

LIME AND LIMING*

THERE is becoming apparent amongst the farming community a growing appreciation of the uses and value of lime. Mainly because of high costs incidental to delivery on the farm, its use in Tasmanian agriculture has not, in the past, been extensive. Recent developments should, however, ensure that adequate supplies will in future be available at more advantageous prices. The results of experimental work, moreover, points to the practicability of smaller and more frequent applications compared with the larger occasional dressings formerly used. The immediate outlay necessary to secure economic results may thus be reduced appreciably.

Liming trials have been carried out by the Department of Agriculture in various parts of the Island for some years. These have yielded much valuable information, but the data in regard to certain problems are as yet incomplete and further trials are required for their elucidation.

Dressings of lime down to comparatively small amounts have yielded outstanding results on the North-West Coast, particularly in the Ulverstone district. Generally, a greater number of useful pasture plants per square yard and greatly increased plant vigour was obtained. Even where these results were less marked, the efficacy of lime was apparent over extensive areas.

Positive responses to lime have also been obtained on a number of widely differing soil types in the north-east of the State. In a series of trials on second-class soil of granitic origin in the Springfield district, where pasture was limed in strips, a marked increase in growth was observed. This was accompanied by a higher proportion of clover plants and a noticeable improvement in the colour of the herbage. Although the whole of the area had previously been topdressed annually with fertiliser, stock concentrated on the limed strips, grazing them out before the unlimed portions, for which they showed considerably less relish.

A similar grazing circumstance was noted in the Branxholm district on first-class basaltic land. Sheep grazed on a lucerne paddock which had been used previously as a liming-demonstration area, so concentrated on the small limed portions that the plants were literally eaten into the ground and damaged by over grazing. The unlimed portions of the paddock were grazed only moderately and suffered no ill-effects.

Applications of lime to certain refractory ironstone soils of the North Midlands have resulted in greatly increased vigour, healthier colour and improved palatability of pastures, especially those consisting of Subterranean Clover.

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The improvement in both the quality and quantity of pasture produced following liming has been fully demonstrated in these and many other trials, thus indicating that the use of lime could be exploited to a greater extent to improve production.

ACTION OF LIME ON THE SOIL

The physical, chemical and biological conditions of the soil, all of which have a profoundly important bearing on plant growth, are intimately associated with the function of lime.

In clay soils it binds the minute soil particles into small grains or crumbs. This renders the soil more open, more friable and better aerated; further, it promotes the penetration of rain and plant roots and the earlier working of the land after rain. In light, drift sands, a similar cohesive effect of lime causes the soil to be less "drifty" better suited for cultivation and of improved moisture-holding capacity.

Lime is an alkaline substance which attacks and neutralises acid compounds in the soil. This "sweetening" action plays an important part in controlling the solubility and resultant availability of plant foods and in maintaining their availability. The action of quicklime, which is a strongly active water-soluble alkali, is far more rapid in the early stages than carbonate of lime (ground rock limestone), which is only faintly alkaline and quite insoluble in water, though soluble in some organic acids found in the soil.

The degree of soil acidity influences the activity of certain bacterial soil organisms whose presence is necessary to the breaking down into soluble compounds of the plant and animal residues and wastes which have been absorbed into the soil. Where lime exists in reasonable quantities these are decomposed and incorporated into the soil as "humus". These humic compounds are rich in nitrogen, but the presence of lime is necessary to promote "nitrification", the process through which nitrogen is converted into a readily assimilated plant food in the form of nitrates.

The presence of lime has a marked effect on the development of bacterial nodules on the roots of legumes. This development in its turn has a direct bearing on the quantity of nitrogen extracted from the soil-air and converted into available plant food. Where legumes are growing in lime-deficient soils, nodule growth is restricted and in some cases non-existent.

The biological effect of lime is largely interlocked with the chemical and physical effects. It is concerned mainly with the activity of soil bacteria. In addition, the improvement in aeration, drainage, and the physical condition of the soil decreases the incidence of certain soil-borne fungi harmful to plant life.

LIME ANALYSIS AND DISTRIBUTION OF LIMING COST

Chemical analysis is not infallibly indicative of the lime requirements of a soil. It may be employed to determine the degree of acidity or alkalinity, but not the form or availability of any lime present. Analysis may reveal that a large quantity of lime is necessary to obtain a condition of actual neutrality. This need not necessarily, however, be achieved immediately, by applying all the lime required at one application. It will usually be found effective and will spread the cost over a long period, to distribute the amount of annual dressings over several seasons.

