

# COWRA CASE STUDY PART II

APRIL 2020

**Soil Wealth**  
NURTURING CROPS



**Integrated Crop Protection**  
PROTECTING CROPS

## Cover crop + Strip till a winning combination for Soil Health

Strip tilled control (fallow)

Strip tilled rolled ryecorn cover crop

Cover crops provide multiple benefits, including reduced soil crusting, increased infiltration rates, reduced compaction, weed suppression, and nutrient cycling. Combining cover crops with strip till is proving a winner for vegetable soils and crops. In the Cowra Case Study Part I (COVER CROP + ROLLED GROUND COVER + STRIP TILL = RECORD FARM CUCUMBER YIELD) we detailed cucumber crop benefits. In Part II we dig a bit deeper to look at the soil health benefits from cover crop + roller crimper + strip till which underpinned the outstanding yield result.

In vegetable production, going from your cover crop to your cash crop can be challenging with lots of residues. In many cases it can be two steps forward for soil health during the growth of the cover crop, and one step backward because of the extra cultivation. Strip till helps keep soil health moving forward, while setting up the soil for the all-important cash crop establishment.

### Stabilising soil structure

The soil at Cowra is a light sandy soil type, low in organic matter (1.2%), and prone to crusting and poor infiltration. These issues are not uncommon in many Australian vegetable production areas.

Cucumbers were directly seeded into strip tilled ground following a ryecorn cover crop and then compared to a fallow field. The cucumber crop emergence and early vigour following the cover crop – strip till combo was phenomenal; very even and 100% emergence. By contrast in the fallow area, cucumbers battled through a



Figure 1. Cucumber seedling emergence in rolled cover crop + strip till area (left) and the contrasting bare fallow area (right).

crust, with an uneven 93% emergence and slower early growth (Figure 1).

The cover crop-strip till combo gave the soil fungi a chance to stabilize the soil structure. More importantly, the strip till prepared the seed bed for the cucumbers with minimal disturbance while retaining much of the cover crop residues. Fungi hyphae grew out of the soil and into the ryecorn residues, excreting compounds stabilizing the soil surface, and slowly decomposing the more complex cellulose and lignin in the ryecorn stalks. Both cultivation and bare fallow ground destroy and deplete beneficial soil fungi, negatively impacting soil structure and mineralisation. The outstanding seedling establishment and early crop vigour highlight these principles.

**Protecting the soil from extremes in temperature and heavy rainfall events**

Soil needs a cover! On 26 Feb 2019, Cowra's ryecorn residue-covered soil (5cm depth) was a cool 30°C compared to 38°C in the fallow. Soil temperatures between 23°C – 33°C are ideal for cucumbers, hence the 8°C cooler covered soil was a big benefit during late summer heat waves.

The soil cover also helped rainfall and irrigation enter the soil and slowed evaporation losses. This effect following a 24mm cloudburst of rain in January is highlighted in Figure 2. With the cover crop residue on the surface, the rainfall infiltrated well and was stored in the soil. By

contrast the fallow area, with capped soil, showed no increase in soil moisture. Instead the rain ran off the beds and into the wheeltracks. The rainfall stored at depth under the cover crop residue lasted for weeks, saving irrigation costs and benefiting the next cash crop! This is a fantastic result for Ed and James during a dry, hot and long end to summer 2019.

Soil temperature and moisture are important drivers for many soil biological processes. Cover crops and crop residues left on the soil surface protect the soil from extreme weather events, helping cash crops grow through stressful periods and achieve maximum yield and quality.

