Establishment and growth of legumes in acid soils in the Falkland Islands

By

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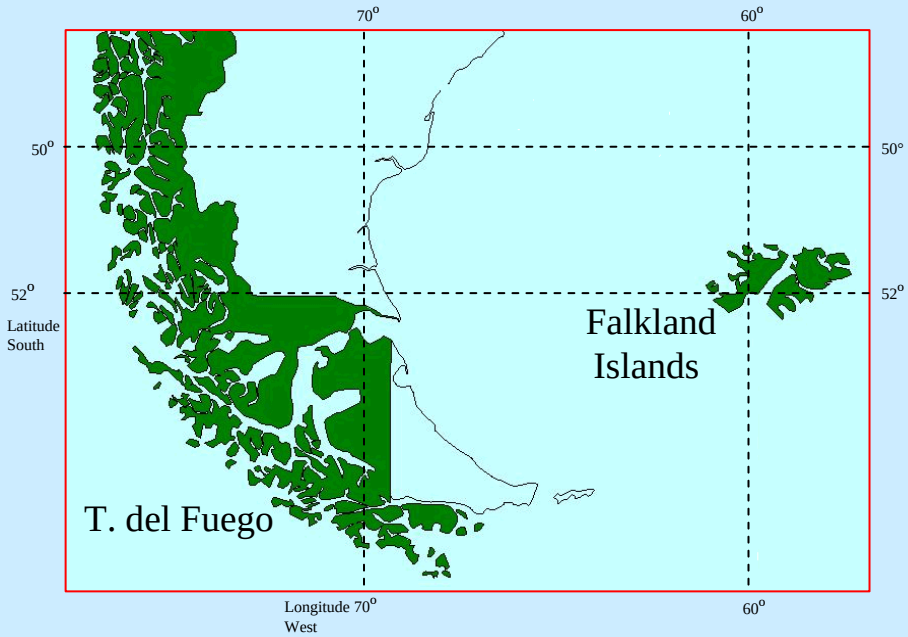
The work is funded by the Falkland Islands Government, the U.K. Falkland Islands Trust, Mecesup Chile and Queen's University Belfast.

Current situation

- Area approximately 1.2 million hectares.
- Sheep production is the principal farming activity.
- Average farm size is 10.000 hectares.
- Soils are acid (pH 4.3 – 5.2), very peaty and low N and P levels.
- Principal vegetation is dwarf shrub heath and tussock – grassland.
  - (Whitegrass; *Cortaderia pilosa*).
- Climate is maritime, cool and windy
  - Rainfall: 600 mm/year; T°: 6,6°C; Wind speed: 13 km/hr.

Overall Aim

To investigate the effect of acid soils on legume establishment, growth and nitrogen fixation in the Falkland Islands.



Calcified Seaweed:
To use this organic fertilizer it is necessary to know:
Particle size distribution, chemical composition & neutralizing strength.

Project Outline

The problem:
Sheep production has a low lambing; high mortality and low lamb weight.

One alternative:
New forage crop with better quality & quantity than grasslands, for extensive production in the Falklands

Legumes:
Good protein; better yield in mixtures; fix nitrogen.

Which legume is adapted to acid soil?
Lotus & some clovers

Problems:
Falkland soils have a low pH; low Ca & P. Also synthetic fertilizer is expensive and is not accepted for organic production.

Another alternative:
To use indigenous and organic calcified seaweed (to raise the pH, Ca & other minerals)

Final goal:
Establish and grow legumes with a good yield and fixing Nitrogen.

To achieved the goal
Use 3 legumes and doses of Calcified seaweed
- *Lotus corniculatus* (Birdsfoot trefoil) var. Leo
- *Trifolium repens* (White clover) var. Gwenda
- *Lotus uliginosus* (Big trefoil) var. Maku

OUTPUT

Overall, this project aims to deliver a package to farmers based on organic methods of legume production and improvement of current sheep performance.

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Sheep Farming in the Falkland Islands

- Low lambing (60%),
- High percentage lamb mortality (10% - 20%),
- Ewe and hogget live weight loss through winter and early spring, increases death rates and reduces productivity of those that survive.

Overall Aim

To investigate the effect of acid soils on legume establishment, growth and nitrogen fixation in the Falkland Islands.

