FO-0725-D
Revised 1994

MINNESOTA EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
COLLEGE OF AGRICULTURE

MAGNESIUM FOR CROP PRODUCTION IN MINNESOTA

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Although magnesium (Mg) is an essential element for plant growth, its use in a fertilizer program receives only minor emphasis in Minnesota. For most of the state, this lack of emphasis is justifiable. If Mg is limited in the diet, animals can develop grass tetany. Therefore, some special consideration is given to the Mg status of forage crops.

The Role of Magnesium In The Plant

Magnesium is the central core of the chlorophyll molecule in plant tissue. Thus, if Mg is deficient, the shortage of chlorophyll results in poor and stunted plant growth.

Magnesium also helps to activate specific enzyme systems. Enzymes are complex substances that build, modify, or break down compounds as part of a plant's normal metabolism.

Magnesium In The Soil

Magnesium is abundant in the earth's crust. It is found in a wide variety of minerals. Magnesium becomes available for plant use as these minerals weather or break down. The majority of the soils in western Minnesota have naturally high levels of Mg. For the acid soils of the eastern counties, the addition of dolomitic limestone in the crop rotation, when needed, should supply adequate Mg for crop growth.

Magnesium is held on the surface of clay and organic matter particles. Although this exchangeable form of Mg is available to plants, this nutrient will not readily leach from soils.

In Minnesota, Mg deficiency has only been observed on very acid soils. These soils usually have a sandy loam, loamy sand or sand texture. A Mg deficiency is not likely to occur until the soil pH drops below 5.5. In Minnesota, the acid sandy soils occur in the central and east-central part of the state.

The low levels of Mg in soils can occur where potatoes are grown on acid sandy soils or where corn follows a potato crop. Sometimes, grass tetany, a livestock disorder caused by low levels of Mg in the diet, is reported where high rates of potash have been applied to grass pastures. Research trials, however, have shown that the use of Mg in a fertilizer program for these pastures has not increased forage yields. For these situations, it is less expensive to supplement the animal diet with a salt that contains Mg.

Relationship of Magnesium to Calcium in Soils

There are some who believe that there is an "ideal" ratio of calcium to magnesium in soils and one of these two nutrients should be added in a fertilizer program if this "ideal" ratio does not exist. The need for this "ideal" ratio has never been verified by various research efforts throughout the Corn Belt which have focused on the importance of ratios. In Wisconsin, for example, the ratio of calcium to magnesium in soils was adjusted in a range of two to eight by adding different amounts of calcium and magnesium in a fertilizer program. This variation had no significant effect on alfalfa and corn yields. Therefore, as fertilizer recom-

mendations are developed, emphasis should be placed on providing adequate amounts of magnesium in soils rather than the maintenance of a certain ratio of one nutrient to another.

Deficiency Symptoms

The loss of a healthy green color can be the first indication of a Mg deficiency. Color loss reflects the shortage of chlorophyll in the plant. As the deficiency becomes more severe, the area between the veins of the leaves becomes yellow while the veins stay green. In corn, there is a definite striping the full length of the leaf, appearing first on the lower leaves (see **Figure 1**).

Figure 1. Magnesium deficiency in corn. The striping extends the full length of the leaf.

In potatoes, the loss of the green color begins on the tips of the lower leaves when there is a mild Mg deficiency. When the deficiency is more serious, the yellowing progresses between the veins toward the center of the leaf.

Figure 2. Magnesium deficiency symptoms in potatoes. The loss of color begins at the tips of the lower leaves.

In the advanced stages of Mg deficiency, leaf areas between the veins show small brown dead spots (see **Figure 2**). Diseases, herbicide damage, and environmental factors also cause leaves to die prematurely. So, care should be taken in identifying a Mg deficiency. Use plant analysis to be sure.

Predicting the Need for Magnesium

The critical plant tissue concentrations of Mg in selected crops are listed in **Table 1.** Since Mg is a mobile element in the plant, the concentration of Mg usually decreases from the top to the bottom of the plant. Also, the Mg concentra-

Table 1. Relative magnesium levels in selected tissue of several crops.

Crop	Plant Part	Time of Sampling	Magnesium Status			
			Deficient	Low	Sufficient	High
			% Mg			
alfalfa	upper 1/3 of plant	1/10 bloom	<.20	.20-.30	.31-1.0	>1.0
corn	ear leaf	silking	<.10	.11-.25	.26-1.0	>1.0
oats	upper leaves	boot stage	—	.13	.13-.40	>.4
potatoes	petiole of most recently mature leaf	bloom	<.20	.20-.30	.30-.70	>.70
soybeans	most recently developed trifoliate	pod set	<.10	.11-.25	.26-1.0	>1.0

Table 2. Magnesium recommendations for corn production.

Magnesium Soil Test	Relative Level	Magnesium to Apply Starter or Broadcast	
ppm		- - - - lb./acre - - - -	
0 - 50	low	10-20	50-100
51 - 150	medium	trial*	0
151 +	high	0	0

** Apply 10-20 lb. Mg per acre in a starter only if a magnesium deficiency is suspected, or if a deficiency has been confirmed by plant analysis.*

Table 3. Magnesium recommendations for fruit and vegetable crops.

Magnesium Soil Test	Relative Level	Magnesium to Apply Starter or Broadcast	
ppm		- - - - lb./acre - - - -	
0 - 50	low	20	100
51 - 100	medium	10	50
101 +	high	0	0

tion usually decreases as the plant approaches maturity. It is, therefore, important to indicate the age of the plant and the part of the plant that was sampled when samples are submitted for a measurement of Mg in plant tissue.

The critical values in **Table 1** have been established for specific stages of growth. When collecting plant samples, every effort should be made to sample the crop at the stage of growth that is listed.

A soil test to measure exchangeable Mg is offered by most soil testing laboratories. In Minnesota, the potential need for Mg in a fertilizer program is highest where sandy soils are very acid. If dolomitic lime has been used in the crop rotation, soils usually have a relatively high level of Mg and it is not necessary to test the soil for this nutrient.

Magnesium recommendations for corn production are summarized in **Table 2**. The Mg suggestions for fruits and vegetables are listed in **Table 3**.

Sources of Magnesium

The application of dolomitic limestone is the most cost effective method for applying the Mg that is needed. The Mg content of dolomitic limestone varies from 8-10%. To be effective, this Mg source should be broadcast and incorporated before planting.

There are fertilizers that are a combination of potassium sulfate and magnesium sulfate. The Mg content is 11%. The sulfur (S) concentration is 22% and the K_2O percentage is 22%. This fertilizer is easily used in a starter fertilizer for corn or as a Mg source when there is no desire to increase soil pH.

Although the need for the addition of Mg to a fertilizer program is not widespread in Minnesota, this nutrient can increase crop production when needed. The potential for need should not be ignored. If there is doubt about the need, analyze the soil to be sure.

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Produced by the Educational Development System, Minnesota Extension Service.