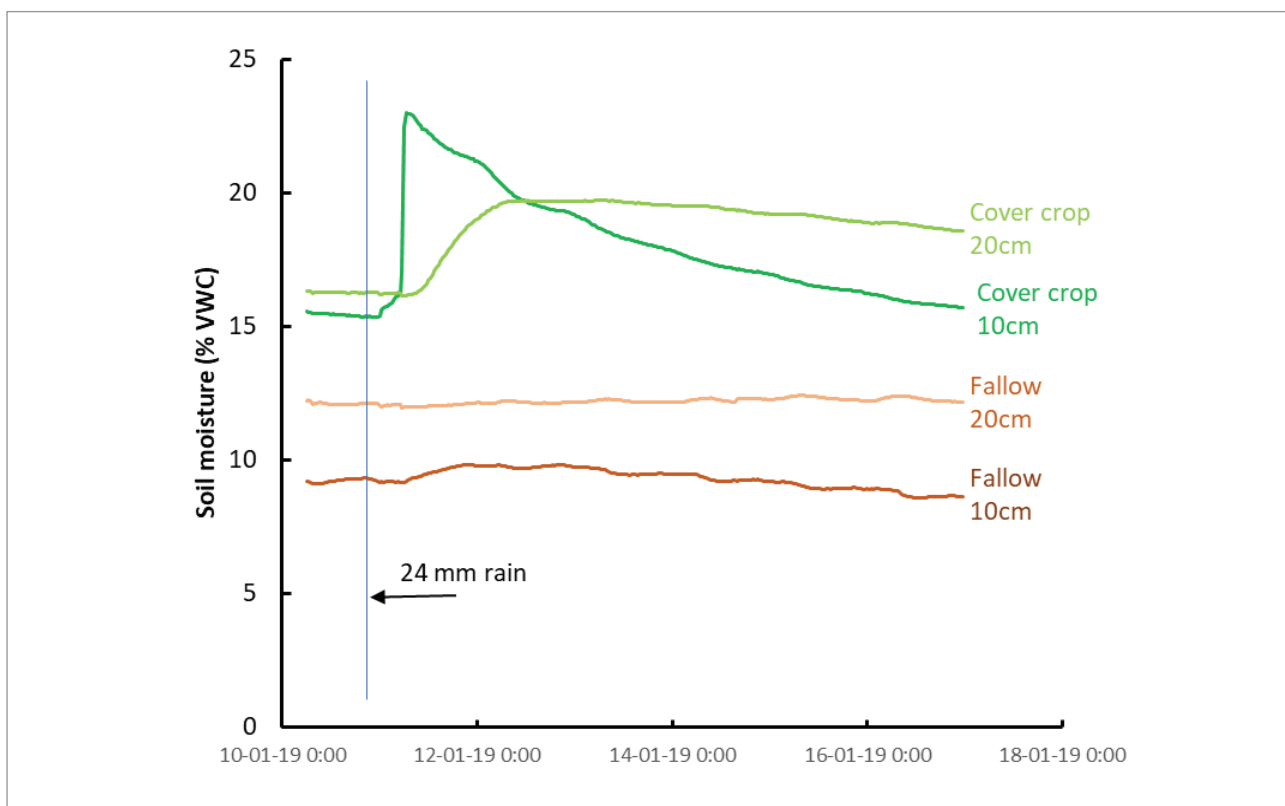


Figure 2. Impact of the rolled ryecorn cover crop residues on rainfall infiltration and storage in the soil following a 24mm rainfall event.

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### Weed Control

Weeds pose a challenge both in-crop and in fallow fields. The biggest weed control benefit from this cover crop was during the winter growing period and early summer fallow months, as the cover crop outcompeted weeds during this growing period. High seeding rates and tall cover crops are best for this desirable result. The rolled residues also suppressed weed growth after termination of the cover crop.

Importantly, in the cover crop-strip till combo, cover crop residues suppressed weed growth prior to cucumber crop vining (Table 1). In our demonstration, the best yield (18.9 t/ha) followed growth of the cover crop with NO in-crop herbicide applied. Several preplant knockdowns (stale beds) and suppression from the cover crop physical barrier gave adequate weed control without herbicides.

In the fallow area, where weed pressure was high, a herbicide application (Group Q; clomazone) more than doubled cucumber yields (Table 2). However, no yield response was seen when the herbicide was applied to the rolled cover crop. Instead a small decline in yield

Date	Fallow	Cover crop
(Weeds/m <sup>2</sup> )		
6 December 2018	3.5	1.0
16 January 2019	4.0	1.5
5 March 2019 (cucumbers = 2 leaf stage)	8.0	3.0
19 March 2019 (cucumbers = early vining)	11.0	7.0

Table 1. Impact of cover crop on weed count where no herbicide application.

was seen, driven mainly by reduced plant productivity. In cucurbits, the herbicide clomazone is sometimes used with crop sensitivity varying between species, soil type and application rates. Generally, cucumbers are quite tolerant to clomazone, and weed control benefits outweigh any yield penalty due to phytotoxicity as seen in the fallow area. However, when the rolled cover crop controlled weeds the herbicide application reduced plant productivity, setting 24% less fruit per plant.

