View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by University of Kentucky

University of Kentucky
UKnowledge

Soil Science News and Views

Plant and Soil Sciences

1992

Use of Fluorogypsum to Reduce Subsoil Acidity in a Fragipan Soil

Grant W. Thomas
University of Kentucky

Gerald R. Haszler
University of Kentucky

Right click to open a feedback form in a new tab to let us know how this document benefits you.

Follow this and additional works at: https://uknowledge.uky.edu/pss_views

Part of the Soil Science Commons

Repository Citation

Thomas, Grant W. and Haszler, Gerald R., "Use of Fluorogypsum to Reduce Subsoil Acidity in a Fragipan Soil" (1992). *Soil Science News and Views*. 119.
https://uknowledge.uky.edu/pss_views/119

This Report is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in Soil Science News and Views by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE
Lexington, KY 40546-0064

COOPERATIVE EXTENSION SERVICE

Department of Agronomy

Soil Science News & Views

Vol. 13, No. 4

USE OF FLUOROGYPSUM TO REDUCE SUBSOIL ACIDITY IN A FRAGIPAN SOIL

G.W. Thomas and G.R. Haszler

In western Kentucky, there are several million acres of fragipan soils which are characterized by both acid subsoils and fragipans which commence at depths of 20 to 30 inches below the soil surface. The combination of subsoil acidity and a fragipan with massive structure impedes root growth and water movement, diminishing, somewhat, the usefulness of the soils for crop production. Alfalfa, a crop which is very sensitive to soil acidity and to poor drainage, was chosen as a test crop to measure the effects of adding fluorogypsum to Sadler silt loam, a soil representative of the fragipan soils found in the western Kentucky coalfields. Fluorogypsum is a by-product produced from the manufacture of hydrofluoric acid from fluorospar and sulfuric acid. It is composed of calcium, sulfate and water. In addition to supplying nutrients, gypsum has been shown to reduce the level of exchangeable acidity in the subsoil.

The experiment was carried out on a field of Sadler silt loam located on the Western Kentucky Research and Education Center at Princeton, Kentucky. It has a fragipan at a depth of 22 inches and had received no treatments at all for at least 25 years and was covered with a poor growth of fescue. Originally, the pH was 5.5 in the topsoil. The subsoil was even more acid and contained high levels of exchangeable aluminum.

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, handicap, or national origin.

UNIVERSITY OF KENTUCKY, KENTUCKY STATE UNIVERSITY, U.S. DEPARTMENT OF AGRICULTURE, AND KENTUCKY COUNTIES, COOPERATING

The experimental area was plowed, limed at 4 tons per acre with agricultural limestone and fertilized in the fall of 1989 with 200 lbs per acre of P_2O_5 and K_2O on all plots. Alfalfa, variety Apollo, was planted in October, 1989 and, immediately after planting, fluorogypsum was topdressed at rates of 0, 1 ton, 2 tons, and 4 tons per acre. The fluorogypsum was broadcast on the surface by hand. Treatments were replicated four times in a randomized block design. Alfalfa was cut three times in both 1990 and 1991. Late summer droughts in both years severely reduced yields but very good first cuttings were obtained both years. After the first cutting in 1990, the alfalfa was topdressed with 200 lbs per acre of P_2O_5 and K_2O. Both plant and soil analyses were performed both years.

The table below shows the annual yields of alfalfa as affected by gypsum application.

The response to gypsum was much greater in 1990 than in 1991, but the overall yields were considerably lower. For the two-year average the least significant yield difference between treatments was 656 lbs/A. Therefore, the only real difference obtained was between no gypsum and <u>any</u> rate of gypsum. Nevertheless, the tendency is towards higher yields with higher gypsum rates.

Plant analysis of the alfalfa in both 1990 and 1991 showed that the sulfur and calcium levels in the alfalfa changed very little with added gypsum and that no other nutrients were affected by gypsum application. Sulfur contents with no gypsum applied were 0.24 and 0.29% in 1990 and 1991, respectively, and these levels are sufficient for good alfalfa growth.

Soil pH was unaffected by gypsum application and <u>subsoil</u> calcium was affected only slightly. The biggest single effect of gypsum was on exchangeable acidity in the subsoil. In 1990, gypsum reduced exchangeable acidity of the 6 to 12-inch depth by an average of 38%. By the end of 1991, lime from the surface soil had reduced acidity in the 6 to 12 and 12 to 18-inch layers and gypsum at that depth had little effect. In the 18-24-inch layer gypsum was still reducing acidity by about 10%. The mechanism of exchangeable acidity reduction appears to be the association of sulfate with exchangeable aluminum, forming fairly insoluble hydroxy-aluminum sulfate (a kind of alum).

Analyses of data from December 1991, at the conclusion of the experiment showed two interesting trends: First, the majority of both calcium and sulfate supplied in the gypsum had been lost in two years, probably by leaching. This suggests that the gypsum treatment is not very long-lasting. Second, lime applied to the surface soil had affected soil acidity to a depth of 18 inches after two years. Perhaps the longer-term effect of lime and the loss of calcium and sulfate from gypsum help explain why the response of alfalfa to gypsum was lower the second year than it was the first.

Grant W. Thomas

Extension Soils Specialist

COOPERATIVE EXTENSION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE
LEXINGTON, KENTUCKY 40546

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

AN EQUAL OPPORTUNITY EMPLOYER

BULK RATE
POSTAGE & FEES PAID
USDA
PERMIT No. G268

Effect of Fluorogypsum on Alfalfa Yields

Rate of gypsum	Alfalfa Yield, lbs of Dry Matter/Acre		
			Average Yield
Tons/Acre	1990	1991	for both years
0	2842	5660	4251
1	3986	6205	5096
2	3891	6925	5410
4	4510	6495	5502