

# Lime and Tillage Research Project

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## Introduction

Farmers growing corn and soybeans in northwest Iowa have to consider the cost of aglime when liming their soils. This is because of the high limestone cost and the fact that the soils in northwest Iowa have high pH subsoil, which moderates the negative effect of acid surface soils. Another factor that must be considered is the variable mixing of limestone into the soil with different tillage systems. The different amounts of soil mixing between no-till systems, ridge till systems, and conventional tillage systems may affect the amount of limestone needed to correct the soil pH, crop yields, and the needed limestone rate.

## Materials and Methods

An experiment designed to evaluate different rates of aglime with three different tillage systems was established in 1994. The soils in the experimental area consist of Galva, Primghar, and Marcus soils that are typical of the predominant upland soils in northwest Iowa. The initial pH of the surface 0-6 inches in the experimental area was 5.6 in 1993. Results of the first six years of this experiment are shown here.

## Results and Discussion

Soil pH was increased with aglime application in this experiment (Tables 1 and 2). The amount of pH correction occurred mostly at the position the aglime was incorporated into the soil. The no-till and ridge till systems corrected the pH in the top two inches of soil and had little effect on pH at the two- to six-inch level. However, the higher rates of aglime increased the soil pH in the top two inches of soil as well as in the two- to six-inch depth with the chisel plow system.

The experimental area was soil sampled for soil pH in the fall of 1999. However, the results were not available for this report.

Lime application significantly increased soybean yield (Table 3). The application of aglime did not affect corn yields in any year of the study (Table 4).

The average corn yield (first five years) was highest for the chisel plow system (152 bu/acre) versus 146 bu/acre for no-till and 147 bu/acre for ridge-till. The data from 1999 were not analyzed for tillage effect.

Tillage system had little effect on soybean yields with no significant difference when averaged for the first five years. Tillage did affect soybean yields in 1994, when the ridge-till system produced 35.3 bu/acre, which was significantly less than 38.1 bu/acre for no-till and the 38.3 bu/acre for the chisel plow system. Soybean yields from 1999 have not been analyzed for yield effect.

An economic analysis of the first five years of the study indicates that it would take about two soybean crops to pay for the total aglime costs. Information from this experiment shows that low rates of limestone (1,000 or 2,000 lb/acre of ECCE) can increase soybean yields on the short term with relatively small effects on soil pH. It is not known how long higher aglime rates (4,000 to 6,000 lb/acre of ECCE) will be effective in changing soil pH and producing higher soybean yields. It is

interesting to note that the highest aglime rate (6,000 lb/acre ECCE) produced the highest soybean yields and maintained the soil pH above 6.0. Aglime applications also appeared to be effective even when aglime incorporation was minimal (as in shallow cultivation with no-till or deeper cultivation with ridge-till).

**Table 1. Effect of aglime on soil pH, fall 1995.**

Aglime ECCE	No-till		Ridge till		Chisel Plow	
	0-2"	2-6"	0-2"	2-6"	0-2"	2-6"
Lb/acre	-----Mean soil pH-----					
0	5.5	5.9	5.6	5.9	5.6	5.8
500	5.7	5.8	5.8	5.8	5.8	5.8
1000	5.9	5.9	5.8	5.9	6.0	6.0
2000	6.3	5.9	6.2	5.9	6.1	6.0
4000	6.5	6.0	6.6	6.0	6.3	6.1
6000	6.9	6.0	6.7	6.0	6.7	6.2

**Table 2. Effect of aglime on soil pH, fall 1997.**

Aglime ECCE	No-till		Ridge till		Chisel Plow	
	0-2"	2-6"	0-2"	2-6"	0-2"	2-6"
Lb/acre	-----Mean soil pH-----					
0	5.2	5.7	5.2	5.6	5.2	5.6
500	5.5	5.7	5.4	5.7	5.4	5.7
1000	5.5	5.8	5.5	5.7	5.5	5.7
2000	5.7	5.8	5.5	5.6	5.6	5.8
4000	6.2	5.8	6.0	5.8	5.8	5.8
6000	6.6	6.1	6.2	5.8	6.2	6.0

**Table 3. Effect of aglime rate on soybean yield.**

Aglime ECCE	Year						
	1994	1995	1996	1997	1998	1999	Avg.
Lb/acre	-----Bu/acre-----						
0	35.2	42.1	45.7	49.6	44.7	47.8	44.1
500	35.5	44.6	44.7	50.2	44.9	48.4	44.7
1000	38.1	45.8	47.1	54.5	46.5	50.6	47.1
2000	38.2	46.3	47.2	54.1	47.0	49.2	47.0
4000	37.7	46.8	47.6	57.9	46.7	51.5	48.0
6000	38.7	46.6	49.8	57.2	48.4	52.0	48.8

**Table 4. Effect of aglime rate on corn yield.**

Aglime ECCE	Year						
	1994	1995	1996	1997	1998	1999	Avg.
Lb/acre	-----Bu/acre-----						
0	171	144	122	153	152	164	151
500	168	146	126	150	149	163	150
1000	170	145	130	148	152	166	152
2000	170	144	136	148	153	161	152
4000	171	144	128	151	156	162	152
6000	166	146	127	149	154	162	151