Establishment and Growth of Legumes in Acid Soils in the Falkland Islands

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Key words : Calcified seaweed , clover , lotus , nitrogen fixation .

Introduction The main problems with sheep production in the Falkland Islands (FI) are mainly a function of the low quality of native pasture and are ; (a) low ewe live weights reduce ovulation rate and subsequent ewe and lamb survival , (b) lifetime performance of lambs (low lambing percentage-60% , high percentage mortality-10-20% and low lamb birth weights x kg-) , (c) significant ewe live weight loss through winter and early spring , (d) Hogget live weight loss during winter and early spring increases death rates and productivity of those that survive . Forage crops can help improve this situation as they have better quality and , in some cases , quantity of production than native grasslands . Legumes are a good source of feed as they have high protein content , better yield in mixtures and fix Nitrogen . Also FI soils have a low pH , low Ca & P , synthetic fertilizer is expensive and is not compatible with organic production systems . One alternative is to use locally-found Calcified Seaweed (CS- an acceptable organic material to raise the pH , Ca & other minerals) . The overall aim of this work is to investigate the effect of acid soils on legume establishment , growth and nitrogen fixation in the FI .

Materials and methods Two groups of experiments were conducted ,
1 . In a controlled environment at Queen's University Belfast , **a .** In an experiment in pots , 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 .** In soil incubations with different doses of CS and different particle size distribution ($<$ 0 .25 mm and $>$ 2 .4 mm) at two different temperatures (11℃×75 days and 60℃×4 days) and lime as a control .
2 . Field experiments in the FI , at Bold Cove , Hope Cottage , Saladero and Shallow Harbour . At each farm grazing exclusion cages were used in established reseeds 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 ^{15}Nitrogen-isotopic techniques . The soil ^{15}N-enrichment to measure N_2 fixation , have been extensively reviewed (Ledgard and Peoples , 1988 ; Witty et al . , 1988) .

Results and discussion *Trifolium repens*-based swards fixed 60 ; 63 ; 65 ; and 67 kg N/ha , with a range between 31-95 kg N/ha depending on the site during season 1 . At the three lowest doses of CS , Al and pHw were unaffected by particle size , however at the two higher doses of CS Al was reduced , at the higher dose only pHw increased with increasing particle size in an incubation experiment (60℃) . For pH in water the difference between doses of 0 g/kg and 6 .4 g/kg is 0 .47 points ($<$ 0 .25 mm) and 0 .11 points ($>$ 2 .4 mm) in comparison to a control value of 0 .67 . From these results , it would be best to mill the CS to improve the pHw and decrease the exchangeable Aluminium (Al) .

Table 1 *Statistic differences between treatments to Ca (meq/100 g) , Al (meq/100 g) exchangeable and pH in water .*

Doses of CS g/kg (tonnes/ha)	Control			Particle size distribution					
	Lime			$<$ 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 .

Conclusion It can be concluded from the first years' data that 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 31-95 kg N/ha .

Reference

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