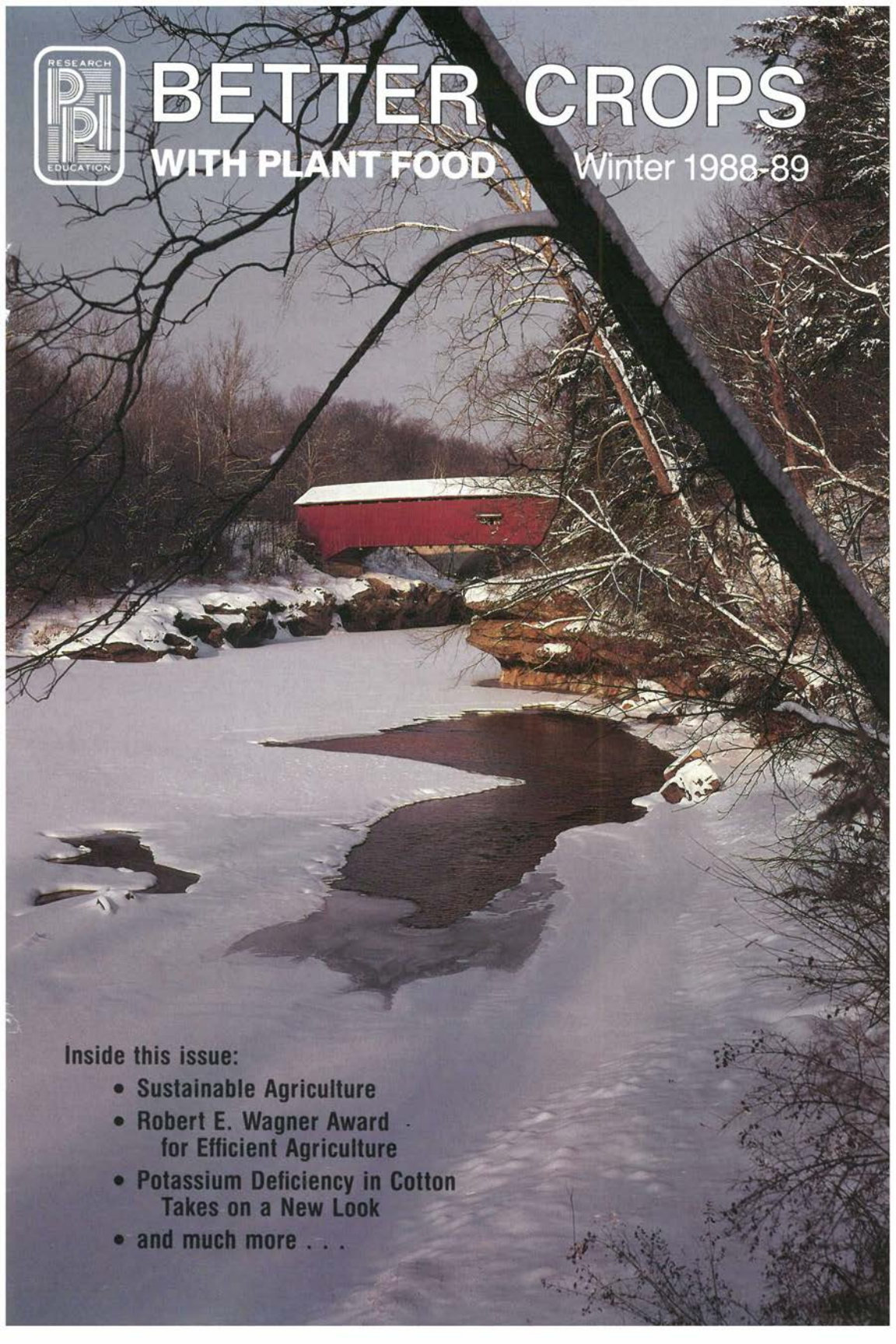

BETTER CROPS

WITH PLANT FOOD

Winter 1988-89

Inside this issue:

- Sustainable Agriculture
- Robert E. Wagner Award for Efficient Agriculture
- Potassium Deficiency in Cotton Takes on a New Look
- and much more . . .

BETTER CROPS With Plant Food

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Our Cover: This winter scene features the Narrows Bridge, built in 1882 over Sugar Creek in Parke County, Indiana.
Photo by J.C. Allen and Son, Inc.

Robert E. Wagner Award for Efficient Agriculture Announced by Agronomy Society

THE AMERICAN SOCIETY OF AGRONOMY (ASA) recently announced the initiation of a new award to be called the "Robert E. Wagner Award for Efficient Agriculture." It is named in honor of Dr. Robert E. Wagner, who retired December 31, 1988, after serving as President of the Potash & Phosphate Institute (PPI) since 1975.

R.E. Wagner

The award, to be administered by ASA and supported by PPI, recognizes the importance of an efficient and competitive agriculture based on sound science and in harmony with environmental and human values. Private or public sector agronomists, crop scientists, and soil scientists are eligible for this award. Criteria include outstanding contributions by individuals or teams whose research, teaching, service, and activities in the past, with emphasis over the last five years, have best served to increase crop yields, quality, and profitability.

Contributions made through the development and integration of appropriate production practices and evaluation of inputs at optimum levels for improving net return for the producer and lowering unit cost for the producer and consumer will be considered.

The focus of this award is on superior leadership and accomplishment in one or more of the following areas:

- better definition or improvement of production potential through research leading to maximum economic yields of crop products;
- implementation of most profitable production systems;
- improvement of production efficiency and crop quality (low unit costs, high quality products, high net return per acre or hectare);
- multidisciplinary research and/or educational approaches;
- determination and evaluation of positive interactions in crop production systems;
- environmental improvements through most efficient production systems.

"The establishment of this award is a fitting and appropriate recognition of the great dedication to efficient production agriculture championed by Dr. Wagner throughout his career," noted Dr. David W. Dibb, new President of PPI. "The ideals and goals of that important philosophy will endure under the banner of this award."

The format for preparation of a nomination for this award is available from the ASA Headquarters Office. The deadline for receipt of nominations is March 1, 1989.■

Sustainable Agriculture

By Myron Johnsrud

The concept of sustainable agriculture has received much attention. This article gives the perspective of the USDA-Extension Service.

RAPID CHANGE characterizes today's world. Nowhere is the impact of this change more dramatic than in American agriculture. Prices of major inputs such as energy and money cannot be effectively predicted from one crop year to the next. In the U.S. we are uncertain who our competitors will be. Yesterday's good customer could be tomorrow's fiercest competitor.

Agriculture can be apathetic and let the effects of change take their course. It can react to change out of fear and without adequate preparation. Or it can choose to focus on a new set of basics: world-class quality and service, increased responsiveness to shifting demands, greater flexibility, and continuous short-cycle innovations and improvements aimed at creating new markets for products and services. This latter approach is the route we in Extension have chosen to take.

The rapidly changing environment of agriculture and rural America led the Cooperative Extension System to address critical issues inherent to this change—through a set of Extension national initiatives. To ensure credibility, Extension involved a broad base of people to identify and prioritize the initiatives.

- Competitiveness and Profitability of American Agriculture
- Alternative Agricultural Opportunities
- Water Quality
- Conservation and Management of Natural Resources
- Nutrition, Diet and Health
- Revitalization of Rural America.

