The 4R Approach to Soil and Water Quality

August 7 – September 25, 2013

Offered by the American Society of Agronomy

Class Schedule/Time Wednesday mornings as shown on the syllabus. 11:00 am to 1:00 pm Eastern, 10:00 am to 12:00 Noon Central, 9:00 am to 11:00 am Mountain, 8:00 am to 10:00 am Pacific.

Most class periods will last 1.5 to 2.0 hours. To maximize their learning, students will be expected to spend time reading and studying outside class in addition to the scheduled class periods. The instructor may be contacted at any time via telephone or email with questions or comments.

Communication Requirements The course is delivered live via the Web using GoToMeeting software.

An email address and high-speed internet access are required.

GoToMeeting Systems Requirements
http://support.citrixonline.com/GoToMeeting/help_files/GTM010003#What

Required Textbook

4R Plant Nutrition: A Manual for Improving the Management of Plant Nutrition (International Plant Nutrition Institute) (770) 447-0335
http://www.ipni.net/ipniweb/portal.nsf/0/231EA9CAE05F5D24852579B200725EA2

Optional Reference Materials

Nitrogen in Agricultural Systems, by J.S. Schepers and W.R. Raun, editors. Available in digital form at:
https://dl.sciencesocieties.org/publications/books/tocs/agronomymonogra/nitrogeninagric

Phosphorus: Agriculture and the Environment by J.T. Sims, A.N. Sharpley, G.M. Pierzynski, D.T. Westermann, M.L. Cabrera, J.M. Powell, T.C. Daniel, and P.J.A. Withers, ed. 2005. Books may be ordered at:
https://portal.sciencesocieties.org/Purchase/ProductDetail.aspx?Product_code=e0ea0c8d-de32-db11-97e1-001279d6310b

Assessment A ten question quiz will be offered after each lesson, available for students to take on-line during their own time. Quizzes must be completed by Midnight Central Time on the last day specified for each quiz (see Syllabus/Schedule). Individual performance on weekly quizzes will be provided confidentially to students via email to give an indication of mastery of various topics. **No make-up quizzes will be offered.** There will not be a final exam for this course, and grades will not be assigned. Students who accumulate at least 56 of the 80 quiz points (70%) can request a certificate of completion for the course. Missed quizzes will count as zero.

Certified individuals seeking Continuing Education Units (CEUs) must get a passing score (at least 7 of 10) on a quiz to get credit for that particular session. The system allows you to take quizzes multiple times, but only your first score is counted. Total CEUs include eight in Nutrient Management and four each in Soil & Water Management and Crop Management.

Student Directory Information Student name, city/state/country, phone, and email will be included in a listing on the class web site, available only to the other students and those administering this class. Students can opt out of this listing when they register for the class.

Use of Class Materials Registrant agrees that the name indicated on the registration form is the sole individual receiving the on-line instruction and the only person completing the on-line quizzes. Individuals found in violation of this policy will be subject to dismissal from this course, revocation of certification, and possible loss of privileges to participate in future offerings from the American Society of Agronomy.

The PowerPoint presentations, class recordings, quizzes, worksheets, and other materials developed specifically for this class are for the educational purposes and use of students registered for this class. They are not to be copied, forwarded or shared in any way with anyone for any other use without the permission of the American Society of Agronomy.

Class Web Site Students registered for the class will have access to the class web site where the following will be posted:

Lecture video recordings (audio with PowerPoint slides)
PowerPoint slides in PDF format.
Link to quizzes
Answer keys to quizzes

Access to the class web site will begin with the first class and end one month following the last class period, ending October 25, 2013.

Schedule/Syllabus (subject to change)

Dates	Topics (CEU'S)	Reading Assignments Prior to Class	Quiz
Aug 7	**Orientation –** short introduction to the course and on-line learning environment. **Lesson 1. Managing Plant Nutrition in the Context of Soil and Water Quality/Plant Nutrient & Soil Fertility Review (1 SW, 1NM)** An Overview of the 4R Nutrient Stewardship Concept, Goals of Sustainable Agriculture, Providing Plant Nutrition in Balance with Ecological, Environmental, and Social Considerations. (Dr. Tom Bruulsema) An Overview of Basic Soil Science Principles including Essential Plant Nutrients and Uptake, Cation Exchange, Soil pH, Soil Ecology, Water Movement and Availability, and Soil Texture Factors as Related to Management and the Soil/Plant/Water System (Dr. Dawn Gibas)	4R Manual Chapters 1, 2, and 7 Reactive Nitrogen in the United States: http://yosemite.epa.gov/sab%5Csabproduct.nsf/67057225CC780623852578F10059533D/$File/EPA-SAB-11-013-unsigned.pdf	None Last Day for Quiz 1 is Aug 20
Aug 14	**Lesson 2. The Nitrogen Cycle, Nitrogen Reactions in the Soil (1 SW, 1NM)** The Processes of Mineralization, Nitrification, Immobilization, Volatilization, Denitrification, Leaching: When They Occur, What Conditions Influence Transformation and Movement, How to Retain Soil Nitrogen for Crop Yield and Quality, Evaluations to Refine and Optimize Management (Dr. Bruce Erickson)	The Nitrogen and Phosphorus Cycle in Soils (AR): http://www.uaex.edu/Other_Areas/publications/PDF/FSA-2148.pdf Nitrogen Basics—The Nitrogen Cycle (Cornell): http://nmsp.cals.cornell.edu/publications/factsheets/factsheet2.pdf	Last Day for Quiz 2 is Aug 27
Aug 21	**Lesson 3. An Adaptive Management Approach to Crop Production (1 NM, 1 CM)** Designing Field Trials, Selecting the Site, Working with Growers, Collecting Data, Results Analysis and Statistics, Adjusting Management with Findings, Examples of Successful Trials (Dr. Quirine Ketterings and Dr. Bruce Erickson)	4R Manual Chapter 9	Last Day for Quiz 3 is Sept 3

