Agricultural Value of Burnt Lime

BURNT lime is made in New Zealand principally for preparing lime mortar and as an industrial chemical. Ground burnt lime sold for agricultural purposes is in many instances a second-grade product and its liming value is often no better than that of ground limestone. D. F. Waters, Senior Agricultural Chemist, Rukuhia Soil Research Station, Department of Agriculture, Hamilton, here gives the reasons for the poor quality of burnt lime and describes the differences in the various forms of lime.

THE value of lime in agriculture is widely appreciated, but not all farmers are aware of the essential differences between the forms of lime available from merchants. For soil treatment lime may be broadly defined as a compound of the element calcium which will reduce soil acidity. Many other chemicals would neutralise acidity, but the value of lime lies in its wide occurrence, its cheapness, and most of all in the fact that calcium is necessary in the soil as a plant nutrient. In applying lime the farmer is adding calcium as well as correcting soil acidity. The common forms of lime which have these properties are:—

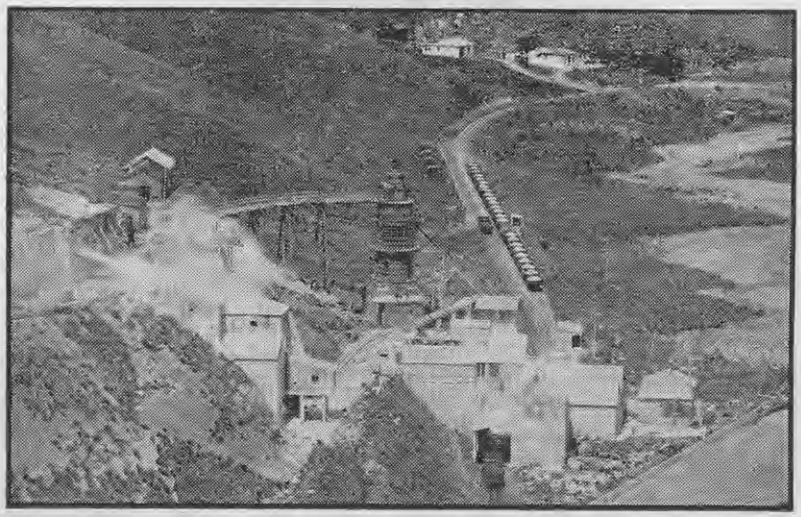
Limestone (calcium carbonate), which occurs naturally and is ground and sold as agricultural lime;

Burnt lime (calcium oxide), produced by burning limestone and sold under various names such as burnt lime, quicklime, burnt shell lime, and Roche lime;

Slaked lime (calcium hydroxide), produced by the addition of water to burnt lime, and sold as hydrated or builders' lime.

Burning

When limestone is to be burnt a mixture of coal and limestone rock fragments is loaded into the top of a vertical kiln. As the charge slowly sinks it burns about half-way down and the heat produced breaks up the calcium carbonate into calcium oxide and carbon dioxide, which is carried away in the flue gases. Burnt stone is removed from an opening in the bottom of the kiln at such a rate that passage of the charge through the kiln takes from 2 to 4 days. Unless a modern kiln is used, the burnt stone will not be of the uniformly high grade which commands a good price for industrial purposes. Accordingly the stone is picked over by an experienced operator who selects the lighter, well-burnt stone to be packed for industry. The heavier pieces will consist of unburnt and partly burnt stone with hard-burnt stone. The last-named is stone which has been subjected to excessive heat and changed to a dense, partly fused rock which will not slake readily. These rejected pieces with smaller fragments of burnt stone are ground and bagged as agricultural burnt lime.



Limeworks with kiln at Dunback, Otago.

Agricultural Use

When burnt lime is slaked by the addition of a small amount of water or by exposure to damp air, each lump swells, heats considerably, and falls away to a fine powder of slaked lime or calcium hydroxide. The whole process of burning followed by slaking was for centuries the most common method of reducing limestone to a fine condition for application to the soil. The extreme fineness of slaked lime permits thorough incorporation with the soil and as it is alkaline, it immediately neutralises soil acidity. Carbonate of lime and burnt lime have the same action in the soil; in fact burnt lime slakes and becomes carbonate rapidly. The advantage of burnt lime for agricultural purposes should be its high content of calcium oxide.

The difference between burnt and unburnt lime can be illustrated by taking two 100lb. samples of limestone, each containing 100 per cent. of carbonate, and burning one sample perfectly. The burning drives off the carbon dioxide and reduces the weight of the sample by about 44lb., though the bulk remains about the same. The residue of burnt lime, weighing about 56lb., has the same acidity-neutralising power as the 100lb. of unburnt lime. In theory it should therefore be possible to effect about 44 per cent. savings in freight and spreading costs by using burnt lime instead of crushed carbonate. Actually, however, most of the ground burnt lime sold for agricultural purposes originally contains considerably less than 100 per cent. of carbonate and is then so imperfectly burnt that it contains only about the same percentage of calcium oxide as does a good specimen of unburnt limestone. In practice, therefore, there is very little saving in freight.

In recent years samples of burnt limes produced for industrial and agricultural purposes have been analysed. The results of the analysis are expressed as percentages of the important constituents in each sample in the table on this page.

CONSTITUENTS OF BURNT LIME SAMPLES

Type	1 True burnt lime (per cent.)	2 Hard-burnt lime (per cent.)	3 Calcium oxide in unburnt limestone (per cent.)	4 Limestone unburnt (per cent.)	5 Liming value of sample as carbonate of lime
NORTH ISLAND					
Burnt lime	52.5	10.0	14.2	25.4	137
Burnt lime	56.6	9.5	10.8	19.3	137
Hydrated lime	(= 49.2)	6.5	9.0	16.0	119
Agricultural burnt	8.2	2.9	39.5	70.5	90
Agricultural burnt	13.3	3.0	38.8	69.3	98
Agricultural burnt	9.4	19.0	19.6	35.0	86
Agricultural burnt	29.0	12.0	14.5	25.9	99
Agricultural burnt	30.4	14.1	14.5	25.9	105
SOUTH ISLAND					
Burnt lime	52.6	19.2	0.7	1.2	129
Burnt lime	69.6	2.4	4.5	8.1	137
Burnt lime	71.0	7.1	4.4	7.8	147
Burnt lime	79.0	10.5	1.0	1.8	161
Burnt lime	85.2	1.3	0.9	1.6	156
Hydrated lime	(= 63.1)	2.7	2.7	1.8	122
Agricultural burnt	49.4	7.0	13.7	24.4	125
Agricultural burnt	21.4	4.1	32.4	57.9	103
Agricultural burnt	30.0	5.6	25.7	45.9	109
Agricultural burnt	57.0	7.7	5.8	10.4	126

Discussion on Table

Burnt lime: A pure burnt lime would contain 100 per cent. of calcium oxide, while a commercial product made from high-grade limestone could be expected to contain about 80 to 90