

# A future direction for property management for a farming system in South Australia

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## 1. Introduction

### *1.1 Background*

Ian and Fiona Koch own and manage 1800 hectares in the northern Barossa Ranges. The property consists of a variety of land classes in three different rainfall zones which require different management techniques. One region of the property, the native grass rangelands, is in a 350 mm rainfall zone. Paddocks are grazed with a commercial merino self-replacing flock for wool, and merino wether lambs which are sold. The second region consists of both cropping and grazing land in a 500mm rainfall zone. Cropping land has been planted with winter crops including beans, lupins, wheat, barley, oats, canola and hay. A rotation is used to minimise herbicide and disease resistance and improve soil structure. The grazing land in the second region is used for the breeding of merino and poll merino sheep for the Bunyara stud. Grazing paddocks have about six months rest each year while stock are put on crop stubbles. The third region, a 600mm rainfall grazing property, has an old established pasture and is used for prime lamb production.

The cropping region of the property has been in no till continuous cropping for 15 years. Although the soil organic matter has increased by about one percent in this time, it has recently plateaued, and a slight decrease in yield of crops has been observed. It is no longer economically viable to grow peas on the property because of low yield and high snail population. In recent years, stubble is breaking down slower than when no-till was first adopted, with over two years of stubble residue now visible in most paddocks. In 2015 the soils were tested for microbial activity; soil fungi levels were found to be satisfactory but soil bacteria were below acceptable levels. Over the years lime has been used to reduce soil acidity, which had increased due to artificial fertiliser applications. Gypsum has also been applied to increase sulphur and help improve soil structure. Based on these observations and analyses, Ian and Fiona came to the conclusion that the system of continuous cropping with artificial chemicals was starting to fail.

### *1.2 Introduction to Gabe Brown*

In 2012 the couple attended a No-till conference in St Louis, USA, where they heard Gabe Brown speak for the first time and were impressed with the holistic and sustainable approach he has taken to manage his farm. Gabe has taken this approach since 1991 on his 2000 hectare farm, developing a sustainable farm management system which is commercially viable at large scale. At the conference Gabe spoke about the importance of using multiple species in pastures to create biodiversity for the animals grazing on the property.

On return to South Australia Ian and Fiona took 36 hectares out of the cropping program and planted a number of species as a primarily annual species based pasture, as an experiment.

### *1.3 Early Experimentation*

The selected paddock had been starting to exhibit ryegrass resistance. The problem was turned into an advantage, as given that ryegrass provides good sheep feed, it was incorporated as one of the species.

The soils on the cropping property have high calcium levels due to underlying limestone in the soil profile. During late summer through to autumn, animals, especially pregnant ewes, were showing signs of manganese deficiency and calcium deficiency, even though the soil had adequate calcium. Supplements and vaccinations have been used to manage these deficiencies. Research into plant species for the poly-culture trial identified that chicory helps in calcium absorption in humans and animals, and therefore chicory was included in the mix.

Gabe had suggested having a mix of 12 different species of plants with a mix of 50 percent legume/brassica and 50 percent cereal. In order to keep costs down for the trial, species of the crops grown on the property were chosen. Various forage species were added as well as some unconventional plants such as vegetables (beetroot, carrots, lettuce, kale) and sunflowers.

The results of the poly culture trial were successful. In the past merino lambs were weaned on a pasture of sown vetch and oats, which would result in lambs scouring and losing weight or having low weight gain. After weaning them on the new poly culture in 2012 no lambs scoured and growth rates were good.

In that year the region experienced the worst drought since 1982, with 275 mm of rain, a little over half the annual average rainfall. Despite this, 400 lambs were able to graze the 36 hectare trial site for four months from the end of August. The lambs selectively grazed different species at different times depending on the palatability, so most of the time ground cover was high. Chicory proved to be a very successful plant for this area, providing green over summer, and having a perennial nature. In 2014 no poly culture was sown in this paddock, to see if it could develop into a perennial pasture, but it was unsuccessful. As such, a poly culture has been sown into this paddock each year with annual species. In time the paddock will return to the cropping program and a new poly culture paddock selected.

### *1.4 Study tour objectives*

A key objective for the study tour was to learn how Gabe maintains a high productivity for a relatively low rainfall region, achieving 4t/ha wheat yields from 400mm rainfall, without artificial fertiliser and only minimal chemical use.

Snails are becoming a problem costing the Bunyara business a lot of money, as well as damaging plants and thinning the planting density. Snail baiting has been a regular annual

practice with limited success and introduces more chemicals to the farming system. Gabe uses poultry to reduce snail populations, thus providing a second key learning objective of the study tour.

## **2 Browns Ranch**

### *2.1 Background*

Gabe Brown and his family own and manage about 1860 hectares near Bismarck North Dakota. The property receives 250mm of rainfall as well as another 125mm from snow. Prior to the introduction of Gabe's sustainable farming system average wheat yields were 1.25-2 t/ha.

About half of Gabe's property was used for cropping and half was grasslands, but in recent years he has sown most of the cropping land to pastures for livestock. He uses temporary electric fencing to regularly move fences so that animals can be moved daily. The pasture is grown with up to 19 species such as sunflowers, canola, radish and turnips. Visibly, significant biodiversity can be seen including ground and flying insects, butterflies, bees and birds.

