Mt Barker Demonstration Site

Practice Change Case Study

Integrated Crop Protection
PROTECTING CROPS

Soil Wealth
NURTURING CROPS

Overview

The Samwell family have been growing premium quality Brussels sprouts at Eastbrook Vegetable Farms in the Adelaide region, South Australia, for over 60 years. They started out as market gardeners in the Adelaide Hills, growing everything from potatoes and parsnips to gooseberries and apples. But it's the sprout they've hung onto for all these years.

Father-son duo Scott and Kent Samwell lead the growing operation, which has become one of the largest producers of Brussels sprout in Australia. Leigh and Jamie Samwell in sales and marketing, as well as Luke who heads up engineering and maintenance, complete the family team. With many years of experience passed down through six generations, Scott focuses on continuous improvement of production systems and innovation. He gets involved with Hort Innovation RD&E projects like the demonstration trial showcased here, on project reference groups, with field days or explaining technologies in extension videos. This is a fantastic contribution to the vegetable industry and Scott can pick up on new developments as they happen.

One innovation is a new brassica vegetable, Kalettes (Figure 1). They are a cross between red kale and Brussels sprouts which may be eaten raw or cooked. Scott discovered Kalettes while on an overseas trip. He brought the idea back to Australia and "collaborated with Fresh Select to bring the idea to life". They have been available for consumers since 2015 and their popularity continues to grow, potentially because they are proclaimed to be highly nutritious.

This case study focusses on the use of cover crops on Eastbrook Vegetable Farms, where they are a long-standing tradition.

Scott and Kent have always been using cover crops to rest the soil between brassica plantings and prevent erosion on the hilly land. They mainly planted rye grass and oats, and have been trying new types over the past 4-5 years, including rye grass mixed with legumes. They continue to be interested in investigating further options. This includes rye grass, faba beans, vetch and triticale, and potentially lucerne and rye corn.

> ***"We want to be sustainable. All the sons that are working here have children. We'd like them to keep on farming this land. We know the farm and the soil intimately and we want to preserve what we've got here because I think it's important for the future, not only of our kids, but also for farming in Australia."***
>
> **Scott Samwell, ABC Landline, 1 June 2014**

Figure 1: Young Kalette crop at Eastbrook farm, January 2017

Document ICPSW5/071/1711

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Mt Barker Demonstration Site

Integrated Crop Protection
PROTECTING CROPS
Soil Wealth
NURTURING CROPS

The plan

COMPONENT	DETAIL
Objectives of site	• Increase/maintain organic matter and soil structure, and control weeds through the use of cover crops (indirectly reducing herbicide application), manage erosion • Build soil nitrogen using legumes in green manure crops (need about 300 kg/ha of nitrogen for sprouts, some green manure crops can produce 200 kg N/ha e.g. peas, beans, lucerne, lupins
Location	Mount Barker SA 5251
Management & Support	Scott Samwell (Samwell & Sons), Nigel Dolenec (E.E. Muir & Son), Doris Blaesing and Carl Larsen (RMCG)
Size of farm	600 acres (243 ha)
Rainfall	762.8 mm (average annual 1861-2016)
Soil types	Heavy & medium clay/loam with variation to lighter, sandier soil
Crop timing	• Planting period (sprouts): 1st week of July to last week of February with one planting each week in July and August, and from September to February planting all week (while kalettes planted November-February and processing cabbage is planted year-round) • Harvesting period (sprouts): 1st week of December to last week of September • Cover crop planting after ANZAC Day Mar-May
Principles for the use of cover crops	• Simple and easy to repeat • No additional inputs e.g. herbicide, fertilsers, irrigation • Use existing machinery e.g. speed disc with air seeder (3.5 m wide) with preference for sowing full rows rather than smaller areas or plots, using the farm's slasher to terminate the cover crop and rotary hoe to prepare ground for planting • Not attracting pests like birds or slugs, not harbouring diseases like clubroot or others • Suitable for control of broad leaf weeds, especially brassica weeds • No grazing, however, fodder may be taken off at times • Long term cover crops preferred that can be slashed and re-grow up to 4-year period
Cover crops trialled	• Rye grass (22kg/ha) • Faba beans (60-70kg/ha) • Rye and faba bean combined • Vetch • Cover crop sown in April to May-2016
Monitoring	Soil testing, visual soil moisture monitoring

