Correction of Sulphur Deficiency on Naturalized Pastures of Western Patagonia (Chile)

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Introduction Sulphur has been recognized as a main deficiency in soils in different parts of the world . Its importance is highlighted in legume-dominant pastures and has been extensively used for decades in New Zealand (e .g . Cornforth , 1998) . Soils in western Patagonia are mainly of volcanic ash origin and show widespread sulphur deficiency , as a result of recent colonization during the XX Century (Hepp , 1996) . This paper reports experimental evidence on S use in W . Patagonia .

Materials and methods Results shown correspond to : (a) a survey and analysis of agricultural soils ; (b) Two experiments with randomized block design (RBD) and four replicates , plot area of 12 m^{-2} , located in the Coyhaique area (45°32′28″S ; 72°5′51″ W) , with five levels of P (as triple superphosphate) and five levels of S (as elemental S) in a four-year evaluation period . All plots were managed with 2～3 cuts per season , weighed , dried , and subsampled for botanical composition . Naturalized pastures were initially dominated by *Poa pratensis* , with *Dactylis glomerata* , *Trifolium repens* , *Taraxacum officinale* , *Cerastium spp* , *Acaena pinnatifida* and other minor species . Soils were of volcanic ash origin , with pH of 6 .5 ; 15 and 5 .1 mg kg^{-1} of available P and S , respectively .

Results and discussion Data from the survey indicated that ash soils of the Intermediate Zone of Western Patagonia (rainfall 700～1 ,500 mm) had average pH levels of 5 .8～6 .5 , high cation exchange capacity , negligible aluminium saturation , low-medium levels of available P , high K levels , and extremely low available S levels (normally under 2～3 mg/kg) . P and S responses are likely under these conditions .

Table 1 shows that there are significant effects on pasture production when P is applied in combination with S . These effects are apparent from the second year on . If S is not applied , even with very high P fertilization , pasture production does not respond (S-0 level) . Levels of S as low as 15 kg ha^{-1} induce 4-7-fold DM production increments .

Table 1 *Effects of repeated P and S fertilization (four years) on naturalized pastures of the Intermediate Zone of western Patagonia . Pasture dry matter production (DM : t/ha) and white clover abundance (% in DM) .*

kg P ha^{-1}	*Year1*		*Year2*		*Year3*		*Year4*		*kg S ha^{-1}*	*Year1*		*Year2*		*Year3*		*Year4*	
*	DM	%	DM	%	DM	%	DM	%	**	DM	%	DM	%	DM	%	DM	%
0	0 .53 a	4 .2	1 .56 e	8 .0	2 .82 d	48 .9	3 .16 d	45 .8	*0*	0 .51 a	8 .0	1 .15 c	14 .9	0 .62 c	31 .8	0 .48 d	5 .8
8 .7	0 .49 a	6 .1	3 .19 d	26 .0	4 .43 c	60 .4	4 .31 c	44 .6	*15*	0 .58 a	6 .0	4 .09 b	47 .1	4 .25 b	76 .0	3 .30 c	47 .9
17 .5	0 .55 a	0 .0	4 .02 c	22 .0	4 .65 bc	68 .9	4 .64 b	51 .6	*30*	0 .49 a	4 .1	4 .83 a	38 .0	5 .84 a	77 .0	5 .84 b	60 .9
34 .9	0 .51 a	7 .0	5 .45 b	59 .8	5 .01 b	74 .4	4 .45 b	51 .9	*45*	0 .52 a	5 .4	5 .11 a	21 .8	5 .66 a	62 .1	6 .56 a	49 .4
69 .9	0 .51 a	4 .1	6 .27 a	38 .0	5 .81 a	71 .6	5 .66 a	60 .9	*60*	0 .50 a	7 .4	5 .30 a	46 .5	6 .08 a	71 .6	6 .05 ab	44 .2

Significant differences between means within columns ($p<0.05$) . Base fertilization : * 60 kg S ha^{-1} ; ** 70 kg P ha^{-1} .

From the second season on , a change in botanical composition was observed , with a strong white clover increase in the sward , boosted by P in the presence of S fertilization .

Degraded naturalized pastures of this area may therefore be recovered with soil P-S correction . Moderate levels of fertilization produce very significant increments in DM production (from 500 to over 5 ,000 kg DM ha^{-1}) . There is also a pasture composition/quality change , with a strong legume increase , which is likely to have positive effects on animal production responses . However , after four years , there was a decline in pH levels (5 .9) in soils of high P-S treatments .

Conclusions In western Patagonia , sulphur is a main primary component in soil fertilization programmes . There is a P-S interaction , indicating that P response is subjected to sufficient available S levels in soils . White clover abundance seems to be directly correlated with the correction of S levels in these soils . Effects on soil acidification have to be monitored .

Reference

Cornforth , I . 1998 . Practical Soil Management . Lincoln University Press . Lincoln University , Canterbury , New Zealand . 248 pp .