

Phosphorus and Magnesium Reduce Grass Tetany Potential

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Research in Texas, Kansas and Missouri indicates that adequate phosphorus (P) fertilization decreases the possibilities of grass tetany in cattle by increasing magnesium (Mg) uptake and translocation to the leaves of forages.

BOTH P AND Mg have long been recognized as important nutrients for energy transformations within the plant and for animal health, reproduction and performance. Many forage soils are characteristically low in P, and many are low to moderate in Mg levels. Research indicates that P is important in plant uptake of Mg and calcium (Ca). When increased concentrations of P are supplied to forages, plant uptake and translocation of Mg and Ca from roots to the leaves are enhanced. This relationship lowers the potential for grass tetany which affects cattle grazing lush green pastures and is related to low blood serum Mg.

Grass Tetany

Grass tetany, also known as "grass staggers" or wheat poisoning, is a serious and often fatal disorder, especially in lactating ruminants. Tetany is usually associated with a potassium (K)/Ca + Mg ratio in forage tissue that exceeds 2.2, Mg concentration less than 0.2 percent, or a Ca concentration of less than 0.4 percent. It can reach epidemic proportions during spring in some years, killing livestock grazing on what appears to be high quality pasture. Affected animals may show symptoms of excitability, uncoordinated walking, and stumbling or falling down. Often an animal will die suddenly without showing any symptoms.

Grass tetany has been studied for years. During this time, scientists have deter-

mined that the disease is linked to a shortage of Mg and sometimes Ca in forages. In laboratory and greenhouse studies, researchers have found that when sufficient P is applied, Mg and Ca uptake and movement from the roots to the leaves of the plant are enhanced. Without sufficient P, even if there is enough Mg in the soil, Mg levels in forage tissue may not be sufficient and grass tetany may result.

Texas

Researchers have studied the influence of P fertilizers on the P, K, Ca and Mg concentrations in tissue of ryegrass, **Table 1**, and Coastal bermudagrass (data not shown). Applied P increased tissue Mg concentrations of ryegrass and Coastal bermudagrass in all three years of both experiments. Phosphorus also increased Ca concentrations in the leaf tissue of both species, but had a slightly depressing effect on K.

Table 1. Phosphorus affects ryegrass tissue nutrient concentrations.

P ₂ O ₅ rate, lb/A	Tissue nutrient concentration, %			
	P	K	Ca	Mg
0	0.108	2.20	0.468	0.108
30	0.120	2.09	0.521	0.112
61	0.144	2.03	0.546	0.118
92	0.167	2.15	0.554	0.119
123	0.200	2.21	0.571	0.120
245	0.210	1.92	0.545	0.115
491	0.285	1.91	0.616	0.132

Hillard, et al

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Fertility Pointer: Phosphorus fertilization increased Mg uptake of both ryegrass and bermudagrass. However, Mg levels in the plant tissue were still below critical levels (about 0.2 percent) for adequate plant and animal nutrition. Although P can increase Mg uptake, soils often need extra Mg (fertilization) along with P to insure sufficient Mg in the plant.

Kansas

The Kansas studies indicate that the addition of P with N significantly increased the Mg and Ca concentrations of tall fescue tissue and lowered the K/Ca + Mg ratio, **Table 2**. An earlier sampling date (April 24), however, did not show the same trends as the May 16 data shown below.

Table 2. Phosphorus, N and K affect Ca, Mg and K concentrations in tall fescue.¹

Treatment	Tissue nutrient concentration, %			K/Ca + Mg Ratio
	K	Ca	Mg	
N	1.89	0.33	0.18	1.54
N P	1.74	0.39	0.22	1.17
N P K	1.83	0.36	0.22	1.30
LSD(0.05)	ns	0.04	0.01	0.14

¹Plants sampled on May 16, 1985. N, P₂O₅, K₂O rates were 150, 40, and 40 lb/A, respectively (Havlin and Sweeney, Kansas State University)

Fertility Pointer: As the K/Ca + Mg ratio falls below 2.2, there is less chance of grass tetany occurrence.

Table 3. Phosphorus and Mg combine to reduce the grass tetany potential of tall fescue.

N-P ₂ O ₅ -K ₂ O Applied, lb/A	Mg (+ or -)	Tissue nutrient concentration, %				Ratio K/Ca+Mg
		Mg	Ca	K	P	
50-0-50	-	0.22	0.40	2.6	0.20	1.52
50-50-50	-	0.23	0.52	2.2	0.41	1.23
50-0-50	+	0.18	0.44	2.4	0.19	1.61
50-50-50	+	0.26	0.53	2.2	0.40	1.20

Mg(+)=15 lb/A

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Missouri

Missouri researchers demonstrated the relationship between P availability and nutrient concentration in the shoots of wheat plants. With increased P, total Mg and Ca translocation from the roots to the shoots was increased in greater proportions than K. This led to a reduction of the K/Ca + Mg ratio with added P. Implications of this research are important in that the potential for grass tetany in forage crops is reduced by applying fertilizer P.

The same relationship in tall fescue pastures described for wheat seedlings when Mg is not added is shown in **Table 3**. When Mg was added, P increased Mg concentration to its highest level and lowered the K/Ca + Mg ratio. Note also that adding Mg without P produced no increase in plant concentrations of Mg and did not lower the K/Ca + Mg ratio.

Summary

Phosphorus interactions and Mg affect grass tetany potentials.

1. Phosphorus fertilization is not a magic cure for grass tetany. However, as P fertilization is increased, it promotes increased uptake of divalent cations (Ca and Mg).
2. Phosphorus fertilization is important for Ca and Mg uptake into the roots, but even more important for movement of Ca and Mg to the leaves.
3. Increased P fertilization has little, or a slightly depressed, effect on K uptake.

4. Many soils used for forage production are not only low in P but in Mg as well. Applying Mg or P alone may not provide total alleviation of grass tetany. In most cases, applications of both nutrients may be required to correct the problem. ■