attendees to focus on the diversity of crop types, rather than the specific plant species, which may not be suitable for Australian conditions.

Another essential ingredient in his system is diverse cover crops that provide what he describes as 'armour' on the soil surface year round. "We learned through the drought the importance of keeping



THE PROOF IS IN THE SOIL.



residue on the soil surface,” he said. “It’s absolutely imperative. Cover crops reduce evaporation, lower soil temperatures and increase organic matter.”

Since he began the change to his current farming system, organic matter in Gabe’s soils has increased by almost 3%. When tested in 1991, organic matter levels ranged from 1.7 to 1.9%, he said. Today they range from 4.3 to 5.3%. Gabe attributes this improvement to the use of cover crops. “After we diversified and started growing cover crops following cash crops, the organic matter levels increased, which makes sense because two thirds of your organic matter comes from roots,” he said.

The increase in organic matter has also affected his bottom line. Gabe says 5% organic matter is valued at more than \$9,000 a hectare, which he includes on his balance sheet, despite his banker’s amusement. “Our soil carbon is more or less a bank account that we have,” said Gabe. “I list it on my balance sheet and my banker laughs at me, but I say, ‘hey, you’re taking into account other farmers’ pre-paid fertilisers, which is the equivalent of my organic matter’.”

Seeding is a constant exercise on the Browns’ property, with cover crops seeded immediately after a cash crop is harvested. “We always have the trailer hooked up to our tractor,” said Gabe, who upgraded to a 1590 John Deere single-disc box drill two years ago.

“Even though it may be extremely dry and sometimes takes three or four weeks for the plants to come up, we want the seeds in there ready to grow when we get the moisture.

“What we’re trying to do is produce that litter on the soil surface and get more carbon into the system.”

The residue on the surface provides a buffer from the summer heat, reducing soil temperatures and evaporation so the plants can use the moisture for growth. Organic matter also contributes to the soil’s water holding capacity. When Gabe’s organic matter was 1.7 to 1.9%, the water holding capacity was approximately 2.4 millimetres in the top 30 centimetres of soil. “We couldn’t hold very much water,” he said. “It doesn’t matter how much rain you get, it’s how much you can hold and store for production, that’s the key. You’ve got to store it, otherwise it’s going to run off and evaporate.”

... **“I don’t look at my soil the same anymore. It’s now the number one thing I focus on. The rest of it will come if we focus on the soil.”**

While it’s not uncommon for North Dakota to experience snow for half the year, summer temperatures peak at 38 degrees and there are often years with low rainfall. The average rainfall at Bismark is 380 millimetres but in 2006 only 40 millimetres of rain fell between the end of April and the end of July. Despite the dry conditions, paddocks on the Browns’ farm carried a flourishing cover crop. According to Gabe, the key was planting a ‘cover crop cocktail’ of plant species that work well in combination.

“We have people tell us we don’t have enough moisture to grow cover crops, but

‘PASTURE COCKTAILS’ ON GABE BROWN’S RANCH. IT TAKES TIME TO DEVELOP DIVERSITY OF THIS SCALE, BUT IT CAN BE DONE, EVEN IN QUITE LOW-RAINFALL CONDITIONS.

we more than triple forage production when we grow things in combination,” he said. For example, Gabe plants deep-rooted sunflowers to break up hard pans and bring nutrients from deep in the soil profile. Millet adds organic matter due to its fibrous root system, while legumes such as soybeans and cowpeas withstand the heat and fix nitrogen, which is captured by kale, radishes and turnips. “We want diversity below ground, not just above the ground,” he said. “We want different root types and different rooting depths.”

High stock density grazing is another integral tool in Gabe’s system of soil regeneration. His cattle are grazed on cover crops for short durations of just a few hours. Less than a third of the above-ground biomass is consumed, with the remainder forming residue on the soil surface. Plant energy is then diverted to producing organic matter under the ground. “The cattle act like a crop roller would,” said Gabe. “They knock the crop down, allowing us to seed another crop; either a cash crop or another cover crop for winter grazing.”

The grazing is intense, with 500 head of heifers grazing a sixth of an acre [675 m<sup>2</sup>] at a time, yet Gabe says compaction is not an issue. “There is 668,000 pounds of beef on an acre, which comes to 1.75 million pounds on a hectare,” he said. “You might think we’re going to have compaction problems, but compaction is a function of time. Our cattle are only on a small piece of land for a matter of

hours.” The Browns use poly-wire fencing with bungy-cord gates fitted with solar-powered timers that open the gates to allow the cattle to move between paddocks without assistance. Gabe’s son Paul takes an hour and a half to set up the paddock wires in the morning, rather than make several trips during the day to move the cattle.

This intensive system is used only some of the time, with lower stocking rates used on crop stubbles, for example, and when lifestyle options or other commitments mean the high-intensity grazing system is not practical.

The combination of livestock and cropping has boosted the Browns’ bottom line. Gabe says they have produced as much as 200 pounds of red meat production per acre [225 kg/ha] a year using this system. “And that’s just a bonus, because we’re still able to go in after grazing and seed a cash crop.”

Fifteen years on, Gabe says his greatest challenge today is producing enough organic matter to feed the life of the soil. “It’s the life in the soil that’s producing the nutrients for our cash crops. We have to feed soil life first.”

This attitude is far removed from his approach when he first started farming in 1991, when he believes he was ‘disconnected’ from the land.

“I did not understand what the soil was and our organic matter levels weren’t near where they should be,” he said. “I had

come to accept a degraded resource and I needed to regenerate my landscape.

“I don’t look at my soil the same anymore. It’s now the number one thing I focus on. The rest of it will come if we focus on the soil.”



GABE BROWN DURING HIS CONFERENCE PRESENTATION.

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