

Pelletized Lime for Short-Term Treatment of Soil Acidity

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Correct soil pH is the cornerstone of a successful crop nutrient management program. Annual applications of nitrogen fertilizers on crops slowly produce acid conditions in fields. If low pH is not corrected by agricultural lime applications, soil acidity will reduce nutrient availability to plants (especially P), produce toxic levels of aluminum and manganese, and diminish the weed control activity of some herbicides.

In recent years, agricultural fertilizer dealers have reported 2 to 3 fold increases in sales of pelletized lime. Pelletized lime is finely ground limestone, which is made into small pellets for broadcasting with conventional fertilizer equipment. Because pelletized lime is relatively expensive per ton, it is applied at lower rates (<300 lbs/acre) as compared to recommended rates of agricultural lime. A “1:10 ratio” rule of thumb has been promoted for comparing the short-term neutralizing effectiveness of pelletized lime to agricultural lime. (Example: if a soil test recommends the ENM equivalent of 2000 lbs of agricultural lime per acre apply 200 lbs of pelletized lime/acre). Most farmers realize that pelletized lime is not a long-term “fix”, but expect it to reduce soil acidity to tolerable levels for one year. Typically, farmers apply this material on fields that a landlord is unwilling to share part of the cost of applying agricultural lime or will not provide a lease agreement for more than one year.

A study was initiated to evaluate the general philosophy of using finely ground lime to provide a short-term, “quick fix” of soil acidity and compare corn and cotton yield response of pelletized lime to agricultural lime.

Accomplishments in Year 1

Elemental sulfur (2000 lb/acre) was applied to acidify a non-irrigated Tiptonville sandy loam soil at the Delta Research Center at Portageville in February. Soil samples collected in early May indicated average soil pH_{salt} 4.6 and 3.5 neutralizable acidity (NA). University of Missouri Lime recommendations showed 1209 ENM/acre was needed. Ag lime (514 ENM/ton) and pelletized lime (720 ENM/ton) were applied to 10' X 40' plots with four replications. Lime materials were incorporated with tillage before soybean planting. Each lime was evaluated at $\frac{1}{4}$ recommended ENM, $\frac{1}{2}$ recommended ENM, $\frac{3}{4}$ recommended ENM, and 100% of the recommended ENM per acre (Table 1). Pelletized lime treatments were included with low rates dribbled over the seed furrow behind the planter press wheel and applied directly in the seed furrow with soybean seeds.

In Missouri soils, manganese (Mn) availability increases as soil pH decreases. Soybean leaf samples collected at R2 growth stage showed Mn was present at toxic levels in all lime treatments (Table 1). Levels greater than 200 ppm Mn in leaves are toxic in soybean plants. At the 100% MU recommendation rate, soybean plants grown in soil receiving agricultural lime had 374 ppm Mn and soybean receiving pelletized lime had

459 ppm Mn. Soybean yields were very low in all plots because of lack of rainfall and low soil pH. At 75 and 100% of MU recommended lime rates yields were generally higher with agricultural lime than with pelletized lime. Applying low rates of pelletized lime over or directly in the soybean seed furrow did not increase soybean yields.

Objectives for Year 2

Neither lime material had adequate time to neutralize soil acidity before soybean planting. We will plant the field in soybeans again in 2005 and monitor soil pH and Mn levels in plants. We also plan to evaluate ag and pelletized lime with corn.

Table 1. Effect of agricultural lime and pelletized lime treatments on R2 apex soybean trifoliolate leaf tissue nitrogen, phosphorus, potassium and manganese contents at Portageville, MO in 2005 on a Tiptonville sandy loam with initial pH_{salt} 4.6 and 1209 ENM/acre University of Missouri Lime recommendation.