Extension is resolving critical issues included in these initiatives. This effort is altering some of Extension's traditional program planning, development, and implementation process. However, it is essential for maintaining relevance in addressing the sustainability of agriculture and rural America. It is compatible with the best of sustainable agriculture and the concept of maximum economic yield (MEY) or most efficient yield.

What is Sustainable Agriculture?

Sustainable agriculture in its best definition provides an opportunity for U.S. agriculture to objectively evaluate best management practices within the context of profitability, environmental soundness, and social acceptability. It is a systems approach to crop production that optimizes the effectiveness of inputs, including producer management. It is characterized by high yield and low unit costs. In reality, sustainable agriculture is a concept without a succinct definition, but can vary from region to region, even farm to farm, and year to year.

Basically, sustainable agriculture involves those farming systems that maintain and enhance the ability of U.S. agriculture to meet human and environmental needs now and in the future. It is also a production system that is profitable and competitive within the global economy. It protects the environment by reducing soil erosion from wind and water. It keeps pollutants out of surface and groundwater by employing fertilizer and pest management practices that result in optimum crop response with minimum "spillage."

Dr. Johnsrud is Administrator of the Extension Service, U.S. Department of Agriculture.

Many of the technological tools now used to maintain competitiveness and profitability of American agriculture are undergoing significant transition, particularly commercial fertilizers and pesticides. Use of these tools is essential to sustain global competitiveness and profitability of American agriculture. Farmers and ranchers will continue to need flexibility in their use, based on such factors as (1) when and if new tools become available that enable U.S. agriculture to maintain its comparative advantage, (2) what policy strategies the U.S. and other nations use to maintain their agricultures' competitiveness, (3) what world weather patterns will be and how they will affect world food supply and demand and (4) whether or not world population will continue to increase as currently forecast.

To maintain present technologies and incorporate new ones will require the cooperation of farmers and ranchers, land grant and other universities, agribusiness and industry, government agencies, and policymakers. Together they can guarantee the use of agricultural technologies in a manner that meets social and environmental as well as economic goals.

Focusing on Tomorrow

Different scenarios are offered to describe agriculture's future. Some believe that worldwide growth in agricultural production has put food shortages behind us and that the capacity to feed the world now and in the future is adequate. Other people think that our apparently excess production capacity in the U.S. results from exploitation of fragile resources, that our productivity level cannot be sustained, and the food shortages or rising real prices in food and fiber will recur. Both of these scenarios have occurred in the past two decades. In the seventies, we could not produce enough food and fiber. In the eighties, we have had difficulty using what we have. In both periods people have said and believed: "never again."

Whatever the scenario American agriculture will face, effective tools and strategies are needed. They must be responsive to an uncertain and fast-changing political, economic, and physical U.S. and world environment.

". . . farming systems that minimize unit costs, produce targeted outputs, recognize the total resource base on farms, and work with the environment."

Systems approaches to problem-solving, such as MEY, provide the most logical response to these needs. We must view agriculture as a system, become "system smart." **This means being involved in creative interdisciplinary teamwork.** Such teamwork, to improve the future of the nation's agricultural economy, must become the norm, not just the desired state.

Interdisciplinary teamwork presents a major challenge to all segments of American agriculture. They must all cooperate in developing farming systems that minimize unit costs, produce targeted outputs, recognize the total resource base on farms, and work with the environment. Long-term competitiveness and profitability cannot be maintained using farm systems that degrade the productivity of our natural resources. We must work to sustain . . . even build . . . our soil and water resources as we capture their abundance through efficient food production.

Summary

Dramatic, dynamic worldwide change is affecting American agriculture. This change has given rise to several critical issues influencing agriculture and rural America. Solution of these issues and opportunities will allow American agriculture to move toward more competitive, profitable, and sustainable production systems. The success of this move will require a winning strategy in which change is seen as an opportunity, not a problem.

All segments of agriculture will need to take more risks, actively cooperate, develop coalitions, overcome constraints, and make the future positive for the U.S. agricultural economy.■

Potassium Deficiency in Cotton Takes on a New Look

By Richard L. Maples, W.R. Thompson, Jr. and Joe Varvil

Potassium (K) deficiency symptoms in cotton are now occurring first at the top of the plant on new growth instead of on older, mature leaves at the bottom of the plant. This has led to difficulty in visually identifying K deficiency in southern cotton fields. This article describes the advancement of the symptoms and related K concentrations in leaf petioles.

FASHION-CONSCIOUS people like to change their appearance occasionally to avoid the "same old look." Now it seems that cotton plants in some areas are changing their appearance in response to an old problem—potassium (K) deficiency.

The cotton plants are not taking on the "new look" in deficiency symptoms due to any fashion trend. One major reason for the new symptoms may be that the popular cultivars produced today are fast-fruiting and high-yielding, and they need large amounts of K. Also, subsoil levels of K fertility have been depleted in some fields. This may be the triggering mechanism for mid-to-late season signs of the deficiency.

Symptoms of K deficiency in cotton have been well defined for many years

NORMAL COTTON in second week of blooming. Rows on right have received K fertilization for seven years. At this time, July 12, the K concentration in the leaf petiole (fourth leaf from the top) was 6.9%. Rows on the left received no K and had a leaf petiole K concentration of 3.9%.

Professor Maples is Resident Director, Arkansas Soil Test and Research Laboratory, Marianna; Dr. Thompson is Midsouth Director, Potash & Phosphate Institute, Starkville, Mississippi; Mr. Varvil is Research Specialist, Arkansas Soil Test and Research Lab, Marianna.

FIRST SYMPTOMS of K deficiency find the K deficient cotton plants turning a dark green color. Rows on the right are in the check plot. Note dark green color. The top leaves then will become mottled with light green to gold mottling between the veins (inset photo). The leaf petiole K concentration was 1.3%. Rows on the left received K and had a leaf petiole K concentration of 3.1%.

and described by several writers. Examples of widely recognized descriptions are in *Diagnostic Techniques for Soils and Crops,* by J.E. McMurtrey, published by the American Potash Institute in 1948, and in *Hunger Signs in Crops,* by Leroy Donald, published by the National Fertilizer Association and the American Society of Agronomy in 1964. These sources describe K deficiency as "cotton rust."

The first symptom described by these writers was yellowish-white mottling of the older foliage that changes the leaf color to light yellowish-green. Yellow spots begin to appear between the veins, then the centers of these spots die and numerous brown specks occur at the leaf tips, around margins and between veins. The tips and margins break down first and begin to curl.

As the physiological breakdown progresses, the whole leaf becomes reddish-brown, dries and finally becomes scorched and blackened in appearance. Many leaves are prematurely shed. Bolls fail to develop properly and many fail to open or open only partially. The fiber is of poor quality.

These symptoms occur at the bottom of the plant on the lower, older or mature leaves.

In the early 1960s, research plots in Arkansas with Rex variety of cotton had a yellowing of leaves at the top of the plants. In the 1980s, K deficiency symptoms on young cotton leaves at the top of the plants were found in Alabama. In 1985, deficiency symptoms at the top of the cotton plant on new leaves were observed in Arkansas K fertilization studies. This K deficiency was defined in 1986 and reported at several meetings.