Dates	Topics (CEU'S)	Reading Assignments Prior to Class	Quiz
Aug 28	**Lesson 4. The Phosphorus Cycle, Phosphorus Reactions in the Soil (1 SW, 1 NM)** Forms of Phosphorus and their Interactions in the Soil, How Phosphorus Reacts in Different Soil Environments—Soil Texture, pH, Moisture Content, How Phosphorus and Other Nutrients Travel Off Site, Phosphorus' Role in Water Quality (Dr. Nathan Nelson)	Understanding Soil Tests for *Plant-Available* Phosphorus (Ohio State) http://ohioline.osu.edu/agf-fact/pdf/Soil_Tests.pdf	Last Day for Quiz 4 is Sept 10
Sept 4	**Lesson 5. Assessing Nutrients in the Soil and Plant (1 NM, 1 CM)** Critical Evaluation Tools for Refining and Improving Management: Soil Sampling, Plant Tissue Analysis, Chlorophyll and Greenness Sensors, Remote Sensing/Proximal Sensing, Managing Field Variability, Zones vs. Grids, Sampling Through the Soil Profile, Sampling Beyond Crop Fields, Assessing the Environmental Impact (Dr. John Grove)	4R Manual Chapter 8 Using Crop Sensors to Improve Corn Nitrogen Management (Pioneer): http://www.pioneer.com/home/site/us/agronomy/library/template.CONTENT/guid.8AA5E524-D466-6643-809B-DA3586758BEA Methods of Phosphorus Analysis (USDA/SERA 17) http://www.sera17.ext.vt.edu/Documents/P_Methods2ndEdition2009.pdf	Last Day for Quiz 5 is Sept 17
Sept 11	**Lesson 6. Selecting the Right Source: Nutrient Sources and Fertilizers, Fertilizer Application (1 NM, 1 CM)** Fertilizer Production, Analyses, Fertilizer Additives, Manure, Biosolids: When to Use, How to Manage Various Sources to Maximize Crop Productivity and Protect Water Quality, The Soil as a Nutrient Source (Dr. Bruce Erickson)	4R Manual Chapter 3 Fertilizer Use and Price (USDA) http://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx Nitrogen Transformation Inhibitors and Controlled Release Urea (KY) http://www.ca.uky.edu/agc/pubs/agr/agr185/agr185.pdf Nitrogen Extenders and Additives for Field Crops (ND) http://www.ag.ndsu.edu/pubs/plantsci/soilfert/sf1581.pdf	Last Day for Quiz 6 is Sept 24
Sept 18	**Lesson 7. Selecting the Right Rate: Fertilizer Recommendations and Economics (1 NM, 1 CM)** Fertilizer Calculations, Management Philosophies in Various Regions/Crops, How University Recommendations are Derived, Nutrient Management Planning, Year to Year and Weather-Specific Variability, Balancing the Productivity and Cost with Ecosystem Considerations (Dr. John Grove)	4R Manual Chapter 4 Corn Nitrogen Rate Calculator http://extension.agron.iastate.edu/soilfertility/nrate.aspx	Last Day for Quiz 7 is Oct 1

Dates	Topics (CEU'S)	Reading Assignments Prior to Class	Quiz
Sept 25	**Lesson 8. Selecting the Right Time and Place (1 SW, 1 NM)** Variable Rate Technology, Application Methods: Foliar, Banding, Broadcast, Surface, Sidedress, Row. Equipment Technology/Placement Options, Case Study Examples Exemplifying Evaluation and Approaches that Support Crop Productivity and Water Quality (Dr. John Grove)	4R Manual Chapters 5 and 6	Last Day for Quiz 8 is Oct 8

Course Description The 4R Approach to Soil and Water Management combines the science of plant nutrition and soil fertility with a practical knowledge to successfully manage crop nutrients. Successful management includes the knowledge and skills to evaluate which combination of the 4Rs is most efficient for an individual farm and field. Upon completion, the learner will have the skills to evaluate the effectiveness of nitrogen and phosphorus practices implemented at the individual field scale to inform farmers and their advisors about the efficiency of their current nutrient management. These evaluation skills will be built upon a solid grasp of the roles of macronutrients in crop production; how soils supply nitrogen, phosphorus, and other nutrients; nutrient transformations and movement in the soil and water; quantifying nutrient needs and availability; modifying crop nutrient amounts through the use of fertilizers and manures, supplying crop nutrients from the correct source, at the right rate, at the right time, and in the right place, and all of the differences that occur amongst soil situations, weather, and cropping systems.

