Liming and Southern Crops: A Working Partnership

By W.R. Thompson and N.R. Usherwood

Soil acidity is an increasing concern in crop production. Correction of this fundamental problem by liming is essential for profitable crop production.

REVIEWS of recent soil testing summaries indicate that the number of samples testing below pH 6.0 is increasing in Southern states, **Table 1**. These continuing drops in soil pH are a concern for optimum crop production and profitability and are due to several factors: crop production economics; reduced lime recommendations; reduced use of lime; continuing use of ammonium nitrogen (N) from legumes, animal and poultry wastes and commercial fertilizers; and less emphasis on liming in educational programs.

Table 1. Percent of samples testing below pH 6.0 for selected southern states.

State	Percent below pH 6.0
Alabama	56
Arkansas	47
Florida	60
Georgia	39
Louisiana	50
Mississippi	58
North Carolina	62
South Carolina	47
Tennessee	46
Kentucky	32

In 1989, a similar review found that the percentage of samples testing below pH 6.0 was 49 percent in Mississippi, 46 percent in Alabama, 36 percent in Arkansas and 50 percent in Florida. One commercial soil test laboratory in the South indicates that 80 percent of all diagnostic soil samples it analyzes have a low pH.

The fundamental value of optimum soil pH in crop production has been recognized and publicized for decades. University research and demonstrations have documented that liming to correct acid soil pH produces the following benefits:

- Increased nutrient availability
- Improved use efficiency of fertilizers
- Increased soil microbial activity

Table 2. Response of crops to liming acid soils.

Crop	State	Soil type	Initial soil pH	Relative yield of unlimed soil,%
Cotton	Mississippi	Silt loam	4.8	50
		Clay	5.1	84
	Alabama	Sandy loam	5.0	18
		Sandy loam	5.0	52
		Sandy clay loam	5.0	99
	Arkansas	Silt loam	5.3	93
Soybeans	Arkansas	Silt loam	5.2	77
	Georgia	Clay loam	4.7	64
	Mississippi	Silt loam	5.1	77
	South Carolina	Sandy loam	5.3	77
Corn	Georgia	Clay loam	4.7	66
		Sandy loam	5.1	86
	Kentucky	Silt loam	5.1	84
	Mississippi	Clay	5.0	81

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Table 3. Relationship of pH, manganese toxicity and cotton yields.

Degree of toxicity	Soil pH	Mn level,ppm	Yield reduction,%
Severe	4.2 to 4.8*	3,000 to 5,000	50 to 100
Moderate	4.6 to 5.1*	1,800 to 3,000	20 to 50
Slight	5.2 to 5.4*	1,000 to 1,800	4 to 20
None	above 5.5	less than 1,000	0 to 4

*Manganese toxicity of greater or less magnitude than indicated may occur within this pH range

- Higher N fixation by legumes
- Reduced toxicity of aluminum (Al) and manganese (Mn)
- Improved soil physical condition
- Improved herbicide activity
- Higher crop yields

Crop yield responses to liming can be spectacular, as shown in **Table 2**. Responses vary as soil conditions vary. University research has also shown that responses to liming can vary with crop varieties and their sensitivity to conditions produced by low soil pH.

MANGANESE toxicity symptoms on cotton may be related to acid soil.

Adverse effects of low pH are strongly affected by increased solubility and availability of Mn and Al, leading to plant toxicities from both elements. The result is reduced plant growth, plant death in extreme situations, and severely reduced yields. The effects of Mn toxicity on cotton yields are illustrated in **Table 3**.

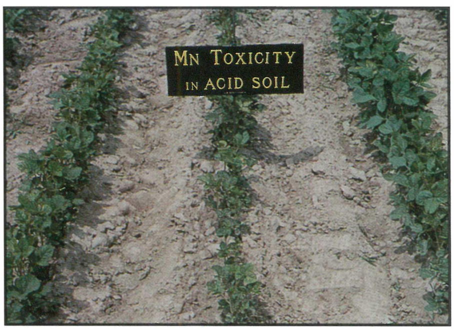
The Solution: Liming

Liming is the only long-term solution to the problems associated with soil acidity. It is economically sound and essential for profitable crop production, including forages. Soil pH must be monitored on a regular basis, through soil testing. Remember, development of soil acidity is a continual process that requires repeated applications of lime over the years.