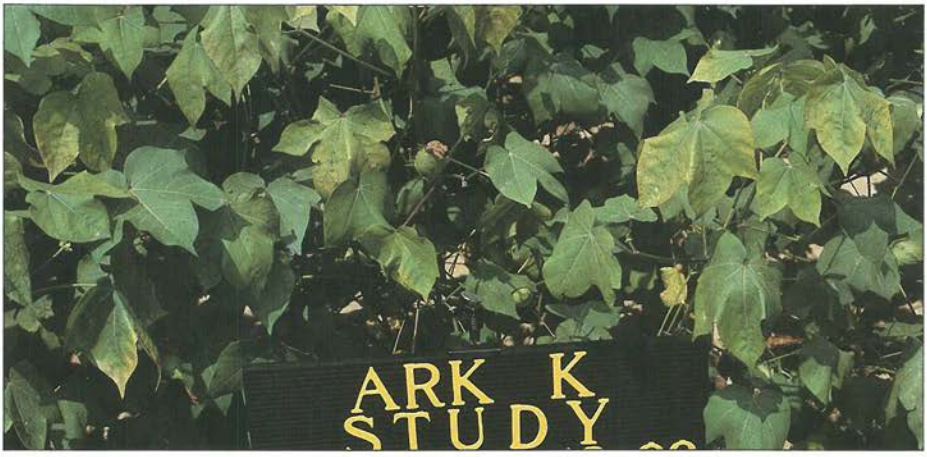
In 1982, a K fertilization study was established by Arkansas Soil Test and Research Lab personnel at the Cotton Branch Station at Marianna. The objectives of the study were to define soil test

(continued on next page)

Deficiency Symptoms . . .from page 7

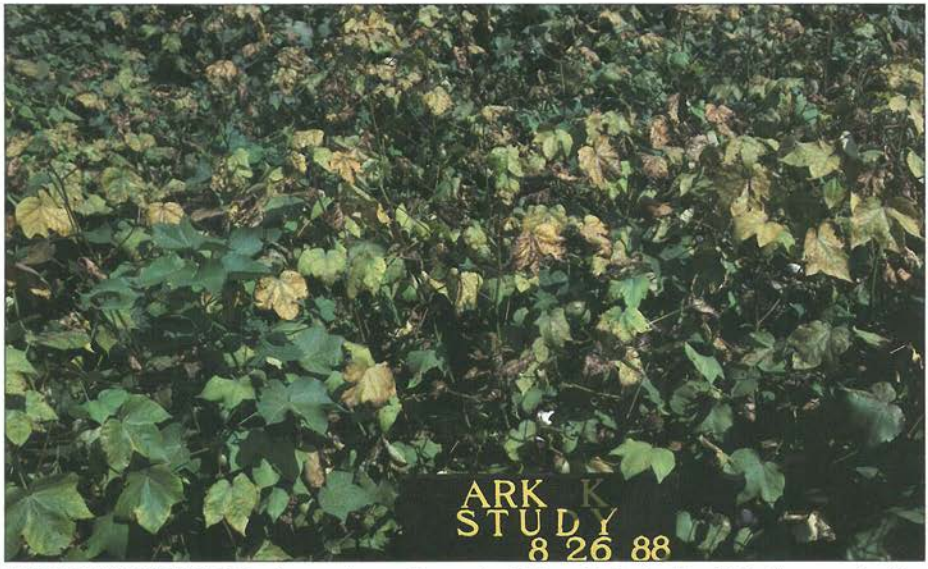
and petiole analysis calibrations for K fertilizer recommendations and critical K levels for K monitoring programs. In 1983, K deficiency symptoms began to appear on young leaves at the top of the plants.

In 1988, leaf petiole K concentrations were taken to document the K deficiency symptoms that occurred at the top of the cotton plants. Color photos also help show this. **While the K deficiency symptoms are similar to the traditional**



THIS PLANT is in the K check plot during sixth week of blooming. Top leaves continue to turn yellowish-green to gold and leaf edges are turning brown. Leaf petiole K concentration was 0.61%. Note that the bottom leaves appear normal.

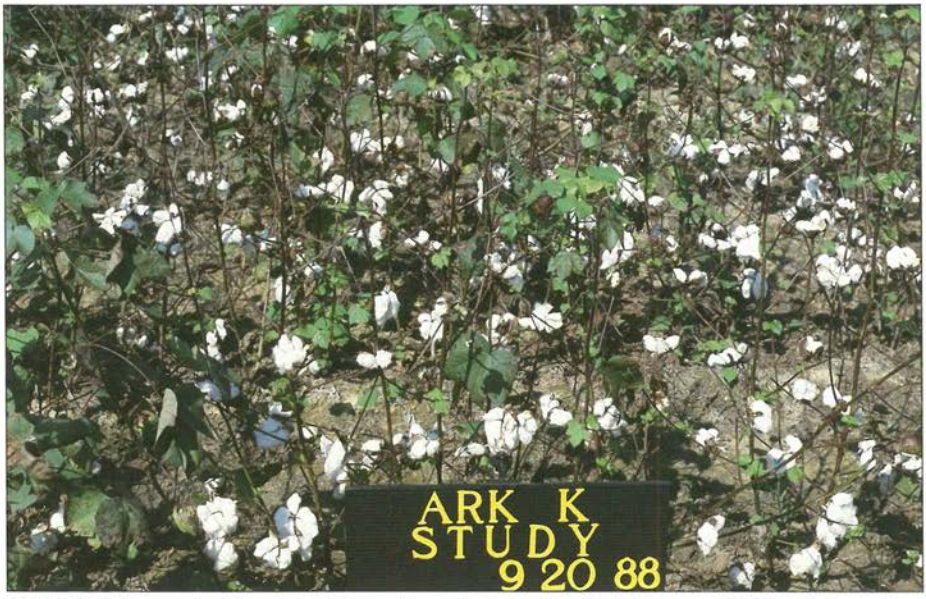
Adjacent K plot received 150 lb/A K_2O each year and had a leaf petiole K concentration of 3.42%. Plants had a normal appearance.



DEFICIENCY SYMPTOMS advance (seventh week of blooming). Leaf petiole K concentration was 0.19%. Top leaves are severely rusted, reddish-brown in color, shriveled and curling. Most bottom leaves still appear normal . . . an adjacent 150 lb/A plot had a leaf petiole K concentration of 2.8%.

symptoms, they occur first at the top of the heavily fruiting plants and progress from younger to the older leaves.

The new appearance of K deficiency in cotton, where the symptoms occur first at the top of the plant, has led to considerable confusion among farmers and professional agricultural workers. This report should help in proper visual identification of K deficiency in cotton, especially when it occurs in mid-to-late season.■



TOP LEAVES are shed in plot with no K applied. Leaf petiole K concentration is less than 0.10%. Bolls are poorly formed. Some normal leaves are still found at the bottom of plants.

For More Information

Reprints of this article (with color photos) are available as an 8½ x 11-inch sheet, front and back. The reprints cost 25¢ each.

A set of color 35 mm slides with printed script is also available on the topic of K deficiency symptoms in cotton.

Cost for the set is $15.00 each (MC* $10.00).

To place an order or to request more information, contact:

Circulation Department
Potash & Phosphate Institute (PPI)
2801 Buford Hwy., NE, Suite 401
Atlanta, GA 30329
(404) 634-4274

*MC indicates Member Cost: For members of PPI, contributors to the Foundation for Agronomic Research (FAR), and to universities and government agencies.

Potassium Improves Cotton Quality and Disease Resistance

By Earl Minton

Potassium (K) improved certain cotton lint quality measurements and reduced incidence of Verticillium wilt and root-knot nematode damage index in Mississippi research.

