Is disease suppression stimulated by increased dry matter input?

RESEARCH

Amanda Cook, Nigel Wilhelm, Wade Shepperd and Ian Richter

SARDI, Minnipa Agricultural Centre

Searching for answers

Location: Poochera
Ian & J Gosling

Rainfall
Av. Annual: 324 mm
Av. GSR: 245 mm
2011 Total: 320 mm
2011 GSR: 223 mm

Yield
Potential: 2.3 t/ha (W)
Actual: 2.0 t/ha

Paddock history
2011: Pasture/trial treatments
2010: Wheat
2009: Pasture/trial treatments

Soil
Grey calcareous loam

Plot Size
40 m x 4 reps

Location: Minnipa
B & K Heddle

Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2011 Total: 374 mm
2011 GSR: 215 mm

Yield
Potential: 2.1 t/ha (W)
Actual: 1.9 - 2.4 t/ha

Paddock history
2011: Wheat
2010: Medic canola hay
2009: Wheat

Soil
Red/brown calcareous sandy loam

Plot Size
40 m x 4 reps

Key messages

- **The fluid fertiliser system increased yield and dry matter production at both sites.**
- **The added carbon treatments with increased microbial activity have not increased grain yield in 2011.**

Why do the trial?

These trials were established on two highly calcareous soils initially to see if disease suppression can be stimulated by increasing organic matter (i.e. carbon) inputs into farming systems under local conditions. The trials have been maintained to monitor the carbon input and breakdown and to determine its impact on grain yield and quality.

How was it done?

Identical trials were established on a grey calcareous soil at Poochera and a red calcareous soil at Minnipa, to vary carbon input into soil with different crops and management practices. Treatments in 2008, 2009 and 2010 were extra cereal stubble added as chaff (5 or 10 t/ha), wheat, barley or canola at high seeding rates with fluid fertiliser (to encourage high dry matter production) and wheat (Wyalkatchem @ 60 kg/ha with DAP @ 60 kg/ha) as a control.

Fluid fertiliser was APP and UAN at the same nutrient rate as granular (12 kg P/ha and 10 kg N/ha). A barley/vetch mixture was included as a brown manure treatment sprayed out at late tillering. Zinc was drilled below the seed on all treatments as a fluid at 1 kg Zn/ha.

Chopped oaten stubble was added to the soil surface in 2008, 09 and 10 one month before seeding for appropriate treatments. This season both trials were sown with CL Kord @ 60 kg/ha with DAP @ 60 kg/ha following barley in 2010 (also with a standard district practice rate of DAP at seeding across all treatments). The trials were sown on 3 May at Minnipa and on 4 May at Poochera. Both trials received pre sowing 1.5 L/ha Roundup PowerMAX®, 1.5 L/ha Treflan®, 80 ml/ha of Hammer® and 300 ml/ha Li700®, and post sowing 700 ml/ha of Intervix®.

What happened?

The trial sites were chosen for severe Rhizoctonia and low productivity in cereal crops to see if improved production or direct organic matter inputs would make a difference. Soil pH down the profile is similar for both soils but the Minnipa site has higher boron compared to Poochera. Soil organic carbon at the sites is relatively low which is typical for the upper EP. The Poochera site had a much higher level of nitrate-N throughout the profile (total of nearly 400 kg N/ha compared to Minnipa at 180 kg N/ha) at the start of the trial. Soil Colwell P levels were high for the highly calcareous soils at Minnipa and Poochera (47 P and 50 P (mg/kg) respectively) although are probably still in the deficient range for these soils. These sites have high calcium carbonate (free lime) throughout the profile.

In 2011 all fluid fertiliser treatments increased early plant dry matter and grain yield at Minnipa and Poochera (Table 1 and 2). There were no differences in grain quality at either site.

Screenings were high in all treatments at both sites but this may have been due to grain filling during the dry period in late August through to the end of September.

The greatest amount of added carbon to the system has been through the 10 t/ha stubble treatments (no extra added in 2011 only grown dry matter) with an accumulated total dry matter input of 52 t/ha at Poochera and 49 t/ha at Minnipa over 4 seasons.

