Boron in the Pasture

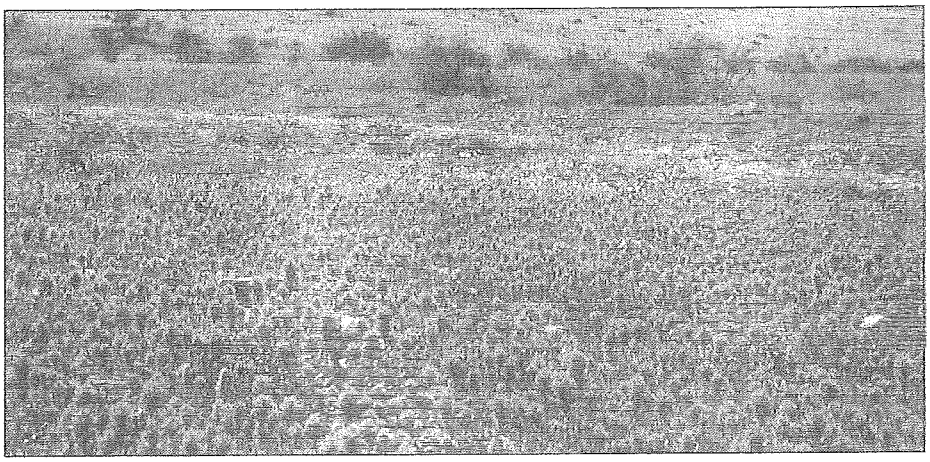
by Vaughan Jones

Some believe that boron is not deficient in any part of New Zealand or the United States, but pasture analyses frequently reveal severe deficiencies. Boron (B) and calcium (Ca) are synergistic (work together) — B is a catalyst for the pasture uptake of Ca. Hill Laboratories in Hamilton, New Zealand, checked 200 pasture tissue figures they had done and found that without fail, where B was adequate, Ca was higher, but where B was low, Ca was also low. There was not one of the 200 that had adequate B and low Ca.

B levels in New Zealand pastures vary between 4 and 16 ppm, when they should be 22 ppm. In North America, many samples I have seen have been as low as 2 ppm, and not just in isolated areas. A Vancouver Island grazing dairy farm client had many samples with only 2 ppm, and right across the United States, even to Jamaica, many levels were only about 3 ppm. Many other countries also have extremely low levels — and they wonder why they can't grow clover. It is strange that most lucerne (alfalfa) growers know that they have to apply B to avoid failures, but many pasture farmers trying to grow clover, another legume, do nothing about it, even after they can't get clover to thrive. They blame their climate, but a farmer's job is to soften the bad effects of our climate.

The application of agricultural lime on its own can create even lower boron levels in plants, and if B is lacking, applying lime (without B) may not raise calcium levels much in pastures. Some researchers use this to justify their belief that calcium is not required, sometimes based on having adequate pH levels.

Not enough attention is given to this very important element, which is sometimes required in amounts as little as one kilogram/hectare (one pound/acre) of actual elemental B. When it and calcium are deficient, soil, pasture and animal health suffer, especially on dairy farms where the animal loses B in lactation. Considerable research has been done on B use in some countries, but not always in conjunction with correcting calcium levels, and without observing animal health improvements in deficient areas. Some farmers, after fertilizing with B, report improved clover growth and animal health with fewer bone problems, but many researchers call it "anecdotal" and ignore it. Boron was identified as an essential nutrient in 1920, but some in the "establishment" still seem unable or unwilling to recognize its benefits or to acknowledge that there can be deficiencies.



TRIAL RESULTS

New Zealand AgResearch did a comparative trial on a mineral soil in the Waikato, where farmers were claiming benefits from applying B. AgResearch didn't believe it and reported that their trial figures proved no benefit.

I managed to obtain their trial figures, and I disagree that they demonstrate no benefit — the response was 9 percent extra pasture dry matter growth, most of which would have been from clover. Adequate lime and the use of a slow-release B could have given a higher pasture response. However, even 9 percent of 16,000 kilograms/hectare (14,000 pounds/acre) of pasture, which can produce 1,000 kilograms of milk solids per hectare at $6.90/kilogram of milk solids or NZ 55 cents per liter (US 42 cents), is worth NZ$540/hectare (US$420) minus the cost of the B at NZ$20/hectare (US$18/acre). Had AgResearch done their trials on peat or pumice, the responses would have been higher, and if only they had used increased income as their criterion, they would have had to admit

that the farmers were right — again. I've been encouraging our researchers since 1960 to use "extra net dollars earned" in their analyses, not just "extra dry matter grown." Some started doing so in the 1990s. Some still don't.

Pasture can remove 100 grams/hectare (1.4 oz/acre) of B per annum. Some soils can replace this naturally, while others (almost all North American soils, for example) need regular applications. Trials I did showed that, after applying 10 kilograms/hectare (9 pounds/acre) of Ulexite (slow-release fertilizer boron that contains 11 percent B) to deficient consolidated peat soils, clover yields doubled and pasture drought tolerance improved. New Zealand trials have shown that clover frost damage is lessened when B is applied to soils growing clover, apples, grapes, eucalyptus and *Pinus radiata* (Monterey pine) trees. It stops radiata getting "brown top." In some soil types and areas, disease and fungal resistance in plants have improved. Do your own comparative trial, and compare clover damage after prolonged frosts and yields in droughts. Analyze your pasture and never apply more than 20 kilograms/hectare (18 pounds/acre) of B product, preferably Ulexite, per annum. Aim for no more than 22 ppm of B in pasture tissue.

B differs from trace elements in that it is not a metal, however it is important in aiding the uptake of moisture, sugars and cations, especially calcium.

Alfalfa, clover, corn and brassicas show marked improvement when B is applied to deficient soils — in fact, some of these plants can fail without it. Ten kilograms/hectare (9 pounds/acre) of a boron product can increase the yield of corn grain in B-deficient soils, while 20 kilograms (18 pounds/acre) on the same soil can decrease yields and thus avoid excesses.

B slows excess moisture uptake by plants, thus reducing the "thin soup" sappy pasture problem that causes scours. B hastens maturity, which encourages the clover to flower, and some farmers say that you get less bloat when clover is flowering. After applying B to a deficient paddock, clover leaves increased in size dramatically, and after a year the farmer noticed fewer weeds, because clover grew better and covered the bare patches. Applying as little as 8 kilograms/hectare (7 pounds/acre) of agricultural borax to deficient soils in Eastern Waikato made the latest clover species (Grasslands Kopu II and Grasslands Tahora) grow leaves and stems four times bigger than previously in soils with adequate calcium. The new higher-producing, more vigorous clovers are more likely to respond than old (New Zealand white and Huia) low-producing clovers.

B also helps pasture take up sugars (energy), calcium and magnesium, and helps keep pasture potassium levels down. High potassium levels in pastures are a serious problem in New Zealand because the establishment and even private laboratory optimum levels here are too high. Some AgResearch scientists have admitted this, but do nothing about making changes for fear of "rocking the boat," so nothing happens. The owner of a private laboratory agreed with me, but didn't want to be different from AgResearch.

The U.K. clover pasture tissue figures in the accompanying box confirm the synergistic benefits of boron applications.

Clover Tissue Mineral Content

	B	K	Ca	Mg
No Boron Applied	11 ppm	2.1 percent	0.7 percent	0.4 percent
	B	K	Ca	Mg
Boron Applied	50 ppm	1.6 percent	1.1 percent	0.7 percent

These changes in levels after applying B are generally beneficial to livestock health, but B should not be as high as 50 ppm.