A POTASSIUM (K) study on cotton was conducted at the Mississippi Delta Branch Experiment Station from 1986 to 1988. The objective was to measure the effects of K on cotton yield, disease incidence, and lint quality. Two current varieties now grown in the Mid-South were included in the study (Des 119 and Stoneville 825).

Cotton varieties now planted in the Mid-South are more determinant than earlier varieties and have a shorter growing season to maturity. The newer varieties fruit heavily and rapidly and mature relatively early.

The K deficiency symptoms that appear on these new varieties are different from those described on the older varieties. The symptoms appear first at the top of the plant instead of at the bottom of the leaf canopy. This has resulted in considerable confusion as to the cause of the yellowing and necrosis of the top leaves of the cotton canopy. (See preceding article.)

The data presented in **Table 1** and **Table 2** represent two-year averages over both varieties and a systemic pesticide (Temik) treatment. The K treatment reduced pathogen incidence and severity and improved certain lint qualities.

Table 1. Effect of K on cotton yield and pathogen incidence.

K_2O lb/A	Lint lb/A	Lint %	gm/100 Seed	Verticillium Wilt Symptoms D1	D2	D3	Root-Knot Nematode Index
0	1,187	38.90	9.20	2.22	6.35	5.87	2.52
100	1,218	38.91	9.60**	1.78**	5.18**	5.29	2.39*

*Significant at 5% level of probability
**Significant at 1% level of probability

Potassium slightly reduced micronaire measurements in 1986, and significantly increased them in 1987. The two-year average response was not significant.

In 1988, K deficiency symptoms were visible in the K check plots on both varieties.

Yield measurements, pathogen severity and lint quality measurements as affected by K are given in the tables.

In 1988, there was a rating for *Verticillium* wilt incidence late in the season (September 13). Variety DES 119 was more resistant to the wilt organism than was Stoneville 825. Wilt incidence was only 6.5% for DES 119, compared to 17.2% for Stoneville 825 variety. The K treatment significantly reduced wilt incidence when averaged across both varieties (17.8% down to 5.9%). There was a positive interaction between variety and K. Ratings are given in **Table 3.**■

Table 2. Effect of K on cotton lint quality.

K_2O lb/A	Micronaire	Fiber Span --Length-- 50%	2.5%	Fiber Elongation E1, %	Fiber Strength gm/Tex
0	3.98	0.51	1.09	7.30	19.98
100	4.05	0.54	1.11	7.40	20.55**

**Significant at 1% level of probability

Table 3. Effect of K on Verticillium wilt incidence. (Measured late-in-season, September 13, 1988.)

Cotton Variety	K_2O Rate, lb/A 0	100
	Wilt incidence rating, %	
DES 119	10.07	3.02
Stoneville 825	25.43	8.87

Interaction of K x variety significant at 1% level

Dr. Minton is Plant Pathologist, USDA-ARS, Cotton Physiology and Genetics Research Unit, Jamie Whitten Delta States Research Center, Stoneville, Mississippi.

PPI Advisory Council Restructured

THE Advisory Council of the Potash & Phosphate Institute (PPI) has been reorganized, with ten individuals named to serve as part of the group. Members of the Advisory Council are all leaders in agronomic research, education, extension or related industry activities.

"The Institute has always put a high priority on maintaining a close bond with agriculture's leaders in the universities, industry, TVA, USDA and other agencies," explained Dr. David W. Dibb, new President of PPI. "The Advisory Council helps to strengthen the unique relationships and programs which PPI staff have had through the years with these groups."

Five of the Council members will serve through 1990. They are: **Dr. D.A. Holt,** Director of the Agricultural Experiment Station and Associate Dean of Agriculture, University of Illinois; **Dr. Thomas A. Kerby,** Extension Agronomist, University of California; **Mr. Henry M. Neutens,** Partner and Vice President, Kent County Fertilizers Ltd. (Ontario); **Dr. E.C. Sample,** Manager of Research, National Fertilizer Development Center-Tennessee Valley Authority; and **Dr. W. I. Segars,** Extension Agronomist, University of Georgia.

D.A. Holt

M.W. Phillips

Also, five other members will serve on the Council through 1992. They are: **Dr. Marvin W. Phillips,** Head, Department of Agronomy, Purdue University; **Dr. Ardell H. Halvorson,** USDA-ARS, Colorado State University; **Mr. John T. Harapiak,** Manager of Agronomy, Western Co-operative Fertilizers Ltd. (Alberta); **Dr. Donald L. Robinson,** Professor of Soil Fertility, Louisiana State University; and **Dr. Joe P. Zublena,** Extension Leader, Soil Science Department, North Carolina State University.

For the coming year, Dr. Holt will serve as Chairman and Dr. Phillips will serve as Vice Chairman of the Advisory Council.■

Werner L. Nelson Award for Diagnosis of Yield-Limiting Factors Announced by Agronomy Society

THE AMERICAN SOCIETY OF AGRONOMY (ASA) has announced the beginning of the "Werner L. Nelson Award for Yield-Limiting Factors." To be presented for the first time in 1989, the award is administered by ASA and supported through a contribution by Dr. Nelson to the Agronomic Science Foundation.

Dr. Nelson retired as Senior Vice President of the Potash & Phosphate Institute (PPI) in 1985.

The format for preparation of a nomination for this award is available from the ASA Headquarters Office. The deadline for receipt of nominations is March 1, 1989.■

W.L. Nelson

C.E. Childers Elected Chairman, J.L. Anderson Vice Chairman of PPI and FAR Boards of Directors

CHARLES E. CHILDERS, President and CEO of the Potash Corporation of Saskatchewan (PCS) was recently elected Chairman of the Potash & Phosphate Institute (PPI) Board of Directors. He will also serve as Chairman of the Board for the Foundation for Agronomic Research (FAR). Mr. Childers had served as Vice Chairman of the two Boards; he succeeds C.C. Williams of IMC Fertilizer Group, whose term as Chairman expired in 1988.

John L. Anderson, President and CEO of Cominco Fertilizers, a division of Cominco Ltd., was elected Vice Chairman of the PPI and FAR Boards.

"We have great enthusiasm toward working with these leaders. They are highly respected and experienced in the industry, and we welcome their cooperation in continued positive efforts for market development through agronomics," said Dr. D.W. Dibb, who became President of PPI January 1, 1989.

C.E. Childers

Mr. Childers was born in West Frankfort, Illinois, and graduated from the University of Illinois with a Bachelor of Science Degree in Mine Engineering. He began his career with Duval Corporation in Carlsbad, New Mexico, and subsequently joined International Minerals & Chemical Corporation (IMC). At IMC, he held various senior positions, including: Vice President & General Manager at IMC's Esterhazy, Canada, Potash Operations, 1977-1979; President, IMC Coal, Lexington, Kentucky, 1979-1981; and Vice President, Potash Operations, IMC, 1981-1982. From 1982-1987, he was Vice President, Expansion and Development,

C.E. Childers

at the IMC Executive Office, Northbrook, Illinois.

In March of 1987, Mr. Childers moved to his current position with PCS in Saskatoon, Saskatchewan, Canada. He was named to the Boards of PPI and FAR in April, 1987.

Currently, Mr. Childers serves as Chairman of Canpotex Limited, the offshore marketing company owned by Saskatchewan potash producers. He has also served on the Board of Saskatchewan Potash Producers Association and in 1987 completed a two-year term as Chairman. He is a member of the Council of the International Fertilizer Association (IFA).