Table 1 Soil organic carbon in 2010 and dry matter, grain yield and quality for Poochera in 2011

Treatments in the first 3 years	Total shoot dry matter accumulated 2008-11** (t/ha)	Organic C (%) 2010 0-10 cm	Early dry matter (g/plant)	Late dry matter (t/ha)	Harvest index (%)	Yield (t/ha)	Protein (%)	Screenings (%)
Barley DM*	18.3	1.5	0.27	5.2	40	2.0	13.5	8.9
Barley & Vetch	12.0	1.5	0.17	4.0	42	1.5	13.5	7.6
Control wheat	15.0	1.5	0.21	4.5	41	1.3	13.5	7.7
Canola*	19.2	1.4	0.30	5.3	42	1.9	13.8	7.2
Wheat DM*	15.9	1.6	0.26	4.2	43	1.9	13.5	7.9
Stubble 5t	30.8	1.5	0.17	4.3	40	1.4	13.5	8.3
Stubble 10t	52.6	1.6	0.18	4.9	38	1.5	13.5	7.9
LSD (P=0.05)	*2.3*	*0.1*	*0.03*	*ns*	*ns*	*0.2*	*ns*	*ns*

** Fluid Fertiliser system, ** includes added chaff*

Table 2 Soil organic carbon in 2010 and dry matter, grain yield and quality for Minnipa in 2011

Treatment	Total shoot dry matter accumulated 2008-11** (t/ha)	Organic C (%) 2010 0-10 cm	Early dry matter (g/plant)	Late dry matter (t/ha)	Harvest index (%)	Yield (t/ha)	Protein (%)	Screenings (%)
Barley DM*	15.9	1.2	0.27	3.7	53	2.5	13.5	8.7
Barley & Vetch	12.0	1.1	0.17	4.1	43	1.9	13.5	8.9
Control wheat	14.2	1.1	0.20	3.7	50	1.9	13.6	9.5
Canola*	15.2	1.1	0.30	3.6	54	2.7	13.7	9.2
Wheat DM*	15.5	1.2	0.26	4.0	50	2.5	13.7	10.5
Stubble 5t	28.7	1.1	0.17	3.4	52	2.0	13.5	10.1
Stubble 10t	49.1	1.3	0.18	3.6	48	2.1	13.5	8.3
LSD (P=0.05)	*2.1*	*0.11*	*0.03*	*ns*	*ns*	*0.1*	*ns*	*ns*

** Fluid Fertiliser system, ** includes added chaff*

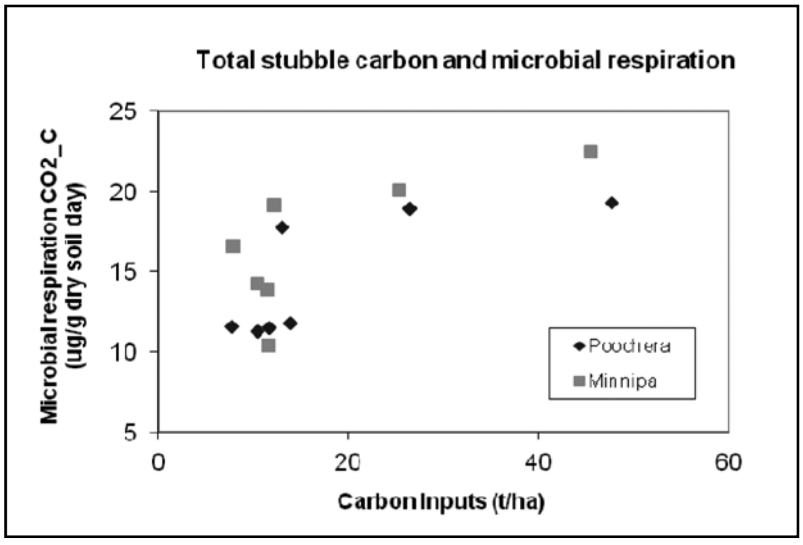

Figure 1 Added carbon inputs (t/ha) and microbial respiration (CO2-C (ug/g dry soil/day) at Poochera and Minnipa sites, 2010

Measurements taken in 2010 showed that added carbon increased soil microbial respiration (Figure 1) but this did not result in increased grain yield for 2011.

What does this mean?

The fluid fertiliser system increased yield and dry matter production at both Poochera and Minnipa for the fourth season in a row. The added carbon treatments have shown increased microbial activity due to the added stubble but this was not enough under standard district practice to support increased grain yields in 2011.

Acknowledgements

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