Results and lessons learnt

The cover crop used was a triticale / vetch mix at a relatively high seeding rate to achieve quick ground cover for weed suppression and produce a lot of biomass for re-incorporation into the soil. This included:

- Seeding – early June 2016
- Seeding rate:
    - 60 kg/ha triticale
    - 30 kg/ha vetch
- Incorporated; October 2016.

The overview photo from August 2016 shows that the cover crop grew well (Figure 2).

The cover crop paddock was sampled 9 August 2016 for an ExpressSoil test (results shown in Figure 3).

The soil test results illustrate that good, balanced soil nutrient levels were one reason for the high growth of the cover crop.

The cation balance was good. Electric conductivity (EC), pH and all nutrients, apart from Sulphur (S) and Boron (B), were in the desired range. Brassica crops take up high amounts of S and B; therefore, the low levels seen can be expected.

While soil Phosphorus (P) levels were satisfactory, the P-Saturation index (M3 PSR) indicated that the soil was P-fixing. Scott will address the low B and S levels and the need for available P for the next brassica crop. Sufficient P in the soil solution is especially important for early root growth. Transplant trays are watered with a suitable P source before planting.

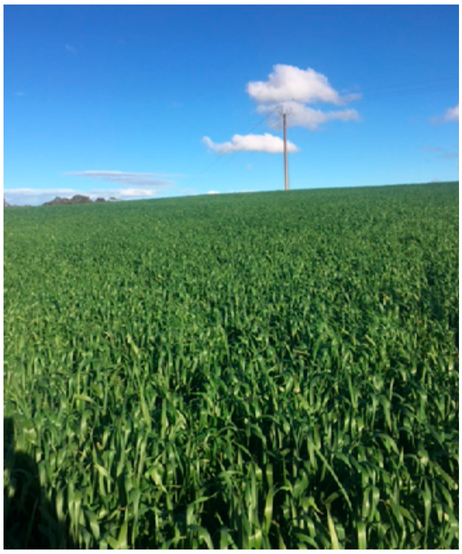
The soil test confirms that growing a high biomass cover crop was a good idea, given the organic carbon level in the paddock was below target and the total nitrogen level was marginal. Organic carbon, nitrogen and other nutrients are all components of the soil's organic matter.

Organic matter

Organic matter is made up of a living biomass of microorganisms, fresh and partially decomposed residues, and humus, which is well-decomposed, relatively stable organic material. Root exudates and charcoal are a small proportion of organic matter. Charcoal is resistant to decomposition.

Organic matter contains about 50% Carbon (C), 5% Nitrogen (N), 2% Phosphorus (P) and 2% Sulphur (S). Cations like Potassium, Calcium, Magnesium and other nutrients are also part of organic matter. Actual percentages and ratios of Carbon and nutrients in organic matter can vary widely mainly depending on soil type, climate and how the soil is managed.

For further information on soil organic matter, read "Managing Soil Organic Matter: A Practical Guide" produced by GRDC and highly relevant for all crops.



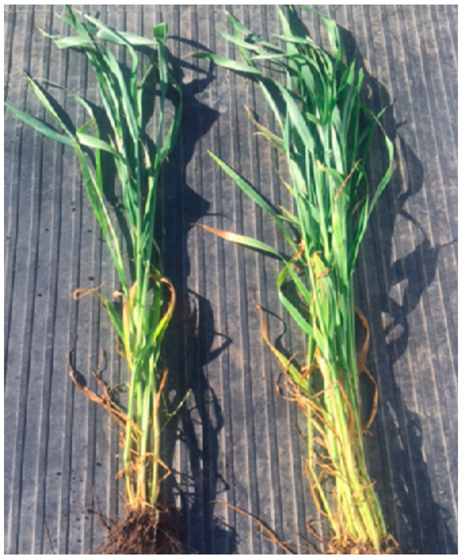


Figure 2: (Top) Cover crop overview, August 2016, (Middle) Triticale, August 2016, (Bottom) Vetch, August 2016