He is a member of the American Institute of Mining Engineers and the Canadian Institute of Mining. In past years he has been active in the New Mexico Mine Association, Saskatchewan Mining Association, Kentucky Coal Association, and the American Mining Association.

J.L. Anderson

Mr. Anderson is a native of Chicago, Illinois. He earned a B.S. degree in chemical engineering and MBA at Northwestern University. In 1984, he attended the Program for Senior Executives at Sloan School of Management, M.I.T.

J.L. Anderson

Mr. Anderson saw active duty in the U.S. Navy Reserve in 1945-46 and the U.S. Army Chemical Corps, 1953-55.

He worked for the George C. Paterson Co., Inc., a petroleum distributor in the Chicago area, from 1955 to 1957, when the company was acquired by Mobil. From 1957 to 1966, Mr. Anderson worked for American Potash and Chemical Corp. in various marketing capacities.

In 1966, he joined Cominco American and moved to Spokane, Washington, as manager of potash sales. Mr. Anderson became President and CEO of Cominco American in 1983. In 1985 he moved to Calgary, Alberta, to assume his current role. He has worldwide responsibilities for Cominco's activities in fertilizers and industrial chemicals. Mr. Anderson became a director of Cominco Ltd. in 1985.

New PPI Directors

Several individuals have been named to the PPI Board of Directors recently, representing member companies of the Institute. The new Directors include: **Robert B. Gwyn** and **Gaynor G. Gremillion,** Agrico Chemical Company; **Fredric W. Corrigan** and **Glen Magnuson,** Cargill, Inc.; **Niven D. Morgan** and **Dean McWilliams,** Cedar Chemical Corporation; **Ken D. Fetrow** and **Robin A. Sommers,** Mobil Mining and Minerals Company; and **C.E. McCraw,** Mississippi Chemical Company.■

B.C. Darst Elected President, New Directors Named to FAR Board

DR. BOB C. DARST of the Potash & Phosphate Institute (PPI) has been elected President of the Foundation for Agronomic Research (FAR). The action came during a recent meeting of the FAR Board of Directors.

Dr. Darst, who had served as Executive Director of FAR, will continue in a dual responsibility as Vice President for Communications at PPI.

"We are pleased that Bob Darst will continue to provide the essential day-to-day direction which the Foundation needs to fulfill its purpose and to attract additional funding," noted Mr. C.E. Childers, Chairman of the Board of Directors for FAR. Mr. Childers is President and CEO, Potash Corporation of Saskatchewan, in Saskatoon, Saskatchewan, Canada.

Dr. Darst, a native of Oklahoma, holds M.S. and Ph.D. degrees from Auburn University in soil chemistry and physical chemistry. He joined the PPI staff in 1973 and was Southwest Director before moving to the headquarters office in Atlanta in 1986. Dr. Darst has been active in professional societies and is well-known among university and industry personnel.

New Directors

In other action, three individuals were elected to serve on the FAR Board of Directors. They are: **A.M. "Gus" Peesker,** Business Manager—Fertilizers, C-I-L Inc., Toronto, Ontario; **Robert Q. Phillips,** President and CEO, Cansulex Limited, Vancouver, British Columbia; and **Dr. Noble R. Usherwood,** Vice President and Southeast Director, PPI, Atlanta.■

James D. Beaton Named Vice President for PPI International Programs as Ken M. Pretty Retires

DR. JAMES D. BEATON was recently appointed to the positions of Vice President for International Programs of the Potash & Phosphate Institute (PPI) and President of the Potash & Phosphate Institute of Canada (PPIC).

The announcement followed the retirement of Dr. K.M. Pretty, who worked in PPI/PPIC international programs for nearly 30 years.

K.M. Pretty

"Dr. Pretty is widely known for his efforts toward increasing international understanding of sound agronomic management. He was a pioneer in establishing contacts in China and other parts of the world," noted Dr. David W. Dibb, President of PPI. "With Dr. Beaton's knowledge and experience, we anticipate a smooth transition in leadership of PPI/PPIC international programs."

Dr. Beaton will be responsible for the development and supervision of all PPI/PPIC international programs, working from the PPIC office in Saskatoon, Saskatchewan.

A native of British Columbia, Dr. Beaton earned his B.S.A. and M.S.A. degrees from the University of British Columbia and gained his Ph.D. at Utah State University. In addition to experience as an Instructor of Soil Science with the University of British Columbia, Dr. Beaton served with Agriculture Canada as a researcher for six years. He worked eleven years with Cominco Ltd., and over five years as Director of Agricultural Research with The Sulphur Institute in Washington, D.C.

J.D. Beaton

Dr. Beaton was appointed Western Canada Director of PPI in 1977. In 1986, he became Vice President of PPIC with responsibility for international research and development programs. In that role he travelled and lectured widely in India, China, Malaysia, Indonesia, and Latin America, as well as directing research and education programs in those countries.

In recognition of his contributions and service to the profession of agronomy and to the fertilizer industry, Dr. Beaton has been elected a Fellow of the American Society of Agronomy, Soil Science Society of America, and the Canadian Society of Soil Science. He has also received other major awards.

A prolific researcher and writer, Dr. Beaton's publications embrace a wide agronomic spectrum including co-authorship of the Fourth Edition of the textbook *Soil Fertility and Fertilizers* (1985) which is used in universities in the United States and Canada. Among his most recent efforts is the definitive *Potash: Its Need and Use in Modern Agriculture* which he co-authored in 1988. The book is currently enjoying widespread circulation in North America and internationally.■

Paul E. Fixen Named to PPI Staff as Northcentral Regional Director

DR. PAUL E. FIXEN has been appointed Northcentral Regional Director with the Potash & Phosphate Institute (PPI). Dr. Fixen will leave a position as Associate Professor in the Department of Plant Science at South Dakota State University (SDSU) in Brookings to begin his new responsibilities in February 1989.

"Dr. Fixen is well-known as a high caliber young scientist. We are quite fortunate and proud that he will bring his talents to work in furthering the research and education program of the Institute," said Dr. David W. Dibb, President of PPI. "Dr. Fixen will give added strength to our efforts in the Upper Midwest and Northern Plains, a key region for agronomic market development."

States included in Dr. Fixen's new region are Minnesota, Iowa, North Dakota, South Dakota and Montana. Dr. Larry Murphy, who previously served the Dakotas and Montana for PPI, was recently named Vice President for North American Programs and is located in Manhattan, Kansas. Dr. Harold F. Reetz, Jr. had served Iowa and Minnesota in recent years and will now work primarily in Illinois and Wisconsin.

Dr. Fixen is a native of Minnesota. He received his B.S. and M.S. degrees at SDSU in Agricultural Education and Soil Fertility, respectively. He earned his Ph.D. degree at

Paul E. Fixen

Colorado State University in 1979 with a specialization in soil fertility, plant nutrition and soil chemistry.

Dr. Fixen's research program has emphasized tillage-fertility interactions, phosphorus placement, plant analysis interpretations and the role of chloride in crop production. He has served as major professor for a number of graduate students and has instructed several courses at the undergraduate and graduate level relating to soil fertility-plant nutrition. Recent recognition of his contributions include the 1988 Great Plains Soil Fertility Leadership award and the American Society of Agronomy Crops and Soils Journalism award.