Demonstration areas	Crop establishment (plants/ha)	Plant productivity (fruit/plant)	Marketable cucumber yield (t/ha)
<b>Rolled cover crop</b>			
+ herbicide	48	2.6	15.1
No Herbicide	44	3.4	18.9
<b>Fallow</b>			
+ herbicide	45	1.9	8.4
No Herbicide	36	1.4	3.7

Table 2. Cucumber crop establishment, productivity and marketable yield following either a rolled ryecorn cover crop or a bare fallow. Cucumbers were direct seeded following strip tillage. Herbicide (clomazone) was applied.

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### Soil Nitrogen

Non-legume cover crops draw down soil nitrogen during their growth and store this in the plant biomass. This can be an advantage when paddock nitrogen status is high, due either to high nitrogen carry over from a previous crop, or high nitrogen mineralization conditions. In cucumbers high nitrogen can produce excess vine growth that detracts from the fruit yield.

In this case study, mineralisation throughout both winter and summer months created excess nitrogen in the fallow areas (brown bars), with almost 250 kg N/ha in the soil before the cucumber crop. Conversely, the ryecorn cover crop took up most of the soil nitrogen and added stability to high summer mineralisation rates.

Pickling cucumbers require relatively small amounts of nitrogen compared to potassium.

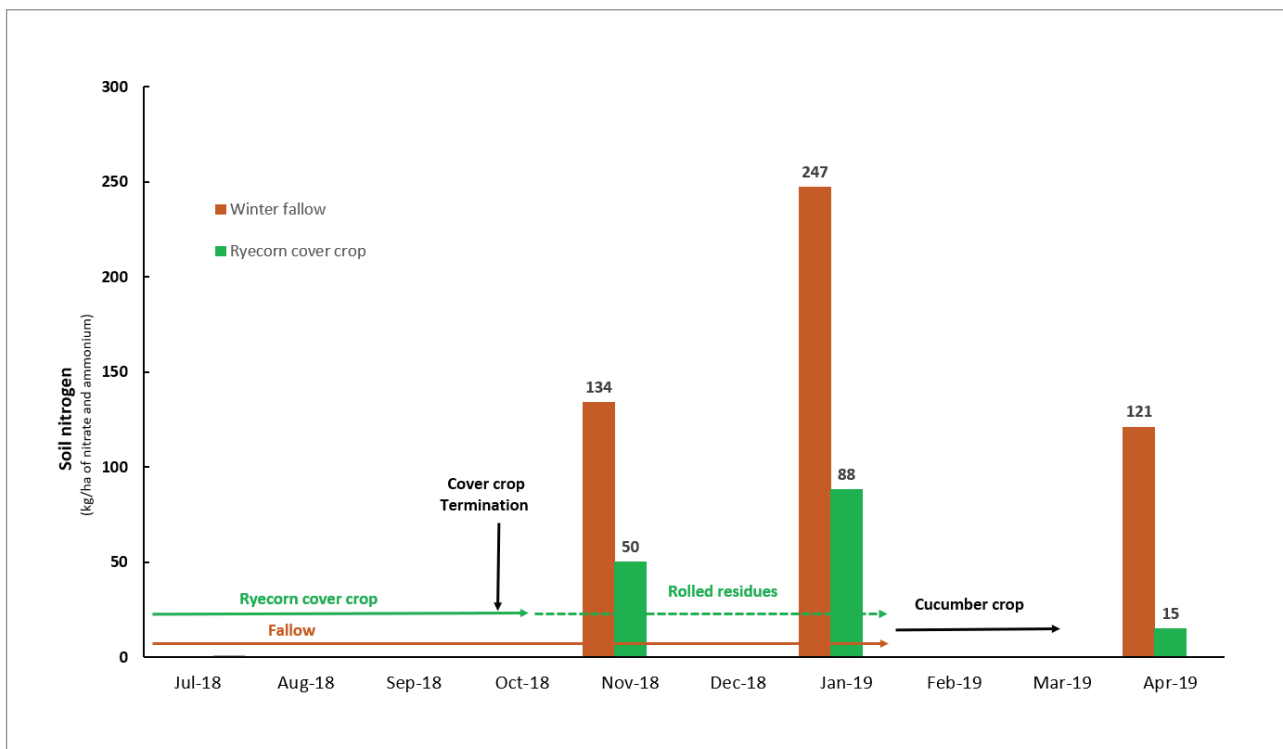


Figure 3. Soil nitrogen levels during the winter period, under either a ryecorn cover crop (green) or fallow (red), and during the summer cucumber crop (soil nitrogen includes both nitrates and ammonium in Kg N/ha).