Client Details

Client:	E E MUIR & SONS (MCLAREN FLAT)	**Date received:**	09/08/2016
Grower:	SAMWELL	**Current Paddock:**	GREEN MANURE BLOCK (Sampled: 09/08/2016)
Order No.:	N/A - Soil Wealth Check	**Date reported:**	15/08/16
Sample ID:	16017963	**Profile sampled (cm):**	30
Lab code:	ES25	**Client agronomist:**	NIGEL DOLENEC
Crop:	TRITICALE / VETCH	**Soil Type:**	Medium Soil (CEC 8-12meq)

N-Check Results

Nitrate:	0.32ppm	**Nitrate:**	3.60kg/ha	**Total Available N:**	10.80kg/ha
Ammonium:	0.64ppm	**Ammonium:**	7.20kg/ha	**Total req. N (kg/ha):**	40
Bulk Density:	1.22g/cm	**Rootzone Moisture:**	71.81mm	**% Moisture:**	19.62% W/W

expressSoil Results

Analyte	Units	Result	Optimal Range	Status
pH (H_2O)	(pH)	**7.1**	6 - 7	Satisfactory
pH ($CaCl_2$)	(pH)	**6.3**	5.3 - 6.5	Satisfactory
EC	dS/m	**0.06**	0 - 0.15	Satisfactory
Lime requirement	t/ha			None
ESI	units	**0.02**		Satisfactory
Total Carbon	%	**1.64**	2-10	Below target
Total Nitrogen	%	**0.14**	>0.15	Marginal
Carbon:Nitrogen Ratio	(ratio)	**11.7**	11-24	Satisfactory
Organic Matter	%	**2.5**	>4	Below target
M3 PSR	(ratio)	**0.04**	0.06 - 0.23	Low
Mehlich Phosphorus	ppm	**41.6**	40 - 90	Satisfactory
Potassium	ppm	**320.6**	245 - 400	Satisfactory
Sulphur	ppm	**9.2**	12 - 45	Below target
Calcium	ppm	**1642.3**	1620 - 2700	Satisfactory
Magnesium	ppm	**254.7**	200 - 400	Satisfactory
Sodium	ppm	**80.7**	20 - 85	Satisfactory
Chloride	ppm	**9.0**	0 - 200	Satisfactory
Zinc	ppm	**7.7**	2.2 - 11	Satisfactory
Copper	ppm	**4.9**	2.5 - 10	Satisfactory
Boron	ppm	**1.4**	2.2 - 6	Below target
Manganese	ppm	**58.1**	18 - 70	Satisfactory
Iron	ppm	**214.2**	35 - 230	Satisfactory
CECe	meq/100g	**11.5**		
Calcium	meq/100g	**8.2 (71.3%CEC)**	8.1 - 13.5	Satisfactory
Potassium	meq/100g	**0.8 (7.0%CEC)**	0.6 - 1.0	Satisfactory
Magnesium	meq/100g	**2.1 (18.3%CEC)**	1.7 - 3.3	Satisfactory
Sodium	meq/100g	**0.4 (3.5%CEC)**	0.1 - 0.4	Satisfactory
Base Saturation	%	**100**	80 - 87	High
Exchangeable Acidity	meq/100g	**0.0 (0.0%CEC)**	13 - 20 %CEC	Satisfactory
Aluminium Saturation	%	**0.00**		Satisfactory
Ca:Mg Ratio	(ratio)		3 - 5	Satisfactory
K:Mg Ratio	(ratio)	**0.4**	0.3 - 0.5	Satisfactory

Analysis by AgVita Analytical

The information in this report is factual only and is based on specific batch sampling, sample handling, extraction and analytical procedures performed by AgVita on the sample analysed. Different results may be obtained from alternate procedures and different batch samples.

