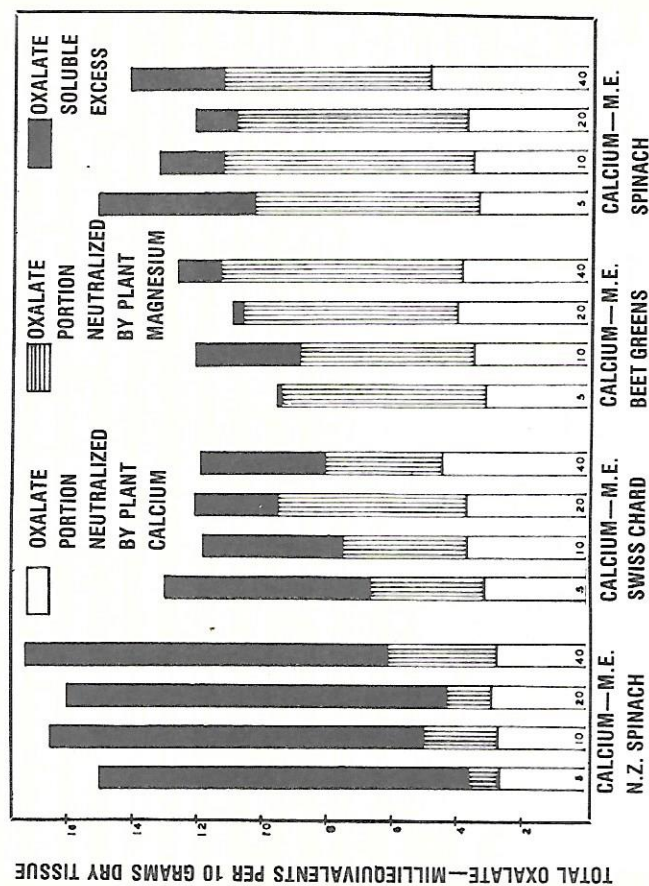


be occupied by hydrogen (a non-nutrient from the soil) which comes in to replace these other cations as the soils become highly developed or more acid and less productive. In terms, then, of the amount needed in the soil in active form, calcium stands at the head of the list. It is the premier of the cationic crowd of elements for the nutrition of healthy plants and animals.

In terms of the amounts in the animal body, calcium is also at the top of the list of essential ash elements coming from the soil. It is located mainly in the animal skeleton. But it is functioning there in more ways than just as so much skeletal reinforcing in a mass of soft tissue. Calcium is highly mobile into, and out of, that bone reserve of itself in combination with phosphate. That mobility is unique. Since calcium is divalent and not so soluble, while phosphorus is trivalent and also combined into many even less soluble compounds, these two take hydrogen, or acidity, into their combination, but thereby bring about more solubility and higher activities of themselves. This



The probable disposition of oxalate in some vegetable "greens," grown on soils with variable tests of calcium, indicates the excess of oxalate (black sections) beyond that needed to make the calcium (white section) and magnesium (ruled section) insoluble and indigestible. It indicates the deception in measuring ash calcium for its nutritional value.

ly when some processes are disturbed, which would result in shock.

Milk fever suggests that the shifts of stored calcium into the larger, active supply for milk production after calving are too slow or are disrupted, or that this element is involved in disturbed body processes about which we know all too little to prevent this trouble. In this situation, which follows usually so close to parturition though possibly at other times, we appreciate the premier role of calcium (supplemented by other nutrient elements) especially when the organic combination of it as a gluconate does so much so quickly in literally resuscitating a cow, or in snatching her from death by milk fever.

CALCIUM EFFICIENCY IN PLANT AND ANIMAL NUTRITION IS IMPROVED BY THE PRESENCE OF SOME ACIDITY OR ACTIVE HYDROGEN

It is significant to note that both calcium and phosphorus in chemical combination with different degrees of acidity, hydrogen, are essential compounds in the animal body. It is a fact that some acidity or hydrogen in the soil is important also in the nutrition and physiology of the plants, especially legumes. When hydrogen is completely removed from the soil and when a surplus of calcium carbonate, or limestone, is maintained to prohibit any acidity, then there prevails a condition highly disturbing to the nutrition of better forages. Liming the soil is not a case of "Where a little is good, more will be better." More may be more damaging to animal health via the crops than we yet recognize as damage to them. Some cases of dwarfism in cattle have suggested their relation to such soil conditions.

Experimental studies of growing crops by using carefully controlled clays for nourishing them have shown that the legumes must have that clay's exchange capacity saturated highly (75 to 85%) by calcium to have them grow by fixing their own nitrogen from the atmosphere. By similar experiments it was shown that when some acidity, hydrogen, is also present or accompanies this large supply of calcium, this premier element is moved into the plant to a higher degree, or more efficiently, from the soil's available supply. This efficiency is higher than when the calcium is accompanied by other elements (barium for instance) to the degree of excluding the acidity, or hydrogen, completely. Therefore, some acidity in the soil is good company for the calcium if this and other nutrients are to be taken from the soil most efficiently for plant growth.

This increased mobilization and exchange of the nutrients into the plant, by means of the active hydrogen originating around the root from its excreted respiratory waste of carbon dioxide, is nature's way of getting the most plant