The impact of livestock on paddock health

Roy Latta and Jessica Crettenden
SARDI, Minnipa Agricultural Centre

RESEARCH

Searching for answers

Location: Minnipa Ag Centre, paddock South 7
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2012 Total: 237 mm
2012 GSR: 180 mm
Yield
Potential: 5.5 t DM/ha (pasture)
Actual: 2.4 t DM/ha (pasture)
Paddock History
2011: Wheat
2010: Medic pasture
2009: Wheat
2008: Wheat
2007: Wheat
Soil Type
Red sandy loam
Soil Test
Organic C%: 1.2
Phosphorus: 23-34 mg/kg
Plot Size
3.5 ha
Yield Limiting Factors
Nil
Livestock
Enterprise type: Self replacing merinos
Stocking rate: Rotational grazing and district practice
Environmental Impacts
Soil Health
Soil structure: Stable
Compaction risk: Plus and minus grazing treatments
Ground cover or plants/m^2: Grazed to 1 t/ha pasture residue
Grazing Pressure: High (1.5 DSE/ winter grazed ha) and medium (0.75 DSE/winter grazed ha)
Water Use
Runoff potential: Low

Key messages

- **As a result of higher regenerating plant numbers the improved annual medic pasture carried double the livestock numbers compared to an unimproved pasture.**
- **There has been no measured change in soil organic carbon over the 5 year project as a result of varying crop and pasture inputs, and grazing or not grazing crop stubbles and pastures.**

Why do the trial?

A trial was established on Minnipa Agricultural Centre in 2008 to test whether soil fertility and health could be improved under a higher input system compared to a lower input and more traditional system. The five year (2008-2012) wheat, wheat, pasture (annual medic), wheat, pasture (annual medic) rotation was also split for plus and minus grazing in both the high and low input systems to establish the impact of grazing between the two treatments.

How was it done?

In 2008 a 14 ha, red sandy loam (pH 7.7, CaCl) portion of a paddock on Minnipa Agricultural Centre was divided into 4 x 3.5 ha sections. Each section represented a system treatment: Traditional - grazed, Traditional – ungrazed, High input – ungrazed and High input - grazed. Four sampling points were selected and marked as permanent sampling points in each section. Data presented for each treatment are a mean of the four selected permanent points in each section. Weed control was imposed on all treatments as required in both summer and during the growing season.

In 2012 the trial was retained as a self regenerating annual medic pasture with no seed or fertiliser inputs. Selective chemical grass control was applied to the medic pasture. See EP Farming Systems Summary 2011 p 113 for 2008 - 2011 crop and pasture inputs.

What happened?

Soil fertility was estimated prior to seeding at five sites surrounding the four selected permanent points in each section. Table 1 presents the 2010, 2011and 2012 phosphorous, total nitrogen and soil organic carbon results.

Colwell P trends show an increase following medic in 2010 across all treatments when 7 kg/ha of P was applied only to the high input treatments, in 2012 levels are similar across treatments following 15 and 8 kg/ha of P applied to the high and low input treatments respectively. 2012 soil analysis figures indicate there was a decline in residual N over the 2011 wheat season following the increased total N contents in response to the 2010 medic pasture. Soil organic carbon levels have been steady to trending higher with no evidence of a separation as a result of grazing or not grazing.

Pasture biomass was collected in 2012 from 5 x 0.1 m^2 quadrats sited at each of the 4 permanent points in each section. Table 2 presents the annual pasture establishment, biomass and seed yield in 2012.

Resource Efficiency
Energy/fuel use: Standard
Greenhouse gas emissions (CO_2,NO_2, Methane): Cropping and livestock
Social Practice
Time (hrs): No extra
Clash with other farming operations: Standard practice
Labour requirements: Livestock may require supplementary feeding and regular checking
Economic
Infrastructure/operating inputs: High input system has higher input costs
Cost of adoption risk: Low

There was less grass, increased biomass production and seed yield in response to the high input treatments with higher annual medic plant numbers. Grazing the medic pastures reduced seed yield and pasture residue that was measured on 7 December as opposed to their comparative ungrazed treatments. Both grazed treatments were stocked between 16 and 20 April, 10 July and 14 August, and 17 September and 5 October, 38 days at 11.25 and 22.5 DSE/ha growing season stocking rates for low and high input treatments respectively. 178 mm of growing season rainfall produced 2.7 t DM/ha in the 2012 improved pasture, which has an estimated water use efficiency (WUE) of 75% of potential, the unimproved pasture produced 1.6 t DM/ha, with 45% WUE.

What does this mean?

In 2012 an improved self-regenerating medic pasture reduced competing annual grass, increased biomass production and carried double the stocking rate, compared to a volunteer self-regenerating medic pasture. Although the stocking rate was quite low there was 1 to 1.5 t DM/ha retained on the grazed plots in early December which suggests there was opportunity for an increased stocking rate over the growing season while retaining adequate groundcover and with no expected loss in soil fertility or condition. The estimated livestock gross margins of $100/ha (2.5 DSE/ha @ $40/DSE) for the high input compares to $50/ha for the low input treatment. Although the high input medic has a 2010 $60/ha establishment cost it is spread over at least 6 pasture seasons, $10/ha/pasture year. The higher $ benefits derived from increased crop yields in response to more nitrogen fixed, better weed competition and root disease control, are forthcoming in 2013 and beyond.

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Table 1 Colwell P (mg/kg 0-10 cm), total mineral nitrogen (kg N/ha 0-60 cm) and soil organic carbon (SOC%, 0-10 cm) in April 2010, 2011and 2012 following wheat, annual medic and wheat respectively

System	Cowell P (mg/kg)			Total mineral nitrogen (kg/ha)			Soil organic carbon (%)		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Traditional - grazed	25	41	34	93	134	64	1.1	1.2	1.3
Traditional - ungrazed	25	29	30	51	99	59	1.0	1.1	1.0
High input - grazed	17	23	23	54	119	72	1.2	1.1	1.2
High input - ungrazed	25	34	30	50	84	60	1.0	1.1	1.2

Table 2 Annual medic establishment (plants/m²) total biomass (t DM/ha) measured in July, August, September and December with and without grazing, and medic seed production (t/ha) in 2012

System	Establishment (plants/m²)	Biomass (t DM/ha)				Seed yield (t/ha)
	Medic (grass)	10 July	14 August	17 Sept	7 Dec	7 Dec
Traditional - grazed	233 (138)	0.2	0.3	1.3	1.0	0.11
Traditional - ungrazed	284 (109)	0.2	0.8	1.6	1.4	0.22
High input - grazed	554 (39)	0.6	0.8	2.3	1.5	0.29
High input - ungrazed	652 (30)	0.5	1.5	2.7	2.4	0.36