The information in this report does not constitute any recommendation or professional advice by AgVita and professional advice from an agronomist should be sought before acting or relying on this information.

To the maximum extent permitted by law AgVita disclaims all and any guarantees, undertakings and warranties, expressed or implied, and is not liable for any loss or damage whatsoever (including human or computer error, negligent or otherwise, or incidental or consequential loss or damage) arising out of, or in connection with, any use or reliance on this information. The user must accept sole responsibility associated with the use and application of the information in this report, irrespective of the purpose for which such use or results are applied.

Figure 3: Soil test results

The cover crop continued to grow very well because winter rainfall was good in 2016. By October 2016, the triticale had become the dominant species and aboveground biomass was high (Figure 4).

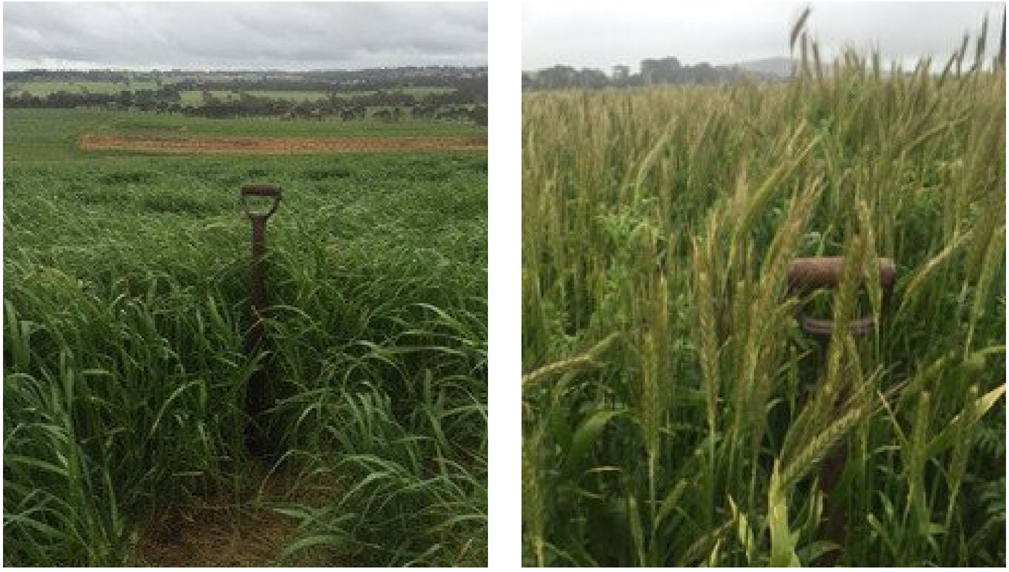


Figure 4: Standing cover crop ready to be terminated, 20 October 2016

After the cover crop was slashed using equipment available on the farm, on 3 November 2016, the weather turned dry. Even after rotary hoeing, a large amount of trash remained on the soil surface (Figure 5). Scott applied nitrogen to improve breakdown. This was important because soil N reserves were low according to the soil test, and the high C and low N content in the trash (high C:N ratio) would also slow breakdown. Still, breakdown of the coarsely chopped cover crop residues was minimal without rain.