### The bottom line in soil health...

Cover crops and ground cover provide many benefits including reduced crusting, increased infiltration rates, reduced compaction, weed suppression, and nutrient cycling. Every crop should benefit the following crop!

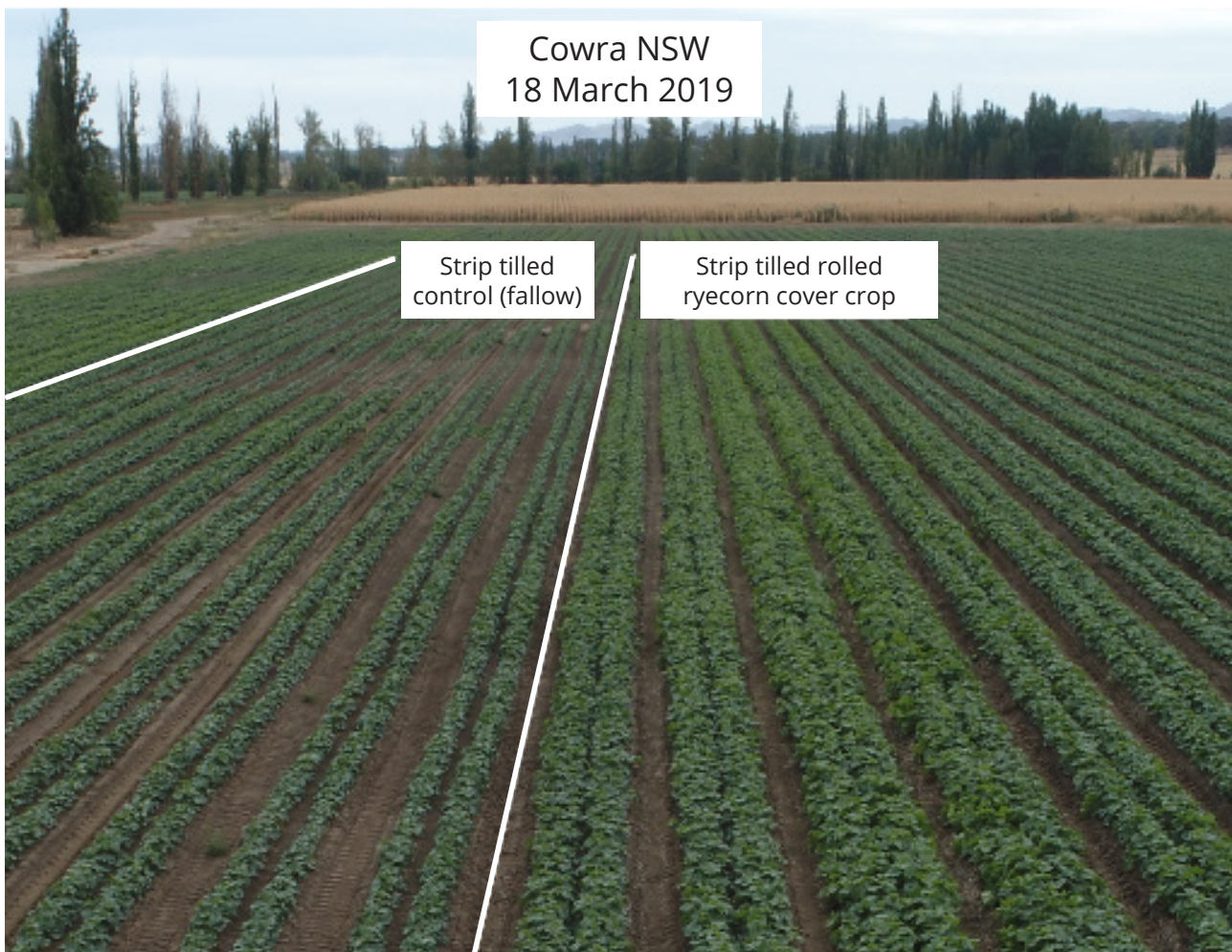


Figure 4. Cucumber crop highlighting better growth under the cover crop–strip till combo.