Dr. Fixen, his wife Nancy, and their two sons will continue to reside in Brookings, South Dakota. Dr. Fixen will have an office in Brookings and may be contacted at this address: P.O. Box 682, 305 5th Street, Brookings, SD 57006.■

North Central Soil Fertility Workshop Proceedings Available

PROCEEDINGS of the 18th North Central Extension-Industry Soil Fertility Workshop are available from the Potash & Phosphate Institute (PPI), 2805 Claflin Road, Suite 200, Manhattan, KS 66502.

The Workshop is an annual opportunity for researchers, extension workers and agricultural industry personnel to be updated on the latest soil fertility research from the North Central region of the United States and neighboring areas of Canada.

Copies of the Proceedings cost $8.00 each, including postage and handling. Checks should be made payable to: "NC Ext-Ind Workshop."■

Fertilization Practices Are Important in Growing Vegetables for Processing

By Nathan H. Peck

Production of high-yielding, high-quality vegetables for processing requires adequate availability of nutrients. This article summarizes findings of New York studies.

A SUCCESSFUL SYSTEM of growing vegetables for processing includes several important factors:

- Produce a profitable crop at all harvests over the course of the growing season.
- Supply predictable and reliable raw products with high quality for continuous processing during the entire season for the processors.
- Provide consistent wholesome, nutritious, and high quality food for the consumers.
- Maintain or improve soil productivity and the environment.

The fertilization portion of this production system must be planned to meet the specific needs of the crop during three phases of growth: (1) seedling establishment, (2) vegetative frame growth and root expansion, and (3) development and maturation.

A major requirement in growing vegetables for processing is to achieve uniform and vigorous seedling establishment which leads to uniformity among the plants at harvest for once-over mechanical harvesters. Consistent production of both yield and quality is needed—not erratic cycles of low and high yields and quality. Low yields will not use the full capacity of the processing facilities, while excessive high yields waste raw produce beyond the capacity of the processor. To achieve the desired results from fertilizer practices, the amount, balance, form and timing of nutrient applications must be considered.

Fertilizer Requirements: A General View

Table 1 shows a portion of the results we have obtained with growing processing vegetables at various rates of phosphorus (P) and potassium (K) over a number of years at Geneva, New York.

Vegetables harvested for reproductive portions (snap beans and sweet corn) were most responsive to P. Those harvested for vegetative or root portions (cabbage and table beets) were more responsive to K. This was most striking when the other nutrients and production inputs were adequate for good yields.

Table 1. Response of vegetable crops (for processing) to various rates of P and K.

Annual Rate P_2O_5	K_2O	Table Beet Roots	Cabbage Heads	Sweet Corn Ears	Snap Bean Pods	Broccoli Heads	Cauli-flower Heads	Brussels Sprouts
-----lb/A-----		----------Yield (1,000 lb/A)----------						
0	0	19.9	17.0	10.3	6.1	2.1	5.6	14.3
35	35	20.8	38.0	13.0	8.7	5.3	13.1	18.6
140	0	12.7	28.0	13.0	8.0	3.1	4.6	16.1
0	140	24.0	31.0	12.1	8.6	3.9	15.2	19.3
140	140	30.9	50.0	16.2	11.0	8.1	15.2	20.9
560	560	43.0	52.0	15.5	9.5	7.0	18.2	17.1

New York

Dr. Peck is with the New York State Agricultural Experiment Station, Geneva, New York.

The general conclusion over these many years of research is that adequate P and K rates (in this case 140 lb/A P_2O_5 and 140 lb/A K_2O) give consistently good yields, maintain soil tests, use nitrogen (N) and other inputs most efficiently, have consistent quality ratings, and reduce the possible environmental problems of using low or excessive fertilizer rates.

Adjustments and Timing in Fertilizer Management

A vegetable fertilizer program should be preplanned. But it must be flexible and adjustable to the plant responses from preceding applications, erratic weather and growth of the crop. A sequential fertilizer management system should be used to provide adequate nutrients from planting to maturity. The dry weight accumulation of vegetables and the corresponding uptake of nutrients continue rapidly from mid-season and up to harvest maturity. **Figure 1** shows P uptake by snap beans over the growing season.

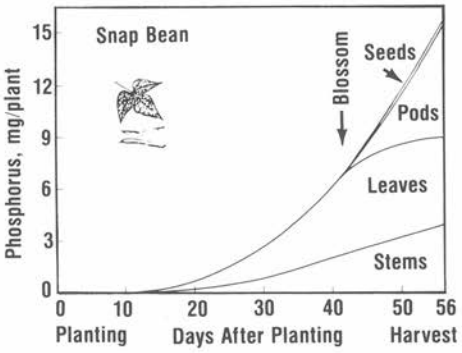


Figure 1. Uptake of P by snap beans during the growing season (New York).

Preplant applications of fertilizers, especially P and K, should be applied according to soil tests and to the estimated nutrient requirement of the vegetable to be grown. Deep applications of preplant fertilizer promote large and deep rooting systems.

Banded application of fertilizer should be adjusted to the soil conditions at planting time and to the responsiveness of each crop. Application of a low rate of a complete, balanced, and nonphytotoxic source of nutrients at planting time consistently promotes establishment of vigorous uniform seedlings. Strong seedlings furnish the foundation leading to uniformity among plants for once-over mechanical harvesters.

Banded fertilizer helps the vegetable seedlings obtain adequate nutrients from a limited rooting zone. This is especially important if the soils are cold and/or wet. The band should be placed two inches below and two inches to the side of the seed. Closer placement may result in injury to the germinating seed while placement farther away might delay seedling response and cause uneven seedling growth.

Sidedress applications, especially N, during the growing season should be adjusted to plant growth and to the yield potential of the vegetable crop in mid-season as the result of previous management or growing conditions. Sidedress fertilizer helps assure continued late season growth (especially for table beet, cabbage, and sweet corn plants). It also improves utilization of available P and K supplies. The result is a more satisfactory yield level and higher quality vegetables for the processor and consumer.

Soil Productivity and the Environment

Vegetable crops need adequate, available nutrients within the rooting zone in order to produce reliable yields with consistently high quality. The available nutrients come from residual nutrients in the soil and/or applications of fertilizer. Fertilization with P and K should be adjusted to P and K soil tests. The residual nutrients must be maintained within the fields by well-planned preventative soil and water conservation methods. Such conservation plans help prevent nutrient losses to the environment surrounding the production field, such as nitrate by leaching or P by erosion.

Vegetable growers should consider use of living cover crops with active rooting systems, planted after the vegetables are harvested. Cover crops take up the available nutrients and hold them for the following crops. Also cover crops add active organic matter to the soil to improve the structure for better seedling establishment.■

A Look at 75 Years of Fertilization and Cropping

By C.C. Mitchell, Jr.

Plots with continuous plant nutrient and legume nitrogen variables have been maintained for more than 75 years by the Alabama Agricultural Experiment Station. This study is commonly known as the "Cullars Rotation."

"MIX THREE PARTS dried blood, two parts kainit and one part superphosphate . . . " This was a standard fertilizer treatment back in 1911 when agronomists at Alabama Polytechnic Institute (now Auburn University) established what is now the oldest continuous soil fertility study in the South—the "Cullars Rotation." The three-year rotation has always included cotton, corn, and a summer legume, but the type of summer legume has changed from cowpeas to crotalaria to soybeans. Vetch and crimson clover follow cotton, and a small grain crop follows corn.

