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Choosing a Magnesium Fertilizer for Pasture and Hay Fields

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Although magnesium (Mg) is an essential element for plant growth, it receives relatively little attention in soil fertility programs. However, its role in photosynthesis is important as the central core of the chlorophyll molecule. When deficient, the shortage of chlorophyll results in poor and stunted plant growth.

Magnesium levels also play a key role in prevention of tetany in beef cattle, which results in low blood magnesium (hypomagnesemia). This can occur while cattle are grazing pasture or consuming stored forages, such as hay or baleage.

The purpose of this paper is to compare the economics, ease of application and availability of five magnesium amendments in West Virginia. The usual recommendation to increase magnesium levels is to apply dolomitic lime, which typically has an elemental magnesium level around 10%. Since most of our soils are acidic and need occasional lime applications to maintain a soil pH level in the sweet spot of 6.0 to 6.5 for grass clover – a pH of 6.5 to 7.0 is recommended for alfalfa – applying dolomitic lime makes perfect sense. It does not require a second trip across the field and is usually reasonably priced.

However, it becomes a more difficult decision if dolomitic lime is unavailable or the price to bring it to the farm becomes extremely high. In some cases, the farm might also be faced with the unusual situation of having low magnesium levels, but pH at a level that needs no adjustment. In this case, applying dolomitic lime might be detrimental if it raises the pH above 7.0.

Here are five products one could use to increase magnesium levels in grassland soils:

1. Dolomitic lime – Dust
2. Pelleted dolomitic lime – Pellet
3. Magnesium oxide (MgO) – Dust
4. Magnesium sulfate (MgSO4) – Pellet
5. Potassium magnesium sulfate (KMgSO4) – Fertilizer-size granule

Cost Comparison Exercise for North Central West Virginia

Assumptions

1. The comparison will use a WVU Soil Testing Lab result that has magnesium at 50% relative sufficiency, which is 75 parts per million (ppm) Mg. To reach 100% relative sufficiency, we need to reach 150 ppm Mg, which is an additional 75 ppm.
2. To convert from soil test Mg (ppm) to pounds of Mg per acre, follow these steps:

Function	**Reason**	**Example**
Multiply ppm by 2	The standard assumption is an acre contains 2 million pounds of soil in 6 inches; since our measurement is parts per million, multiply it by 2 to get parts per 2 million.	75 ppm * 2 = 150 pounds per acre Mg needed
Divide by 3	Our sample represents 2 inches rather than 6 inches.	150/3 = 50 pounds per acre Mg needed

3. In Table 1, the price of treatment five, KMgSO4, does not include delivery; this product would need to be picked up in Bruceton Mills, West Virginia. All other prices include delivery to Weston, West Virginia. None of the prices include spreading.

Table 1. Amount and cost of each treatment to apply 50 pounds per acre of magnesium.

Treatment	Product	% Mg	Cost per ton	Pounds applied per acre	Pounds Mg applied	Cost per acre
1	Dolomitic lime (to meet Mg needs)	10	$46	500	50	$11.50
2	Pelleted dolomitic lime (to meet Mg needs)	11	$170	455	50	$38
3	MgO (powder)	54	$640	93	50	$30
4	MgSO4 (pellet)	36	$840	139	50	$58
5	KMgSO4	11	$479	455	50	$109

Discussion of Treatments

Dolomitic Lime

Easy to apply, as the magnesium is in the lime. If a pH adjustment is not needed (due to a soil test pH of 6.0 to 6.5), a relatively small amount of dolomitic lime will provide the needed magnesium and be the cheapest option. If soil test pH is 6.5 or higher, this option would not be the best, as the pH increase could be detrimental. Applying lime at 500 pounds per acre with a spreader truck would be cost prohibitive. This rate and product could be an economic option if you are using a district lime spreader.

Pelleted Dolomitic Lime

This treatment costs over three times as much as regular dolomitic lime, but it may be the best option because of ease of spreading. Since it flows, it can be spread through a fertilizer spreader, reducing spreading costs.

MgO

The cost of this treatment is reasonable, but it does have practical issues. It would be difficult to apply accurately by itself. In the example above, you are only applying 93 pounds per acre. Accurately applying that small amount of a dust is difficult. Blending with potash, or any fertilizer, makes spreading easier. It would be difficult for most farms to evenly blend it with fertilizer themselves, so ideally this would be done by a fertilizer bulk mixing plant, which may not be available in all communities.

MgSO4

Since this is a pellet, it is cleaner to work with than magnesium oxide (MgO). Because of the lower magnesium content compared to MgO, you are spreading more per acre, but it is still a relatively small amount – 139 pounds per acre in the example. As a pellet, accurately spreading by itself might be possible, but it would still be easier to spread mixed with fertilizer. It is also relatively expensive.

KMgSO4

This treatment is the most expensive when you value only the magnesium content. However, it also contains 22% potassium oxide (K2O), so 455 pounds (the amount needed to meet magnesium needs in the example above) also contains 100 pounds of K2O. At the time of this analysis, potash was

being priced at $470 per ton. Since potash is 60% K2O, the amount applied here has a value of $39 [1]. Deducting the potassium value from the total ($109 minus $39) leaves us with $70 for the magnesium, which is still higher than other treatments, but more reasonable.

*Note: [1](2,000 pounds *0.60=1,200 pounds K2O per ton; value of K2O: 470/1,200=$0.39 per pound; $0.39*100 pounds=$39)*

Conclusions

While dolomitic lime is probably the best option for many, a blanket recommendation of the best way to supplement magnesium cannot be made because it depends on the products available to you and the cost of those products. If a soil pH is below 6.0, dolomitic lime is convenient because it provides both an increase in soil pH and multi-year magnesium supplementation in one application.

The cost comparison above does not take spreading time into account. For example, if you are able to spread 2 tons per acre of a high quality calcitic lime to raise pH, spreading MgO for Mg would only cost $70 per acre total ($40 for the lime + $30 for the Mg), compared to $92 per acre for dolomitic lime ($46 per ton * 2 tons per acre). However, the calcitic lime and MgO would require two trips across the field, in addition to the fertilizer to mix with the MgO.

If a raise in pH is not needed, small amounts of dolomitic lime, pelletized dolomitic lime, MgO or KMgSO4 are good options. Which is best depends on availability, cost, your pH level and whether you need any fertilizer (phosphorus and potassium) applied.

If your pH is so high that no lime product is an option and you don’t need any other fertilizer applied (to mix with the MgO), MgSO4 is probably the best option. As a pellet, it could be applied by itself through a fertilizer spreader. However, calibration would be necessary.

Pelletized dolomitic lime will often eliminate itself due to cost. However, convenience can be a factor since it will flow through a fertilizer spreader, and the amount needed if you are not adjusting pH is relatively small.

The economic comparison will vary in different regions of the state and depends on the cost and availability of dolomitic lime.

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