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PELLETIZED LIME IN MICHIGAN

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Interest in applying pelletized lime to agricultural soils has increased in recent years. This publication will help agricultural producers gain a better understanding of the characteristics, performance and recommended applications of pelletized lime.

The source material for pelletized lime is calcitic or dolomitc limestone, the same as for regular aglime. Regular aglime is produced by crushing limestone rock to give a product with a range of particle sizes. Pelletized (pell) lime is made by binding very fine particles of calcitic or dolomitic lime together with a water soluble binding agent to form pellets or granules. Nearly all of the particles used in the pelletization process have been ground to pass through a 100 mesh sieve with 25 to 40 % passing a 200 mesh sieve. Lignosulfonate is the most commonly used binding agent; however other lignins, brewex or molasses may also be used. The formed pellets typically range in size between 4 and 20 mesh in the final product.

Pelletized lime offers some advantages in handling over aglime. It spreads more uniformly than aglime, and it can be blended with fertilizers for row or broadcast application. It can be spread with fertilizer spreaders, which are capable of applying lower rates of material than lime spreaders. Since pelletized lime costs 4 to 5 times more than aglime the important question to ask is: "Are low rates of pelletized lime more effective than aglime?" Since the pellets are composed of fine particles, pelletized lime would be expected to react quickly in the soil to neutralize soil acidity.

All liming materials neutralize soil acidity in the same way. Calcium (Ca^{2+}) and magnesium (Mg^{2+}) displace H^{+} and Al^{3+} (primary sources of soil acidity) from soil exchange sites or complexes which then react with carbonate to form water and carbon dioxide or precipitated aluminum hydroxide. Liming materials, including pelletized lime, contain varying amounts of calcium or magnesium carbonate. A standard method is used to enable comparison of liming products. The ability of all lime products sold in Michigan to neutralize soil acidity is compared to pure calcium carbonate, which has a neutralizing value (NV) of 100 (Christenson et al.). If the

NVs are equal, then pound for pound aglime and pelletized lime will neutralize equal amounts of acidity. NV is an important consideration when deciding how much lime to apply to bring about a given amount of pH change in soil. Lime recommendations made by the Michigan State

University Soil and Nutrient Lab are based on a neutralizing value of 90%.

Neutralizing value (NV) does not indicate how quickly the liming material will react in the soil. Reaction time is controlled largely by the fineness of the liming material. The finer the material, the more quickly it reacts to reduce acidity in the soil. Coarser materials persist longer and continue to neutralize acidity for several years. In Michigan lime vendors are required to report the percent material passing through 8-mesh, 60-mesh and 100-mesh sieves. Liming products containing a range of particle sizes are desirable to produce rapid and lasting benefits. Fine lime materials react quickly, but have limited long-term effects. Particles passing through a 100 mesh sieve will dissolve and neutralize acidity within the first month or two of application and incorporation. Particles coarser than a 50 or 60 mesh sieve can take up to 3 years to fully react in the soil.

Once in the soil, lime pellets break down into fine lime particles that should react quickly, but interestingly observed effects on soil pH change have not been as much as expected. This may be due to the fine particles all being in a concentrated zone rather than be evenly distributed through the soil, which limits the rate of reaction. Incubation studies in Michigan (Pierce and Warncke) and Wisconsin (Kelling and Schulte) and field studies in Ohio (Mullen) and Wisconsin (Kelling and Schulte) have shown pelletized lime does not change pH any quicker than aglime when applied at the same rates. Applying lower rates than recommended resulted in less pH change. A good example of this is the recent study in Ohio (Table 1) where the effects of pelletized lime and agricultural lime on soil pH and corn yields were evaluated. The liming materials were broadcast and incorporated in March of 2004. Results from the study show that pelletized lime did not react faster than agricultural lime. Two months after application the change in soil pH was greater with regular aglime than with the pelletized lime (0.8 unit vs 0.3 unit with 1.25 t/a). The low rate (1.25 t/a) of pelletized lime did not neutralize acidity sufficiently to prevent a large yield loss. To bring about equal pH change and yield improvement pelletized lime must be applied at rates comparable to aglime.

Table 1. Lime material and application rate effects on soil pH levels at various sampling dates and corn grain yield in 2004 at Wooster Ohio. (Wooster silt loam)

Material	Application Rate *tons/acre*	Soil pH 5/24/2004	Soil pH 7/23/2004	Soil pH Spring 2005	2004 Corn Yield *bu/acre*
None	0.0	4.9	5.2	5.1	121
Ag Lime	1.25	5.7	6.1	5.7	175
	2.5	6.1	6.6	6.2	177
	5.0	6.5	6.4	6.6	184
Pell Lime	1.25	5.2	5.8	5.6	156
	2.5	5.2	6.1	5.9	177
	5.0	5.9	5.9	6.3	191

Data presented with permission of Dr. Robert Mullen, The Ohio State University.

Growers should also consider cost when deciding if pelletized lime is the liming material to apply. Pelletized lime is significantly more expensive than agricultural lime. Prices range from

4 to 5 times more expensive than dolomitic or calcitic lime. From the Ohio study and other studies it is apparent that applying low rates of pelletized lime does not provide the desired results in terms of pH change or yield improvement.

Annual applications of reduced rates of pelletized lime have been suggested for rental ground. The strategy is to limit the long-term financial investment in lime if the ground is rented or sold to another farm. This is a legitimate concern with the increased competition for land. However, annual applications of small quantities of pelletized lime are not the solution to the problem for the reasons previously stated; reaction times and application rates are similar to agricultural lime and the comparatively high cost of pelletized lime. Broadcasting pell lime at low rates or banding it with planting time fertilizer provides additional calcium and magnesium, but does little to neutralize soil acidity throughout the root zone. Alternative strategies include: 1.) obtaining multiple–year rental agreements lasting the life of agricultural lime, 2.) adding terms to the rental agreement stating that the tenant will be reimbursed for the remaining value of applied agricultural lime if the ground changes hands, and 3.) consider adjusting lime application rates on rental ground to maintain soil pH levels around 6.1 rather than 6.5 (contact your local MSU Extension office for help with this).

Because pelletized lime has been shown to react no more quickly than agricultural lime, reduced rates of pelletized lime are not effective in adequately neutralizing soil acidity and may result in loss of crop yield. The primary benefit of pelletized lime is its ease of handling and spreading. Pell lime is a good of source of available calcium and magnesium where those nutrients are needed. Agricultural lime is a better choice for most situations in field crop production due its distribution of particle sizes for quick and long lasting reaction, lower cost and lasting benefits.

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