However, the real value of the Cullars Rotation (named for the farm where it is located) is its continuous plant nutrient and legume nitrogen (N) variables. Plots exist which have received no fertilizer at all, no micronutrients, no sulphur (S), no legume N, no fertilizer N, and phosphorus (P) and potassium (K) variables.

Treatments have been modified five times since 1911; the last modification was in 1967. The experiment provided the basis for early fertilizer recommendations to Alabama cotton farmers, and it still is a valuable research and teaching site. Within a half mile of the classroom, students and visitors can observe nutrient deficiencies on five different crops during a year: (1) cotton, (2) vetch and crimson clover, (3) corn, (4) rye, and (5) soybeans. In the spring, each of the three blocks is planted to one of the three main crops in the rotation: cotton, corn, and soybeans. Soybeans are planted after harvesting rye for grain.

The Coastal Plain soil was originally mapped as Norfolk loamy sand, but is now identified as Marvyn loamy sand (fine-loamy, silicieous, thermic Typic Hapludult). Soil from these plots is frequently used in greenhouse and laboratory studies and exchanged with researchers throughout the region.

Long-term yields of cotton, corn, and soybeans in the treatment that is now the "standard N-P-K" are shown in the graph. The most obvious trend in cotton yields during the 75-year period was the decline from 1937 through 1954 when only 38 lb/A of N and no P or K was applied to this treatment.

There was a steady increase in cotton and corn yields from 1955 to 1966 when P and K applications were resumed and the N rate was increased to 120 lb/A for both cotton and corn. Also during this period, an improved variety, "Auburn 56," was used along with better insect control. The decline in cotton yields during the 1970s may be the result of poor insect control in years following the loss of DDT in 1972. The advent of synthetic pyrethroids in the late 1970s resulted in another improvement in cotton yields. The no P and no K plots resulted in only 61% and 24% average relative cotton yields, respectively, over the past 12 years.

Rainfall distribution is the most critical factor in corn production on these sandy, upland, Coastal Plain soils.

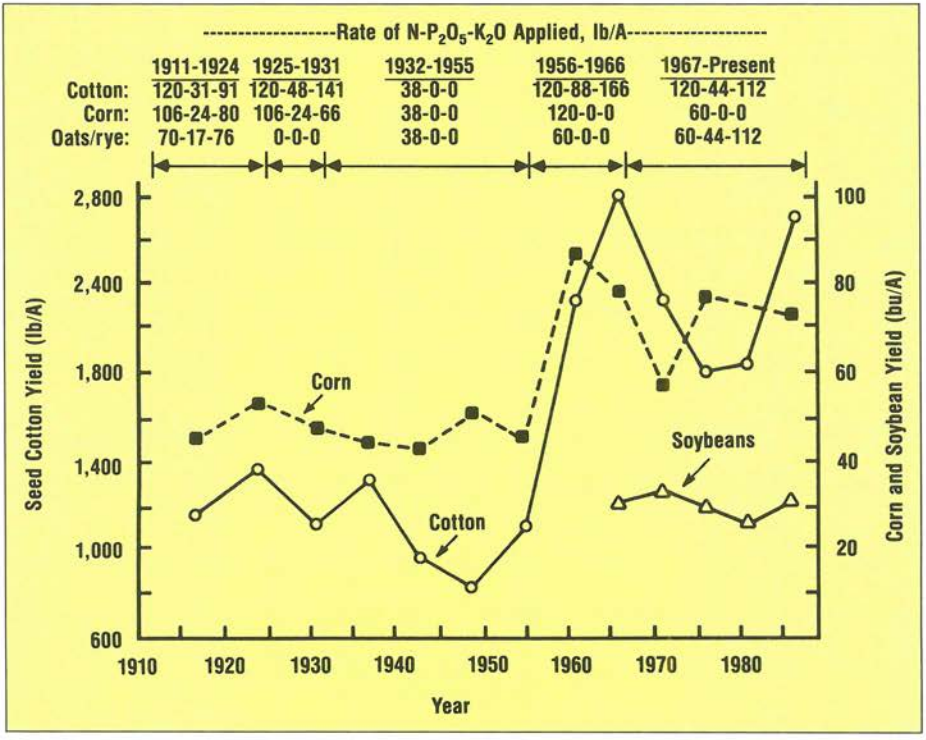
Dr. Mitchell is Extension Agronomist-Soils and Assistant Professor, Department of Agronomy & Soils and Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama.

Corn is generally planted in mid-to-late April in this test because it follows the winter legume. This is 3 to 4 weeks later than ideal. The highest corn yield recorded on this treatment was 126 bu/A in 1982 with an average of 63 bu/A. The no P and no K plots have resulted in only 31% and 43% average relative corn grain yields, respectively, over the last 12 years.

Soybeans have been grown since 1962 and have produced very consistent yields in the 3-year rotation. The highest was 57 bu/A in 1967 and the lowest was 14 in 1980 with an average of 30 bu/A.

Some notable, recent observations include the following:

- Highest yields of all crops (except rye) are on plots receiving micronutrients. Cotton response is to boron. The average relative yield where micronutrients were applied was 104% of the standard treatment with no micronutrients.
- Winter legumes provided adequate N for the following corn crop. These low average yields are common for unirrigated corn in Coastal Plain soils. Nitrogen provided by legumes is about the same as fertilizer N (120 lb/A).
- The "no legume" treatment has significantly reduced average soybean yields, probably due to lower soil organic matter and its effect on soil structure, moisture retention, and soil microbial populations.
- Potassium appears to be the most limiting (lowest yields) single nutrient for cotton, whereas P is most limiting for other crops in the rotation.
- Only cotton yields were significantly lowered by the "no S" treatment.
- NPK with no lime resulted in an extremely low soil pH (4.1) but higher average yields than the "no lime/no fertilizer" treatment.
- Extremely high soil P from continuous applications of rock phosphate has had no detrimental effect on yields.■



Yields of seed cotton, corn, and soybeans on the "Standard N-P-K" treatment of the Cullars Rotation over 75 years. Each point is a 5-year average yield.

Diseases, Insects, and Nitrogen Rates Affect Soft Red Winter Wheat Management

R.K. Bacon and B.R. Wells

Results from three years of studies point to some of the management requirements and interactions of inputs for high yields of wheat in the Mid-South.

CONSIDERABLE EMPHASIS has been placed on optimizing wheat yields in recent years. Warm, humid weather conditions during grain filling in the Mid-South tend to promote foliar disease development and limit kernel filling. Relatively mild winters can also provide for proliferation of harmful insects.

Recently, we studied the effects of disease, insects, cultivars and nitrogen (N) nutrition on yields of wheat under these climatic conditions in Arkansas. Studies were conducted for three years (1985-87) at three locations: the Rice Research and Extension Center at Stuttgart, on a Crowley silt loam; the Northeast Research and Extension Center at Keiser, on a Sharkey clay; and the Vegetable Substation at Kibler, on a Roxana silt loam.

Cultivars used in the studies included four pure-line cultivars and two hybrids: McNair 1003, Coker 983, Saluda, Caldwell, HW 3015, and HW 3021. Also included in the studies were treatments with and without a foliar fungicide (Tilt, from Ciba-Geigy); with and without an insecticide (Furadan 4F, from FMC Corp.); and four rates of N fertilizer applied in the spring (60, 100, 140 and 180 lb of N/A). All cultivars were treated with a fungicide seed treatment, and all plots received 30 lb N/A in the fall. Soil samples were taken yearly at each location and fertilizer was added if needed to insure sufficient levels of all elements except for N.