Trt	Lime	MU Rec % applied	Material per acre	N	P	K	Mn ¹ ppm in leaves
				-----% in leaves-----			
1	check	0	0	5.3	0.28	1.66	510
2	Ag lime ²	100	2.3 Tons	3.1	0.32	1.71	374
3	Ag lime	75	1.7 Tons	4.5	0.27	1.77	343
4	Ag lime	50	1.2 Tons	4.5	0.35	1.63	386
5	Ag lime	25	0.6 Tons	4.4	0.24	1.48	400
6	Ag lime	12	0.3 Tons	5.5	0.32	1.55	482
7	Ag lime	6	0.1 Tons	4.4	0.32	1.77	533
8	Pell lime ³	100	1.7 Tons	4.8	0.36	1.72	459
9	Pell lime	75	1.3 Tons	6.2	0.24	1.53	422
10	Pell lime	50	0.8 Tons	4.3	0.27	1.54	393
11	Pell lime	25	0.4 Tons	4.9	0.25	1.60	390
12	Pell lime	12	0.2 Tons	4.9	0.29	1.57	492
13	Pell lime	6	0.1 Tons	2.7	0.23	1.48	511
14	Infur Pell ⁴	<1	4 lbs.	5.1	0.35	1.62	440
15	Infur Pell	<1	8 lbs.	4.9	0.34	1.52	389
16	Infur Pell	<1	12 lbs.	5.7	0.34	1.53	491
17	Infur Pell	<1	16 lbs.	3.5	0.32	1.42	452
18	Drib Pell ⁴	<1	4 lbs.	4.8	0.36	1.50	512
19	Drib Pell	<1	8 lbs.	5.3	0.36	1.68	407
20	Drib Pell	<1	12 lbs.	5.3	0.39	1.65	427
21	Drib Pell	<1	16 lbs.	4.2	0.28	1.55	440

1 Leaf manganese greater than 200 ppm is usually toxic to soybean plants.

2 Agricultural lime tested 514 ENM per ton.

3 Pelletized lime teste 720 ENM per ton.

4 Pelletized lime was placed in seed furrow at planting with soybean seeds.

5 Pelletized lime was dribbled over seed furrow behind the planter press wheels.

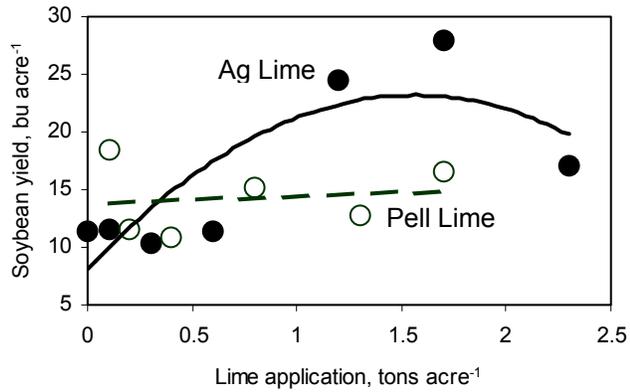


Figure 1. Soybean yields following broadcast lime treatments incorporated before planting at Portageville, MO in 2005 on a Tiptonville sandy loam with initial pH_{salt} 4.6.

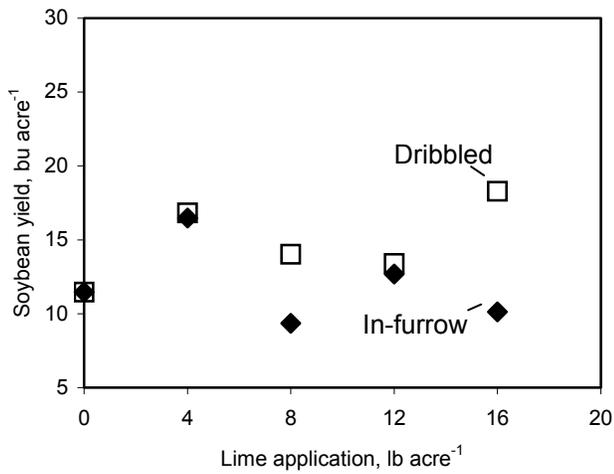


Figure 2. Soybean yields following low rate pelletized lime treatments incorporated before planting at Portageville, MO in 2005 on a Tiptonville sandy loam with initial pH_{salt} 4.6. Dribbled treatments received pelletized lime behind the planter press wheels. In-furrow treatments received pelletized lime with soybean seeds in the furrow.

Proposed budget:

Expenses	2005	2006	2007
Res. Specialist salary (0.3)	\$8,400	\$8,736	\$9,085
Fringe benefits	\$2,100	\$2,184	\$2,271
Supplies	\$1,500	\$1,560	\$1,622
Travel	\$1,000	\$1,040	\$1,082
Total	\$13,000	\$13,520	\$14,061