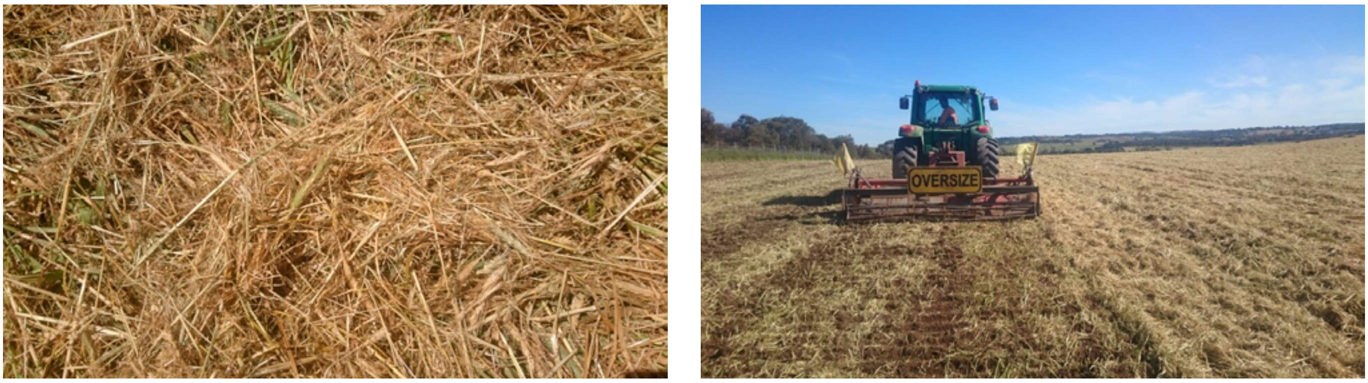


Figure 5: Cover crop after slashing and rotary hoeing, early November 2016

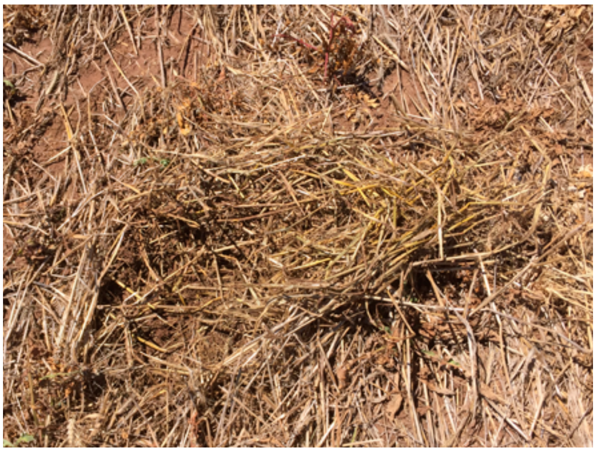


Figure 6: Cover crop residue 17 January 2017 (L), and Kalette crop (R) transplanted January 2017 in another paddock on the farm

The photo of crop residues in January 2017 shows that the paddock was far from ready for planting. It should have looked like that used for the crop transplanted in January 2017 (Figure 6).

Given the situation, Scott left the paddock untouched until the autumn break in 2017. He then planted a rye cover crop to protect the paddock from erosion over winter and increase carbon levels. In October 2017, nearly a year after terminating the initial triticale / vetch cover crop, the paddock is finally ready for planting before Christmas 2017 (Figure 7). The soil is in excellent condition, smelling and feeling like a healthy soil should. Scott may grow the best ever Kalettes here!

Scott was lucky to have sufficient land available to be able to keep a paddock out of production for a year. Most vegetable growers do not have that luxury.

Figure 7: Cover crop residue 19 October 2017

Summary and next steps

The cover crop trial at Eastbrook Vegetable Farms highlighted the following:

- When trying new crop management approaches, be prepared for a scenario where not everything goes to plan; think through the risks and management options
- Having the right equipment on hand to deal with cover crop residues under adverse weather conditions (too dry or too wet) is beneficial
- Having to purchase extra equipment for trials is not an option because it is not clear whether it will be needed in the long run. This is a challenge for all soil management trials.

Scott will stick with his cover crop principles and keep an open mind about new options. These would have to provide management or financial benefits above his current regime. Minimum tillage including strip tillage and planting into trash are options Scott could explore, however, these would require investment into machinery without having proof of the benefits for the operation. The fact that Scott has sufficient land to leave paddocks under cover crops up to four years may mean he does not need to invest in tillage systems that benefit intensive vegetable production systems.

Scott stresses that every farming operation is different and growers have to do what is best for their business. He will continue to try new technologies and remain involved in research and development so that he can take advantage of innovations that fit the operation. Apart from his focus on healthy soils, Scott is also continuing to use integrated crop protection and Integrated Pest Management (IPM) methods.