Topdressing Pasture With Salt (NaCl)

The following is a reproduction of data contained in a paper published in the proceedings of the New Zealand Grasslands Association 50: 83-87 (1989).

INTRODUCTION

The importance of salt (NaCl) in the diet of grazing animals has been recognised for many years. Reference to the use of salt for cattle can be found as early as 150BC. A response in milk production of dairy cattle given a salt supplement was shown by Babcock (1905) (2). Later work (Aines & Smith, 1957) (1) showed sodium rather than chloride to be the cause of the milk production response.

Direct supplementation of salt to animals is probably the most effective method of correcting a deficiency but the use of salt as a fertilizer is an alternative method. It relies on being able to increase sodium concentration in the leaves of pasture plants. Estimates of adequate and deficient sodium concentrations in mixed pasture for animals is shown in Table 1 (Towers & Smith, 1983) (6).

TABLE 1: Estimates of herbage Na concentrations required for stock health.

	%Na	
	Adequate	**Deficient**
Lambs	0.07	0.04
Ewes (Lactating)	0.09	0.05
Cattle	0.10	0.06
Dairy Cows (Lactating)	0.12	0.09

In September 1987 three fields were commenced in the Waikato to determine rates of NaCl required to raise Na concentrations in pasture, the length of time required to do this and how long the effect lasted and the influence of added K on the increase in Na concentration. The result of the first 30 weeks of the study are reported in this paper.

METHODS

Three trial sites were chosen on the basis of low pasture Na status (<0.10% Na). All were on dairying pastures and included a yellow brown pumice soil 10km south of Putaruru (Site 1); a yellow brown loam 4km west of Tirau (Site 2) and a peat soil 8km south-west of Cambridge (Site 3).

The trials consisted of five rates of NaCl O, 50, 100, 200 and 400 kg/ha and two rates of KCl O and 140 kg/ha in a split-plot design with rates of KCl as main treatments and rates of NaCl as sub-treatments. Plot size was 5 x 2 metres. Trials were commenced in September 1987. All trials were operated under a 'mowing and clippings return' technique with approximately 35% of the clippings returned to each plot.

Measurements included pasture dry matter determinations on eight cuts September 1987 to March 1988, % K and Na determinations on pasture samples taken at 0, 6, 12, 20 and 30 weeks. MAF Soil Quick Tests (0-8cm) soil samples taken at similar intervals together with deep soil samplings (8-15 and 16-30cm) on the control and 400 NaCl, 140 KCl treatments only.

Rainfall was measured at each site and Na concentrations determined.

RESULTS

Pasture Production

Pasture production measured over 30 weeks totaled 10.3t/ha dry matter at Site 1, 8.9t/ha at Site 2 and 8.0t/ha at Site 3. NaCl had no effect on pasture production at Sites 1 and 2 but for the first four months on Site 3 pasture production was depressed. Pasture burning was not evident.

Sodium in the Pasture

% Na in pasture increased o n all sites following NaCl application to reach a peak after six weeks (Table 2). Thereafter % Na gradually declined on sites 1 and 3 but remained remarkably constant on site 2 (yellow brown loam) up to 30 weeks after application. There was a strong linear relationship on all sites between % Na in the pasture and rate of NaCl (= 0.99).

On sites 1 and 3 100 kg/ha NaCl increased Na in pasture above 0.2% Na; on site 3 200 kg/ha was required to achieve a similar increase (Table 2).

TABLE 2 : Effect of applied NaCl on % Na in Pastures.

Kg NaCl/ha	**50**			**100**			**200**			**400**		
Soil Group	**YBP**	**YBL**	**PEAT**	**YBP**	**YBL**	**PEAT**	**YBP**	**YBL**	**PEAT**	**YBP**	**YBL**	**PEAT**
At start (Sept. 87)	.07	.12	.06	.07	.12	.06	.07	.12	.06	.07	.12	
6 weeks (Oct.)	.15	.21	.12	.23	.22	.14	.24	.27	.23	.34	.39	
30 weeks (March 88)	.11	.17	.13	.15	.23	.17	.16	.31	.16	.21	.34	

Sodium in the Soil

Applying NaCl increased soil Na (0-8cm) on all sites and, as with % Na in the pasture, reached a peak six weeks after application and gradually declined thereafter (Table 3). After 30 weeks however, soil Na levels were still approximately twice the original values. Again there was a strong relations between soil Na and rate of NaCl applied. Depth sampling on the 400 NaCl/140 KCl indicated definite movement (leaching) of Na through the profile (Table 4).

