Calculating Lime Rates

FACT SHEET

When lime rates are reported by A & L Canada certain assumptions are made concerning the quality of the lime and the depth of plowing. These assumptions are listed in table 1 – if the conditions shown are not met, the lime rate given on an A & L Soil Fertility Recommendation report should be adjusted.

FINENESS FACTOR

Particle size varies greatly among lime sources. Finely ground liming materials react quickly with the soil. Large particles may not react at all within a reasonable length of time. It is important to consider fineness when computing the rate of lime to apply. Table 2 lists adjustment factors to use when the fineness is different than the assumed base. To use the table, match the actual lime being used with the closest entry on the table. Multiply the A & L recommended rate by the fineness factor.

NEUTRALIZATION FACTOR

Due to variations in the percentage of calcium and/or magnesium and impurities such as silt and clay, Total Neutralizing Value (TNV) has a wide range. TNV is based on a comparison with pure calcium carbonate. Pure calcium carbonate has a TNV of 100%. Liming materials such as dolomite of hydrated lime may have a TNV greater than 100%. Use the neutralizing factor listed in Table 3 to adjust the A & L lime rate. Multiply the A&L recommended rate by the Neutralization Factor.

DEPTH FACTOR

The rate of lime necessary to raise soil pH depends on the volume of soil being treated. A & L assumes a tillage depth of 8" for lime recommendations. Note that lime rates are much lower for minimum tillage situations. Use Table 4 to adjust lime rates for tillage depth other than 8". Multiply the A & L recommended rate by the Depth Factor.

EXAMPLE

A simple formula for adjusting A & L Lime rates based on Tables 2 through 4 given below:

Adjusted Lime Rate = A & L Rate x FF x NF x DF

Assume A & L has recommended 5000 lbs/A lime. The lime source to be used is A Coarse Meal grade, with 80-89% TNV. The plow depth is 6". The following calculation can be made:

Adjusted Lime Rate: 5000 lbs x 1.45 x 1.12 x .75 = 6090 lbs

The grower should apply 6090 lbs/A of the given lime source.

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LIME SOURCE COMPARISONS

Alternative lime sources may be compared by using Tables 2 and 3. Compute the adjusted lime rate for each material using a 1000 lb. A & L application rate. The resulting figures represent equivalent amounts of lime, taking the fineness of grind and TNV into consideration.

CALCITIC OR DOLOMITIC LIMESTONE

There is continuous concern over the balance of calcium and magnesium in soil and the need to adjust the ratio of these nutrients with either calcitic limestone or gypsum. Claims have been made that soil testing high in magnesium can be harmful to soil physical properties and antagonize crop nutrient uptake.

CALCIUM TO MAGNESIUM RATIOS

The calcium to magnesium ratio is the relative proportion of exchangeable calcium and magnesium in the soil. Most soils tested in A & L Canada agricultural service area has Ca:Mg ratios from 3:1 to 10:1.

Calcium and magnesium available for plant uptake are held as exchangeable cations in the soil and organic particles. Exchangeable soil calcium normally ranges from 200 to 3000 ppm while exchangeable soil magnesium normally ranges from 20 to 300 ppm.

LIME APPLICATION

Lime applications that are based on Ca:Mg ratios may prove to be misleading. For example, a soil deficient in magnesium may have the same Ca:Mg ratio as another soil with excessive amounts of calcium and magnesium. It is difficult to distinguish between inadequate and excessive levels of calcium and/or magnesium by using only ratio as a measure.

The University of Wisconsin has shown that if adequate amounts of calcium and magnesium are present ratio variations between 2:1 and 8:1 have no effect on yield. Varying base saturation of calcium from 32 to 68% and magnesium from 12 to 35% also had no influence on yield. Applying calcitic lime to increase the Ca:Mg ratio does not appear to be a wise practice if the soil pH is already in a good growing range.

LIME PLACEMENT

The most important factor determining the effectiveness of lime is placement. Placement for maximum contact with the soil in the plow layer is essential. To begin with, most common liming materials are only slightly soluble in water, so distribution in the soil is a must for lime reaction. Even when properly mixed with the soil, lime will have little effect on pH if the soil is dry. Moisture is essential for lime-soil reaction to occur.

When applying large amounts of lime to clay soils, best mixing comes from applying part before disking and plowing and the rest after. On sandy soils that can be harrowed or disked four to six inches deep, one application, disked in before or after plowing, will do.

In some cropping systems, such as perennial sods mixing can be done only before seeding. Once the sod is established, the lime must be top-dressed. Surface-applied lime reacts more slowly and not as completely as lime mixed with the soil. So fields should be relimed before pH drops below the desired range to avoid acidity in the root zone.

MAGNESIUM IN SOIL

It has been theorized that the use of dolomitic lime in low calcium/high magnesium soils may induce a potassium deficiency. Michigan State University reports that in field research performed on alfalfa, the potassium levels in plant tissue were not changed by the use of either calcium or magnesium. If low potassium levels are observed in plant tissue in soils that test high in magnesium, it is possible that factors often associated with high magnesium soils may be the cause (i.e. compaction and/or poor drainage).

There are varying levels of exchangeable magnesium in soils. Note that coarse textured, well-drained soils have much less magnesium than fine-textured poorly drained soils. This explains why magnesium deficiencies frequently occur in sandy soils.

A test level of 50 ppm magnesium is generally considered adequate for high crop yields. Ohio State University suggests the application of dolomitic limestone if the magnesium base saturation falls below 10%. They indicate that this is particularly important where grass crops are being grown for forage and magnesium is needed to prevent grass tetany.

CORRECTING MAGNESIUM DEFICIENCY

Dolomitic limestone contains about 11% magnesium and 21% calcium. Calcitic limestone contains about 40% calcium and 2% magnesium. Either material can be applied to increase the soil pH if the magnesium level is 50 ppm or more. If the soil pH is low and the magnesium level is less than 50 ppm, it may be advisable to use dolomitic lime and/or fertilizer materials containing some magnesium. In high pH, magnesium deficient soil, fertilizer materials containing soluble magnesium or small amounts of fine-particle dolomitic lime should be applied. Apply 50 to 100 lbs of magnesium broadcast or 10 to 25 lbs in the row.

TABLE 1. A & L CANADA LIME STANDARDS

% PASSING MESH SIZE				TNV	PLOWING
8	20	60	100	%	DEPTH
95	70	50	40	90-99	8

TABLE 2. FINENESS FACTOR

	% PASSING MESH SIZE				
TYPE OF LIME	**8**	**20**	**60**	**100**	**(FF)**
SUSPENSION	100	100	100	100	0.60
AG-SUPERFINE	100	100	95	80	0.63
AG-PULVERIZED	100	95	70	60	0.76
AG-GROUND	95	70	50	40	1.00
AG-FINE MEAL	85	60	40	30	1.19
AG-COARSE MEAL	80	50	30	20	1.45
AG-FINE SCREEN	80	45	20	10	1.77
AG-COARSE SCREEN	80	40	15	5	2.03

TABLE 3. NEUTRALIZING FACTOR

TNV	NEUTRALIZING FACTOR (NF)
100-119	0.83
100-109	0.90
90-99	1.00
80-89	1.12
70-79	1.27
60-69	1.46
50-59	1.73

TABLE 4. DEPTH FACTOR

PLOWING DEPTH (INCHES)	DEPTH FACTOR (DF)
2	.25
4	.50
6	.75
8	1.00
10	1.25
12	1.50