The study was designed to allow an evaluation of interactions among these inputs. Grain yields were the criteria used for evaluation; however, we also noted the incidence of insects and diseases as influenced by the treatments. Addition of Furadan (fall and spring treatments) resulted in increased grain yields at six of the nine locations/years of the study **(Table 1).** Most of the response was measured in 1986 and 1987 with only one location having a yield response in 1985. At those locations where the addition of the insecticide resulted in increased grain yields there was a differential response among the wheat cultivars. Coker 983 showed very little response to the insecticide, indicating that it may be more tolerant to insect infestations; however, it also tended to be relatively lower yielding than the other cultivars in the tests which may have partially masked its response to the insecticide.

Table 1. Wheat yields as influenced by application of insecticide (Furadan).

	Year			3-Year
Insecticide	1985	1986	1987	Mean
	----------bu/A----------			
Yes	69	69	76	72
No	68	61	71	67

Addition of the foliar fungicide Tilt at Feekes' growth stage 9 (early booting) resulted in increased grain yields at all locations for all three years of the study **(Table 2).** The magnitude of this response varied with location and year. There were also differences among cultivars; however, these differences also varied with location and year with no obvious trends among the cultivars.

Dr. Bacon is Assistant Professor and Dr. Wells is Professor, Department of Agronomy, University of Arkansas Division of Agriculture.

Table 2. Wheat yields as influenced by application of fungicide (Tilt).

Fungicide	Year 1985	1986	1987	3-Year Mean
	----------bu/A----------			
Yes	75	68	77	73
No	62	62	70	65

Yields of the cultivars also varied by location and year. Averaged across locations **(Table 3)** there was a trend for McNair 1003, HW 3015 and HW 3021 to consistently produce the highest yields. Saluda produced yields similar to these three cultivars in 1985 and in 1987; however, its yields were lower than the other cultivars in 1986. Conversely, Caldwell produced yields similar to McNair 1003, HW 3015 and HW 3021 in 1986 but not in 1985 and 1987. Coker 983 tended to be in the lower yielding group of cultivars in each year of the study.

Table 3. Wheat yields as influenced by cultivar and year.

Cultivar	Year 1985	1986	1987	3-Year Mean
	----------bu/A----------			
McNair 1003	72	65	76	72
HW 3015	71	70	75	73
HW 3021	70	66	73	70
Coker 983	68	61	72	67
Saluda	69	62	77	70
Caldwell	61	67	67	65

Grain yields as influenced by spring N rate are shown in **Table 4.** Increasing the N rate from 60 to 100 lb/A tended to be associated with only slight yield increases at most locations; however, yields decreased at N rates above 60 lb/A at the Vegetable Substation (data not shown). There were also fungicide-by-N-rate interactions for yields at several of the test locations. In these instances, as N rates increased, there was a greater yield response to the fungicide application. This indicates that excessive N rates were rendering the wheat more subject to disease infection and thus increasing the need for a fungicide.

Table 4. Wheat yields as influenced by spring N rate and year.

N-rate	Year 1985	1986	1987	3-Year Mean
lb/A	----------bu/A----------			
60	67	64	73	68
100	69	65	75	70
140	70	65	73	69
180	69	66	72	69

In these studies, diseases were the major factor limiting wheat yields. However, insects also limited yields at some locations and years. Nitrogen applied at recommended rates appears to be adequate to optimize yields, whereas, rates above those recommended resulted in only small or no yield increases and tended to increase the need for the addition of a fungicide.

Based on the limited number of cultivars included in this study, there are a number of pure-line and hybrid cultivars capable of producing reasonably high yields of wheat in the Mid-South provided diseases and insects are controlled and N fertility is managed correctly.■

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PPI Appoints Kathy Hefner as New Editorial Assistant

Kathy Hefner

THE Potash & Phosphate Institute (PPI) has appointed Kathleen (Kathy) Hefner as Editorial Assistant in the organization's headquarters office in Atlanta. She will work with various responsibilities involving the Institute's communications effort related to agronomic research and education.

"With her background and experience in personal computer applications and related software programs, Mrs. Hefner will help us streamline the preparation of various print media materials," noted Dr. Bob C. Darst, PPI Vice President for Communications.

Mrs. Hefner attended Capital University in Columbus, Ohio, and graduated in 1969 with a B.S. in Education. She has worked as a public school teacher, and with the college loan and grant office of a financial institution. Most recently, she was employed with a data communications distribution company.■

Susie Bushman Retires

Susie Bushman

MRS. Selma (Susie) Bushman, formerly Assistant Editor for PPI, retired at the end of 1988 after nearly 40 years of service with the organization.

A native of North Carolina, Mrs. Bushman began working for the Institute in 1950. She and her family live in the Atlanta area.■

Eugene D. Dixon Retires

Gene Dixon

AFTER more than 50 years of dedicated service, Eugene D. Dixon has completed his tenure with PPI. He began in 1937 and worked in several responsibilities for four different presidents of the Institute.

Although Mr. Dixon officially retired as Assistant Treasurer in 1986, he had continued on a part-time basis through 1988. A native of Maryland, Mr. Dixon and his family live near Stone Mountain, Georgia.■

"Advances in Fertilizer Technology and Use" Symposium Proceedings Available from PPI

PROCEEDINGS of the 25th Anniversary Symposium, "Advances in Fertilizer Technology and Use," of Division S-8 of the Soil Science Society of America are available from the Potash & Phosphate Institute (PPI), 2801 Buford Highway, N.E., Suite 401, Atlanta, GA 30329.

The contents of this volume should be of significant interest as an update on current fertilizer technology and use from manufacture to application to plant uptake.

Copies of the Proceedings cost $7.00 each, including postage and handling, in the U.S. and Canada. For individual copies to other countries, the cost is $10.00. Checks should be made payable to: "Potash & Phosphate Institute (PPI)."■

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The Land

"Land is the only thing in the world that amounts to anything, for 'tis the only thing that lasts..."
—Gone with the Wind

There are fewer and fewer people who have experienced the pleasures and the difficulties of working the land. And, too often, farm policies and practices are dictated by non-farmers.

Farming must be close to nature. Nature is wonderful, but treacherous. As we have learned to use and harness nature, farm life has become physically easier and more rewarding.

Newer farm machinery is a blessing. So are farm chemicals and improved varieties. All are designed to help nature. Yes, nature needs help. We have been blessed with great scientific discoveries in this century that improve human health, fight human and plant diseases, and produce livestock and bountiful crops of high quality.

It's hard to imagine this country without antibiotics, shining hospitals—or farm chemicals. We don't want to go back to patent medicines and polio, or mules and manure, or boll weevils and other bad bugs.

Yet, some have the impression that scientific farming will lead to greater soil erosion, to water contamination, to pollution in general, and even to reduced farm income. Not so! In fact, the opposite should be true.

The advances in scientific farming have **increased** our ability to conserve soil and water. Fortunately, when the farmer produces his product at the **M**ost **E**fficient **Y**ield **(MEY)** level, he is, at the same time, providing the greatest conservation of land and water.

How fortunate! MEY allows us to produce all our needs on lands we **should** cultivate, and thus put areas most subject to erosion into soil conserving crops.

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