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Lime Needs in Minnesota

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THE IMPORTANCE OF LIME

When needed, liming materials are major inputs for crop production enterprises in Minnesota. When soils are acid, there are many benefits from liming. Liming to a pH of 6.0 to 6.5 or higher provides an ideal environment for bacteria in soils. Some of these bacteria actively participate in the breakdown of soil organic matter. Others form nodules on the roots of legumes. With this bacterial partnership, legumes are able to utilize the nitrogen in the air and no fertilizer nitrogen is needed.

The availability of phosphorus is also affected by soil pH. So, liming to a pH of 6.0 to 6.5 also increases the supply of soil phosphorus available to plants. Most soils in Minnesota contain ample calcium (Ca) for crop growth. Liming materials are generally not used to supply Ca, but depending on source may be used to supply magnesium (Mg).

DETERMINING THE NEED FOR LIME

The need for lime is not uniform across Minnesota and recommendations will vary. Analyzing a soil sample for pH and buffer pH is the only way to arrive at an accurate lime recommendation. Soils should be sampled to a depth of 6 to 8 inches for this test. The recommendations will not be accurate if other sampling depths are used.

After the soil sample reaches the laboratory and is dried, a pH reading is taken in a mixture of equal parts of soil and water. This value is referred to as the soil pH. If the soil pH reading is less than 6.0, a buffer solution is added to the soil/water mixture and another pH reading is

taken. This second reading is referred to as the buffer pH and is used to determine the amount of lime to apply. The current buffer used at the University of Minnesota is called the Sikora Buffer. The pH of the buffer itself is 7.5. When it is added to an acid soil, the pH of the buffer will drop. The change in the pH of the buffer is directly related to the amount of lime needed. The buffer pH is not determined on soils with a soil pH of 6.0 or higher. The relative error of using the buffer is too high in this soil pH range. For these soils, standard guidelines are used to raise the soil pH to 6.5.

Lime guidelines for Minnesota are summarized in **Tables 1-3**. The area of the state must also be considered when these suggestions are used (see map **Figure 1**).

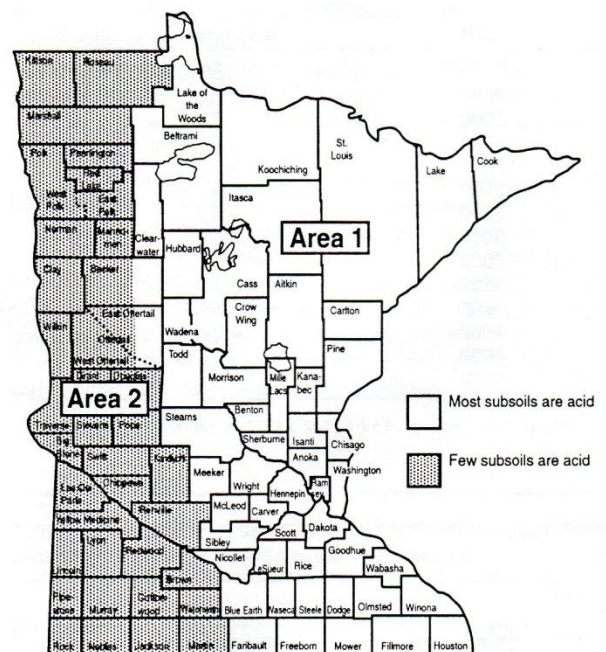


Figure 1. Reference map for lime suggestions.

The same pH is not required for optimum growth of all crops. Crops grown in Minnesota are divided into 3 groups. These groups are as follows:

Group I. Alfalfa, alsike clover, apple, asparagus

Group II.

Annual canary seed	Oat
Barley	Pea
Birdsfoot trefoil	Raspberry
Buckwheat	Red clover
canola	Rye
Corn	Sorghum sudan
Edible bean	Soybean
Flax	Strawberry
Grape	Sugar beet
Grass for seed production	Sunflower
Grass hay	Sweet corn
Mustard	Vegetable crops
millet	wheat

Group III. Potato, grass sod, blueberry, wild rice.

For mineral soils, lime should be applied to raise the soil pH to 6.5 if alfalfa, alsike clover, apples, or asparagus are the intended crops. For any crop in Group 2, lime should be applied to raise the soil pH to 6.0. The crops listed in Group 3 grow best in acid soils and no lime is needed except for potato and grass sod when the pH drops below 4.9. In these cases application of 2000 lb ENP/A is suggested. For potato, this application should be made prior to growing a rotation crop to minimize scab development.

Table 2. Lime suggestions for mineral soils when the SIKORA BUFFER TEST IS NOT USED (soil pH is 6.0 or greater). The rates suggested should raise the pH to 6.5.

Soil-Water pH	Area 1	Area 2
	ENP	ENP
	lb/acre	lb/acre
6.5	0	0
6.4	2000	0
6.3	2000	0
6.2	3000	0
6.1	3000	0
6.0	3000	2000

Table 1. Lime suggestions for mineral soils when the soil pH is less than 6.0. The rates suggested should raise the pH to 6.0 or 6.5.

Sikora Buffer Index	Target pH 6.0		Target pH 6.5	
	Area 1 ENP	Area 2 ENP	Area 1 ENP	Area 2 ENP
	lb/acre	lb/acre	lb/acre	lb/acre
6.8	2000	0	3000	2000
6.7	2000	0	3500	2000
6.6	2000	0	4000	2000
6.5	2500	0	4500	2000
6.4	3000	2000	5000	2500
6.3	3500	2000	5500	2500
6.2	4000	2000	6000	3000
6.1	4500	2000	6500	3000
6.0	5000	2500	7000	3500
5.9	5500	2500	7500	3500
5.8	6000	3000	8000	4000
5.7	6500	3000	8500	4000
5.6	7000	3500	9000	4500

* An ENP of 1,000 lb per ton is an average value for ag lime (crushed limestone) in Minnesota.

For organic soils, (Table 3), it is suggested to raise pH to 5.5. A pH greater than 5.5 in organic soils will cause nutrient availability problems.

Table 3. Lime suggestions for organic soils. The rates suggested should raise the pH to 5.5.

Soil-Water pH	Area 1	Area 2
	ENP	ENP
	lb/acre	lb/acre
5.4	2000	2000
5.3	2000	2000
5.2	2000	2000
5.1	2000	2000
5.0	2000	2000
4.9	3000	3000
4.8	3500	3500
4.7	4000	4000
4.6	4500	4500
4.5 or less	5000	5000

Additional Publications

FS-05957-Liming Materials for Minnesota Soils