A common rotation on the farm is to first plant sorghum Sudan for winter grazing, followed by a cash crop such as oats, under-sown with clover. Once the oats are harvested, perennial grasses are planted. Pasture species are selected for specific uses, for example a pasture species may be selected to improve soil health, or optimum animal health and nutrition during winter.

The area has about 120 frost free days per year so frost is a real issue. In Gabe's pastures he plants 65 percent to a cool season environment and 30 percent to a warm season environment. In his no-till grass lands he has and plants up to 140 different species of plants, of which 100 are native and about 40 are introduced.

### *2.2 Polyculture Benefits*

In 1993 the soil was 0.7 to 1.9 percent Organic Matter (OM) with 12.5 mm infiltration of rainfall per hour. The water holding capacity was 7-8 percent. By 2015 this had increased to 6 percent OM in the croplands and 8 percent OM in pastures. The soil now has an infiltration of 200mm per hour. The ratio of soil bacteria to fungi is 2:1, with an aim of 1:1. It is quite common in the district of the bacteria to fungi ratio to be 10:1.

Gabe believes that using the no till system has helped soil fertility and structure however there are other tools to use. He thinks it is possible to transition from conventional farming to seeing the results of a better system within about five years.

Today Gabe is growing spring wheat, oats, barley, hairy vetch, triticale and corn. His spring wheat now yields 4 t/ha and his corn 8 t/ha. The county average of corn is less than 6.25 tonne/ha, showing that Gabe is achieving higher than average yields despite his low-chemical system.

Gabe rarely uses herbicides, and the last time synthetic fertiliser was used on his own land was in 2008.

### *2.3 Livestock diversification*

Free range chickens were introduced on the farm to increase the diversity of livestock and introduce another saleable product.

The farm has about 700-800 hens which forage in the crops after harvest. The hens are trained to live in modified horse floats, which have a small door near the front where the hens exit and enter. This door has a sensor and opens in the morning and closes at dusk. As pullets the hens are trained to go into the hen house at night; young pullets, if not trained, will camp under the float, where they are eaten. A plastic mesh electric fence is put around the float until the hens are trained, to stop coyotes eating hens. Inside the float are nesting boxes and a roost. In winter the hens will go into a hoop-house for 4 months, a little like a plastic glass house. There is a small forest on the farm and fallen limbs of trees are mulched for the base of the hoop house. Gabe is also looking at developing a chicken processing system.

Sheep and pigs have also been introduced to the rotation. Pigs, in particular, have been found to be highly profitable, returning \$1,00 per pig from sales of smallgoods.

## **3 Key learnings**

The main points learned from Gabe Brown were:

- The benefits are significant from improving soil health to reduce dependence on artificial fertilisers in terms of soil structure, organic matter, water holding capacity and ultimately yields. This can be achieved by using diversification of plants, plant root systems and organic carbon and mineralisation.
- Using a mix of plants including legumes, brassicas and cereals supports achieving soil balance. Each plant has its own unique purpose to bring balance to the soil system and environment.
- Strip grazing using electric fencing is a successful method for reducing parasites
- Diversity of livestock reduces animal parasites and pests.
- Encourage beneficial insects and predators
- Continue learning from observation of nature, history and mentors

## **4 Practice Adoption**

After returning to Australia, Ian and Fiona are introducing a poultry element to the farm to control pests, and in particular snails. Guinea fowls have been selected and a breeding flock started. A benefit of guinea fowls is they are carnivores and will eat rodents such as mice as well as pest insects.

Fowls are very routine and easy to train so it is expected they will be able to be trained to use a float to roost in and that they will stay close to the float. Guinea fowl seasonally lay eggs from September to November but are very poor at raising chicks, so breeding is expected to be the biggest challenge of this endeavour.

Pollinator patches are being planned, in particular in cropping paddocks where there are areas that are not arable. A wide variety of native and introduced species will be planted, specifically to promote beneficial insects.

Bunyara's poly culture system will also be improved following the learnings from Ian and Fiona's study tour. In the short term, water points will be improved and strip grazing trialled. In the long term, more deep-rooted species will be planted to increase organic matter.

Plant nutrition will be a long-term focus, with using mulches and animal manures a key strategy to reduce the dependence on artificial fertilisers, and trials of foliar application of liquid nutrients.

Ian and Fiona are working with their local producer group, the Barossa Improved Grazing Group, to share their findings and experiences with the local farming community.

## **7. Conclusions**

The properties visited during the study tour, who have been no till farming for over 20 years have confirmed what Australian producers are now finding. Organic matter levels have not increased enough by just using no till, and diversity of species in an annual cropping system can increase soil organic matter.

Australian graziers have to change the way we look at farming and grazing. At the moment chemical and artificial fertilizer use is high, resulting in high input cost systems for cropping, which are not providing returns for the financial investment. If we continue down this path we will no longer produce economically viable crops. We need to go back to a sustainable system and a more holistic approach to our farming business.

Gabe Brown has demonstrated that a sustainable holistic system can work over a long timeframe and provide measureable improvements to soil health and crop yields. Most importantly what he is doing works on a commercial scale and is profitable. The process of sustainable soil fertility starts by changing the way we think and how we manage the land today for the benefit of the future. One way is by thinking about change from monocultures and introducing diversification of species and livestock into cropping and grazing systems.

Ian and Fiona Koch are now on a journey of positive change for a sustainable future for agriculture on their property. Adopting a more holistic approach, they will introduce changes conservatively but are more confident about their success.