SYMPTOMS OF LIME DEFICIENCY

Visual evidences which suggest a lime shortage in grassland are the accumulation of a skin of decayed vegetable matter on the surface, a wiry type of grass-growth, and clovers exhibiting a pale, unhealthy colour, or even completely absent. In arable land a deficiency might be expressed by crops "going off" in patches and having little resistance to drought, disease and insect attack.

COMMERCIAL TYPES OF LIME

The main sources of lime in Tasmania are the limestone rock deposits, though in some districts limestone marls and seashell deposits may be of local importance.

Lime is available for agricultural purposes in two main forms—Oxide and Carbonate. Oxide of lime (quicklime) is obtained by burning limestone and grinding it to a fine powder. Commercially it is known as "ground burnt" lime. Carbonate of lime is simply crude limestone rock, finely ground. Though the burnt lime is at first more active in the soil than carbonate of lime, it quickly absorbs moisture to form "slaked" lime. Later it reverts to the carbonate form.

Some diversity of opinion exists as to the better form of lime for agricultural use. The majority of trials have shown that either is equally effective, though the effects of ground limestone may be somewhat slower in becoming manifest. On the other hand, burnt lime is particularly unpleasant to handle and quickly burns through any bags in which it is stored. The most important consideration is that of monetary value, and the most practical guide is a comparison of purchasing and transport costs, based on actual lime content. In comparing values, 56 lb. of pure oxide of lime may be considered as equivalent to 100 lb. pure carbonate.

METHOD OF APPLICATION

Numerous methods are employed of applying lime to the soil. These range from simple hand broadcasting to the use of machinery especially designed for the work. These machines are expensive and usually beyond the economic capacity of most Tasmanian farms. Generally, therefore, spreading is done by means of the small rotary fertiliser-spreader or the seed-drill, or broadcast by hand.

TIME OF APPLICATION

Trials have indicated that the best results are obtained when lime is applied to a fallow. It tends naturally to work downwards through the soil, and should not, therefore, be applied before ploughing but distributed over a ploughed surface and incorporated in the soil by subsequent cultivation.

The top dressing of pasture with lime can be undertaken at any time, but the best results may reasonably be expected from late summer or early autumn applications which are readily washed into the soil by the late autumn and winter rains.

The near-neutral and less active ground limestone may be applied at almost any time without risk to the plant. The strongly alkaline burnt lime is liable to burn the leaves or even to kill the plant if applied to growing crops. The

application should therefore be made not less than two weeks prior to seeding, and preferably earlier. It is desirable, though not essential, that rain should fall following the application and prior to seeding. As may be expected, the heavier the quantity applied, the greater the burning action, and, conversely, when lighter dressings are used and the distribution is reasonably even, the risk of damage is extremely slight.

• Lime will combine chemically with superphosphate, causing a reversion of the phosphate into an insoluble form. Accordingly, lime should not be mixed with super or sown at the same time. An interval of three weeks at least should elapse between their application.

RATE OF APPLICATION

The application of lime in some form has been practised for many centuries in some countries, the practice generally being to apply large quantities once or perhaps twice in the lifetime of the landowner. As the result of increased knowledge, the modern trend is to reduce the amount used at each dressing but to increase the frequency of application, so that in the aggregate a like amount will be applied over a period.

The presence of lime stimulates the conversion of soil organic matter into a soluble form (humus) which may readily be lost. Lighter dressings are therefore to be preferred, preferably interspersed with green manuring or combined with cropping programme designed to increase the organic content of the soil. The amount of lime required will obviously vary according to the type and condition of any particular soil. As a standard dressing, however, it is recommended that 5 to 10 cwt. per acre of ground burnt lime be applied, or 10 to 20 cwt. per acre of ground limestone.

CONCLUSION

There is little doubt that the majority of Tasmanian soils are lime deficient to a greater or lesser extent. The shortage is liable to affect adversely the quality and yield of crops and pastures and to be a significant factor in animal health troubles. Without possessing a greater knowledge of the requirements of their own particular soils, many farmers may hesitate to embark on any considerable outlay for lime. It is therefore, suggested that small trial areas be limed and any improvement noted, particularly in growth-vigour and palatability. This would provide a practical basis for any subsequent decision with regard to a general liming programme.