TABLE 3: Effect of applied NaCl on Soil Na*.

Kg NaCl/ha	50			100			200			400		
Soil Group	YBP	YBL	PEAT	YBP	YBL	PEAT	YBP	YBL	PEAT	YBP	YBL	PEAT
At start (Sept. 87)	5	5	8	5	5	8	5	5	8	5	5	8
6 weeks (Oct.)	8	9	17	15	12	22	16	16	27	24	24	40
30 weeks (March 88)	7	7	14	8	8	18	9	9	22	13	12	32

*MAF Quick Test analysis

Effect of NaCl Plus KCl Application on Sodium in the Pasture

Initial soil K tests were medium-high in all sites (range 6-12) and plant K levels high to very high (range 3.6-4.3 % K). Such levels are typical of many Waikato (and North Island) dairy farms. The addition of KCl (140 kg/ha) with NaCl in these situations had only minimal effect on pant Na reducing it by 10-15% compared with no KCl addition. Other evidence suggests the additions of KCl will have a more detrimental effect on Na status where initial K is lower (McNaught & Karlovsky, 1969) (4).

Recovery of Applied Sodium

The proportion of applied Na in soil and pasture (after 30 weeks) was 40% on site 1, 64% on site 2 and 71% on site 3. If allowance is made for Na additions from rainfall (15-25 kg Na) these figures are reduced to 21, 36 and 62% respectively. Actual recovery in the pasture was 14%, 19% and 9% respectively. Such figures do not differ greatly from other applied nutrients, for example MgO (O'Connor et al, 1981) (5).

Fluctuations in % Na in Pasture

% Na in the pasture on the control (= no NaCl) plots fluctuated widely over the 300 week sampling period (Table 4). Some of the variation could be seasonal, other sample contamination (eg. Salt on hands and equipment) and other laboratory error, again possibly contamination. The data suggests a 40-100% fluctuation in pasture % Na is possible in trial situations. It is likely that paddock sampling for advisory purposes will give even greater fluctuations in % Na values in the pasture.

TABLE 4: Fluctuation in % Na on control (= no NaCl) plots over 30 weeks.

Soil Group Date	YBP	YBL % Na	PEAT
02/09/87	.10	.14	.06
13/10/87	.12	.18	.09
24/11/87	.09	.11	.07
14/01/88	.13	.13	.11
29/03/88	.13	.21	.12

DISCUSSION

Field trial results suggest NaCl applied to pasture will rapidly increase % Na in the pasture to reach a peak some six weeks after application. The response lasts for at least 30 weeks but at a diminishing level. Even so, % Na at say the 100 kg/ha NaCl rate after 30 weeks was still well above the stock deficiency range and some two to three times the initial sodium status (Table 2).

This leads to the conclusion that an annual top dressing of NaCl at 100 kg/ha will provide adequate Na status in the pasture for animal health on a range of Waikato soils. On some soil groups (yellow brown loam) the annual rate may be as low as 50 kg/ha.

In practice salt can be applied directly to pasture or mixed in with phosphatic fertilizers. Where pasture potassium levels are already high (most dairy pastures) some substitution of NaCl for KCl in the fertilizer mixture could occur. For example, a 30% potash super phosphate could become a 20% salt 10% potash super phosphate.

Present results suggest that uptake of Na in pastures already high in K is only marginally affected by added K in fertilizer.

On pastures which are lower in K (many sheep/beef pastures) adding KCl with NaCl could adversely affect Na uptake (McNaught & Karlovsky, 1964) (4). In such cases a salt only or salt/phosphate fertilizer is recommended. Monitoring by soil and pasture analysis should be done on an annual basis.

These trials confirm that Na in pasture can be increased by salt applications.

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SUMMARY OF MAIN POINTS

1. **MAFTech pasture trials with Sodium (Na) topdressing confirm rapid pasture uptake.**
2. **The reponses lasted at least 30 weeks at 2 to 3 ties initial Na status.**
3. **Annual topdresing with 100 kg/ha salt (NaCl) will provide adequate Na for animal health on Waikato (and other) pastures.**
4. **On some soils the annual rate may be lower at 50 kg/ha.**
5. **Where pasture potassium (KCl) levels are high, substitution of NaCl for KCl in fertilizer can occur.**
6. **Monitoring by soil and plant analysis should be done every year.**

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