Materials & Methods

Two groups of experiments were conducted,

1. Controlled environment, **a**. Pot experiment. The effect of different doses of Calcified Seaweed (CS) on growth of legumes (*Trifolium repens* var. Gwenda, *Lotus corniculatus* var. Leo and *Lotus uliginosus* var. Maku) was investigated, **b.** Soil incubations with different doses of CS and different particle size distribution (< 0.25 mm and > 2.4 mm) at two different temperatures (11°C x 75 days and 60°C x 4 days) and lime as a control.

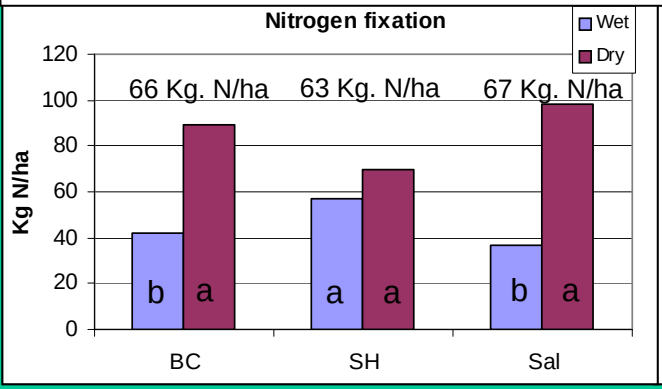
2. Field experiments in the Falkland Islands. At 3 farms grazing exclusion cages were used in established reseeds (dry and wet areas) to measure the yield, chemical composition and nitrogen fixation of the legumes during the growing season (October – February). Data collected was used to measure how much nitrogen is being fixed using 15Nitrogen-isotopic techniques.

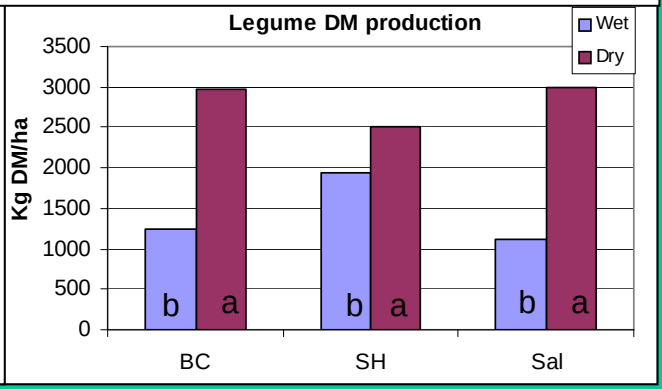
Experiment 1. The effect of CS doses on incubated soils (60°C x 4 days) to Ca (meq/100g); Al (meq/100g) exchangeable and pH in water).

Doses of CS g/kg (tonnes/ha)	Control Lime			Particle size distribution					
				< 0.25 mm			> 2.4 mm		
	Ca	Al	pHwater	Ca	Al	pHwater	Ca	Al	pHwater
0 (0)	1.02d	8.01a	4.41d	1.02e	8.01a	4.41c	1.02d	8.01a	4.41b
0.8 (0.63)	1.42dc	7.34b	4.48d	1.57d	7.69ab	4.43c	1.63c	7.61ab	4.45ab
1.6 (1.26)	1.89c	6.62cB	4.61cB	2.16c	6.87bA	4.53bAB	1.92c	7.24bA	4.48abA
3.2 (2.52)	2.73bA	5.16dC	4.77bB	3.50bB	5.95cB	4.62bAB	2.68bA	6.73bA	4.53aA
6.4 (5.00)	4.65aA	2.77eC	5.08aC	6.21aB	3.94dB	4.88aB	6.04aB	6.26bA	4.52aA

Values with different lower cases in the column are statistically different for doses. Different upper cases in the row are statistically different for particle sizes.

Experiment 2. Nitrogen fixation and dry matter production of legumes swards on each of 3 farms (BC=Bold Cove; SH=Shallow Harbour and Sal=Saladero).





CONCLUSION

From the first years' data, doses of calcified seaweed and particle sizes significantly affected the release of nutrients from incubated soils. Finer CS material had a better reaction with the soil and released nutrients faster than coarse CS. Nitrogen fixation rates in the Falkland Islands range from 63-67 kg N/ha .