Yield response to P & K fertilizers over landscapes

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University of Missouri, Plant Sciences Division and MU Extension

Objective & Relevance:
The objective of this project is to measure grain crop yield response to P and K over landscapes and identify factors that favor response. Soil tests are currently used as the main tool to predict response, but we know that many other factors are involved.

This project is relevant to Missouri agriculture because fertilizer is a major crop input whose price has fluctuated dramatically in recent years. Adequate P and K nutrition is crucial for optimizing yields, but unneeded applications have negative effects on profitability and on the environment. Currently soil testing is the main (and nearly the only) tool for targeting applications of P and K fertilizer. We think we can Widely available yield monitoring technology will allow us to work with producers to measure crop response to P and K and identify the factors contributing to that response.

Procedures:
- We will target working with three producers each year.
- An effort will be made to work with producers in different regions of the state in order to make results applicable to different regions.
- Our basic procedure will be to install field-length strips with and without P & K fertilizer, then analyze yield monitor data to quantify and localize the yield responses to P & K.
- We have tried this at the pilot scale with a single producer this year. In this case P and K were placed in a subsoil band in February, but four strips were left with no P or K (see field map below). Colored areas show where P & K were applied, and the four white strips are the ones left without P & K. Strips were 16 rows wide. Corn yields in this field were excellent for the Nevada area, averaging over 160 bushels/acre.
- By subtracting yield with P & K from yield in the adjacent strip(s) without P & K, we can measure yield response to P & K. Numbers on the field map indicate corn yield response to P & K (in bushels/acre).
- Responsive areas at the north end of the field were not different in yield, pH, or soil test P or K from non-responsive areas.
- A soils map shows that the soils in the responsive areas were derived from sandstone, while soils in the rest of the field were derived from shale.
Current status and importance of P & K response over landscapes:
- Soil testing is currently used as nearly the only variable to predict where fertilizer response will occur.
- We know from the calibration research on which the soil tests are based that the range of possible yield responses is wide within each soil test category.
- We also know that there are other factors influencing nutrient availability to crops, including water relations, soil oxygen, mineral content of the soil, soil organic matter, soil pH, root growth, and so on.
- Measuring response over a range of landscapes should help us to identify which of these other factors are important in determining crop response to P and K.

Timetable:
- **February 2010**: Locate cooperating producers.
  - Plan side-by-side strips with and without P & K.
- **March 2010**: Apply side-by-side strips with and without P & K.
- **April-May 2010**: Plant corn or soybean.
- **June-July 2010**: Scout field trials, take notes and photos. Note GPS locations of any important notes or photos.
- **Sept-Oct 2010**: Harvest.
- **Nov-Dec 2010**: Analyze data, identify locations of significant yield response and factors that differentiate them from non-responsive areas.
- **December 2010**: Progress report.
- **Feb '11-Dec '11**: Repeat Feb ‘10-Dec ‘10 tasks
- **December 2011**: Final report.
- **Jan-Feb 2012**: Develop educational programs, present results at Extension meetings.

Strategy for application/transfer of knowledge:
- Written and oral (presentation) educational materials will be developed to promote understanding and application of results.
- Written materials will include newsletter and farm press articles and possibly guidesheets.
- Presentations will be used in Extension meetings, sent to regional Extension Agronomists for their use, and shared with anyone who requests them.
- Results will be posted on the University of Missouri Nutrient Management website.
## Budget:

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<th>Category</th>
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<td></td>
<td>2010</td>
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<tr>
<td>labor and benefits for setup and scouting</td>
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<td>labor and benefits for data analysis</td>
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<td>field supplies and fuel</td>
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<td>TOTAL</td>
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2-year total budget $30,000
Peter Clifton Scharf
Professor and Nutrient Management Specialist
Plant Sciences Division
210 Waters Hall
University of Missouri
Columbia, MO 65211

Research and Extension education interests
- developing, evaluating, and promoting tools to predict crop N needs, including variable-rate N management
- evaluating N management alternatives including source and timing
- minimizing environmental impacts of agricultural nutrients
- coordinated management of soil, fertilizer, and manure nutrients
- tailoring fertilizer and lime recommendations to account for soil properties
- economic comparisons of production alternatives

Education

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<th>Degree</th>
<th>Date</th>
<th>Institution</th>
<th>Major</th>
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<tr>
<td>Ph.D.</td>
<td>May 1993</td>
<td>Virginia Polytechnic Inst. and State University</td>
<td>Crop &amp; Soil Environmental Sciences</td>
</tr>
<tr>
<td>M.S.</td>
<td>July 1988</td>
<td>Virginia Polytechnic Inst. and State University</td>
<td>Agronomy</td>
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<tr>
<td>B.S.</td>
<td>August 1982</td>
<td>University of Wisconsin</td>
<td>Biochemistry, Genetics</td>
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Recent Research Publications

Recent Extension Publications


SUMMARY OF QUALIFICATIONS

- Have a practical knowledge of agricultural production.
- Have developed educational programs with the goal of improving agricultural profitability.
- Have a good ability to work with others.
- Take pride in a job well done.
- Willing to learn, so as to broaden my knowledge as an agricultural engineer.

RELEVANT EXPERIENCE

Helped Missouri citizens turn knowledge into know-how as a Regional Extension Agricultural Engineering Specialist.

Served as Associate Director of the Missouri Precision Agriculture Center.

Worked along with my dad and brother on the family farm.

EMPLOYMENT HISTORY

2008 to present
University of Missouri Extension Natural Resource Engineering Specialist, University of Missouri System-Boone County, Columbia, Missouri

1998 to 2008
Associate Director of the Missouri Precision Agriculture Center, University of Missouri-Columbia, Columbia, Missouri

1992 to 1998
University Outreach and Extension Agricultural Engineering Specialist, University of Missouri System-Adair County, Kirksville, Missouri

1991 to 1992
Graduate Student
University of Missouri-Columbia, Missouri

Summer of 1990-1991
Extension Associate
University of Missouri-Portageville, Missouri

Summers of 1987, 88 and 89
Brush Crew Laborer
Macon Electric Cooperative-Macon, Missouri

1982-90
Helped work on family farm
Larry Shannon Farms-Anabel, MO
EDUCATION

M.S., Agricultural Engineering, University of Missouri, May 1993
B.S., Agricultural Engineering, University of Missouri, December 1990

PROFESSIONAL AND COMMUNITY INVOLVEMENT

American Society of Agricultural Engineers, served as President, Vice President, Secretary, and Parliamentarian of the Student Branch-University of Missouri. Honored at Mid-Central Conference in the Student Paper Contest 1990. Honored as Young Member of the Year of the Missouri Section of the American Society of Agricultural Engineers 1997. Honored as with the Achievement Award from the Missouri Agriculture Extension Professionals 2001.

Member of Ten Mile Baptist Church, Anabel, MO, served as Sunday School Superintendent for 5 years.

Selected Publications


Abstracts and Professional Presentations


Extension Publication Guidesheets
Precision Agriculture: Yield Monitors (WQ 451)
Casady, W.W., D.L. Pfost, C. Ellis, and D.K. Shannon
http://extension.missouri.edu/explore/envqual/wq0451.htm

Precision Agriculture: Global Positioning System (GPS) (WQ 452)
http://extension.missouri.edu/explore/envqual/wq0452.htm