Soil testing is a dependable tool for measuring soil acidity and determining lime requirements. Soil tests are only as good as the sample, so laboratory sampling procedures should be closely followed to produce the most accurate information.

Conservation tillage systems, particularly no-till, encourage the development

WHEAT in plot at left is exhibiting effects of low pH.



MANGANESE toxicity symptoms on soybeans in acid soil.

Table 4. Soil pH of surface inch after 5 years in no-till.

Nitrogen source and soil pH				
Control	Urea	N sol., 28%	Ammon. nitrate	Ammon. sulfate
6.7	5.9	5.8	5.5	4.7

Pennsylvania

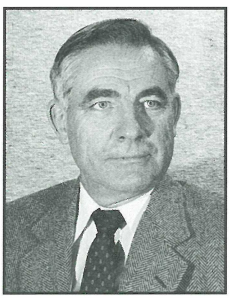
of an extremely acid layer, 1 to 2 inches deep, at the soil surface due to the application of N fertilizers, decomposition of crop residues and little disturbance of this accumulation zone by tillage, **Table 4**. This acid soil zone can depress the effectiveness of herbicides, lower the availability of plant nutrients, and damage roots of emerging seedlings. It is a good idea to monitor this surface soil pH by taking shallow soil samples, about 2 inches deep and to correct the problem by lime applications. The amount of lime needed to neutralize the accumulated acidity may be quite small. Be sure to indicate the shallow sampling depth when these samples are sent to the lab.

Summary

Proper soil pH and profitable farming are a team. If soil pH is extremely acid, soil fertility suffers and farm profits will be lowered. Liming is a capital investment that affects crop production over several years and should be treated as such. Its total cost should not be charged against the first crop after liming.

Acid soil, infertility and low soil pH are problems that seem to be growing in magnitude. The solution to this trend requires increased emphasis on liming . . . and increased use of agricultural lime. ■

Dr. W.K. Griffith Retires as PPI Eastern U.S. Program Director



Dr. W.K. Griffith

DR. WILLIAM K. GRIFFITH of Great Falls, VA, is retiring effective March 4 from his position as Eastern Director for the Potash & Phosphate Institute (PPI). The announcement came from Dr. David W. Dibb, President of PPI.

"Dr. Griffith has been an effective, dedicated and highly respected leader in market development during his many years of service," Dr. Dibb stated. "He will certainly be missed both inside and outside of PPI. His many friends and colleagues join in wishing him continued success."

As Eastern Director, Dr. Griffith coordinated research and education programs for PPI in 14 states in the Eastern U.S. His tireless efforts encouraged greater understanding among university and USDA scientists, agribusiness, and others, helping build sound crop production systems.

A native of Henry, IL, Dr. Griffith earned his B.S. degree from Western Illinois University at Macomb, where he was also an All-American basketball player. He later received his M.S. in agronomy from the University of Illinois at Urbana, and the Ph.D. in agronomy from Purdue University at West Lafayette, IN.

Dr. Griffith served four years in the U.S. Navy as a weather specialist. He later worked as an assistant county agent in Arizona. He joined the staff of the American Potash Institute (now PPI) in 1960.

Through involvement in numerous organizations and associations, Dr. Griffith has contributed in many capacities. He has held several offices in the American Forage and Grassland Council, including a term as President. He received the Agronomic Service Award and the Industrial Agronomist Award of the American Society of Agronomy (ASA). He was elected a Fellow of ASA and of the Soil Science Society of America. Dr. Griffith received a special award from the Virginia Small Grains Association in 1992, recognizing a decade of leadership in improved management for soft red winter wheat production. ■