The impact of livestock on paddock health

RESEARCH

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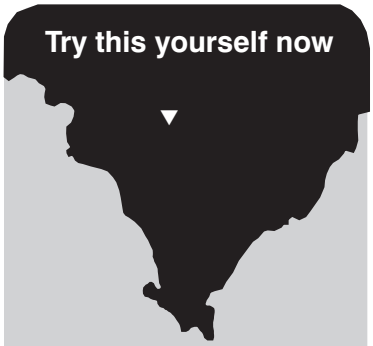

Location:
Minnipa Agricultural Centre paddock S7
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2015 Total: 333 mm
2015 GSR: 258 mm
Yield
Potential: 7.4 t DM/ha (pasture)
Actual: 4.1 t/ DMha
Paddock History
2014: Wheat
2013: Wheat
2012: Medic pasture
Soil Type
Red sandy loam
Soil Test
Organic C%: 1.16
Phosphorus: 20 - 26 mg/kg
Plot Size
3.5 ha
Yield Limiting Factors
Nil
Livestock
Enterprise type: Self-replacing merinos
Stocking rate: Rotational grazing and district practice

Key messages

- **Grazing sheep have not damaged soil health over eight years of several crop/ pasture rotations.**
- **In 2015 total annual biomass was greater in higher input and grazed rotations. High input grazed systems carried twice the stocking rate of a low input system.**

Why do the trial?

Since 2008, a paddock on the Minnipa Agricultural Centre has been studied to determine the impact of a higher input system compared to a more traditional lower input system on overall paddock health.

How was it done?

The paddock history and background to the trial, including results from the last eight years, are described in EPFS Summaries 2008 to 2014.

The eight year rotation studied was wheat, wheat, pasture (volunteer and sown annual medic), wheat, pasture (self-regenerating annual medic), wheat, wheat and finally pasture (self-regenerating annual medic). This rotation was split into four sections, with high and low input systems with grazed and ungrazed treatments to study the influence of sheep in the mixed farming system.

In 2015 the trial was retained as a self-regenerating annual medic, with a fertiliser treatment of 18:20:00 DAP broadcast @ 100 kg/ha to the high input areas on 23 April. Soil water and fertility were measured at four selected permanent points in each section on 4 May and snail numbers and mice holes were counted on the same day. Medic establishment, weed counts and groundcover were also measured on 4 May.

The high input scenario was rotationally grazed with higher stocking rates at 43 DSE/ha on the improved pasture from 19 August for 31 days (1333 DSE grazing days). Warm and dry conditions in late September meant the heavily grazed medic was not able to recover sufficiently for sheep to return to the paddock for a second graze. The low input scenarios with traditional grazing were set-stocked with lower winter stocking rates of 13 DSE/ha for 49 days (637 DSE grazing days) from 19 August to 6 October. Biomass and groundcover were measured pre and post grazing, with pasture cages placed in the grazed treatments to determine intake. Sheep were removed from grazing treatments at anthesis, when groundcover was still considered sufficient to protect the paddock. Grass weeds were sprayed-out of the ungrazed sections on 7 October. No spraying was required on grazed treatments. Soil water for all treatments was measured on 18 December.

What happened?

Table 1 presents the 2013, 2014 and 2015 phosphorous, total nitrogen and soil organic carbon results. There was a decline in mineral N at the beginning of 2015 following two years of wheat, with higher N in the ungrazed treatments, opposing the trend of more N measured in the grazing treatment in the previous two years. Colwell P and soil organic carbon levels have been steady, and generally there have been no notable changes after eight years of the trial.

There was no difference in medic establishment, however grass weed counts were higher in the grazed treatments at this time (averaging 44 versus 26 plants/ m^2 in the grazed and ungrazed treatments respectively), resulting in more groundcover in these sections. Snails and mice at this stage appeared to be higher in the ungrazed treatments.

Medic production increased in response to the higher input and grazed treatments. Biomass at anthesis was higher in ungrazed treatments, however this is just reflective of livestock consumption. Water use efficiency of medic (kg biomass/mm/ha, French Schultz) in 2015 averaged 62 percent of potential pasture growth from 258 mm of growing season rainfall (Table 2).

Table 1 Colwell P (0-10 cm), total mineral nitrogen (0-60 cm) and soil organic carbon (0-10 cm) pre-seeding in 2013, 2014 and 2015 following annual medic (2012), wheat (2013) and wheat (2014) respectively.

System	Colwell P (mg/kg)			Total mineral nitrogen (kg/ha)			Soil organic carbon (%)		
	2013	2014	2015	2013	2014	2015	2013	2014*	2015
Low input - grazed	34	36	26	111	78	24	1.3	1.0	1.2
Low input - ungrazed	27	24	24	84	39	30	1.2	1.0	1.1
High input - grazed	18	16	20	118	85	23	1.2	1.0	1.2
High input - ungrazed	22	18	21	74	54	32	1.1	1.0	1.1

**Please note that soil organic carbon results in the EPFS Summary 2014 were incorrect. Table 1 shows the corrected data.*

Table 2 Medic biomass production and water use efficiency 2015.

System	Biomass at anthesis (t DM/ha)	Total biomass (t DM/ha)	Water use efficiency (% of potential)
Low input - grazed	2.8	5.2	66
Low input - ungrazed	3.7	3.7	65
High input - grazed	3.2	5.7	65
High input - ungrazed	4.1	4.1	54

Sheep intake averaged 2.4 t DM/ha (averaging 3.8 kg DM/DSE/day) in the low input treatment, and the high input treatment averaged 2.6 t DM/ha (averaging 1.9 kg DM/DSE/day) for the period of grazing. This figure does not take into account trampling of pasture, which is usually considered to be 10%. Sheep condition score was measured pre and post grazing, averaging 3.5, with no difference in condition from the start to the end of grazing or between treatments. Sheep were removed at anthesis and when medic residue needed to be retained for groundcover with 3.2 and 2.8 kg DM/ha of biomass remaining in the high and low grazed treatments respectively. Sheep feed intake levels and trampling had no impact on end of season groundcover, with all treatments having over 90% groundcover at anthesis.

What does this mean?

Similar to results in 2012, which was the last phase of medic in the trial rotation; the higher input, improved self-regenerating medic pasture increased biomass production and carried a higher stocking rate. The grazed treatments had greater water use efficiency and produced sufficient feed to sustain sheep condition over the grazing period. The high input grazed treatment supported twice the DSE grazing days of the low input treatment. This greater carrying capacity on the high input treatment was due to higher medic production, which is conceivably the result of the fertiliser input in 2015 and medic sown in 2010. Grazing stimulated the medic to grow, and it was able to respond to timely rainfall events throughout the growing season, which resulted in grazed treatments producing an average of 1.5 t DM/ha more total biomass than ungrazed treatments, and no negative impact on soil health.

The differences in profit margin and other mixed farming systems benefits and detriments between the four systems will be analysed after the 2016 season to summarise this long-term trial through funding provided by the Grain and Graze project.

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