The goal of the course is enable agricultural service providers to understand and utilize this process of evaluation, learning, and refinement with their farmer clients to identify the 4Rs for individual fields to optimize crop yields while reducing the environmental impact of crop production systems.

The course is taught using distance education technology, but a variety of practical examples and case situations will be woven into content delivery to maximize understanding and its application in the field. Whether you are personally involved in production agriculture, advising farmers as an agricultural retailer or consultant, a representative for an agricultural business or government agency, or just looking to build your expertise, this course will cover topics that should be of direct interest to you.

Course Facilitator

Dr. Dawn Gibas joined the SSSA staff in July 2010 as the Soil Science Program Coordinator. Previous to SSSA, she was a faculty member at The Ohio State University in the School of Environment and Natural Resources (SENR) where much of her research was located in Iceland studying successional landscapes, restoration and soil carbon. She still maintains an adjunct faculty position within SENR. Prior to her position at OSU, Dr. Gibas spent the majority of her career in environmental consulting and, for a shorter time, in county government where she spent much of her time working in watershed management, natural resource management, environmental review documents and permitting. During her career she has, among other things, owned her own consulting business, managed the MN office of Tetra Tech, and traveled across the U.S. as part of her work. She has a B.S. in soil science from the University of Wisconsin, a M.S. in soil physics and a PhD in Forest Hydrology from the University of Minnesota. Dr. Gibas is both a licensed and certified soil scientist and has worked on issues surrounding the implementation of these programs since the early 1990s.

Briefly, some of the primary objectives of Dr. Gibas's position with SSSA include overseeing the soil science licensing and certification programs for SSSA (including legislative issues), facilitating continuing education for soil scientists, and to overall help to grow the soil science profession by working with and facilitating communication between the private sector, government and academia.

Instructors

Dr. Tom Bruulsema Dr. Bruulsema directs research and education programs in the Northeast region for the North American program of the International Plant Nutrition Institute, a not-for-profit, scientific organization dedicated to the responsible management of plant nutrition. Dr. Bruulsema completed his BS and MS degrees at the University of Guelph and his PhD in Soil Science at Cornell University. Dr. Bruulsema is a Fellow in the Canadian Society of Agronomy, the American Society of Agronomy and the Soil Science Society of America, and a Certified Crop Adviser. He has research experience in soil science with Cornell University and the University of Minnesota, and in Bangladesh agronomy with the Mennonite Central Committee.

Dr. Bruce Erickson Dr. Erickson is a Certified Professional Agronomist employed by the American Society of Agronomy as their Agronomic Education Manager, and is also Adjunct Assistant Professor of Agronomy at Purdue University. Erickson's areas of expertise include corn and soybean production, remote sensing and its application in precision agricultural practices, instructional design, and competency-based education and assessment. Erickson grew up on an Iowa farm, completed his undergraduate work at Iowa State University in Agronomy, then began his professional career as an agronomist with Pioneer Hi-Bred. After completing his Master's at Iowa State in Crop Production and Physiology and his PhD in Agronomy at Purdue, Erickson was on the staff of the Purdue Department of Agronomy where he taught the introductory agronomy course and played a leading role in developing and maintaining the performance objective documents and the minimum proficiency exams for the International Certified Crop Adviser Program (CCA). For three years Erickson served as Senior Technical Designer at Agri Business Group in Indianapolis (now Adayana), an agricultural consulting company. Most recently Erickson was Director of Cropping Systems Management and Associate Director of the Center for Commercial Agriculture, where he coordinated the Top Farmer Crop Workshop, and worked extensively with precision farming and crop production economics research and Extension.

Dr. John Grove Dr. Grove is Professor of Agronomic Soil Science at the University of Kentucky, responsible for teaching nutrient management at both undergraduate and graduate levels and world food issues in the Honors Program. His research interests are in the management of the chemical and physical properties of soils under grain production. Field research involves inorganic/organic source nutrient management (rate, timing, placement); crop species and tillage rotation; and particularly the no-tillage crop establishment/soil management system. That work includes evaluation of spatial and temporal dynamics in nutrient cycling and crop nutrition to give improved nutrient management with greater sustainability and minimal adverse impacts on water quality. Dr. Grove has directed/co-directed 28 graduate students (13 Ph.D., 15 M.S.) to completion.

Dr. Quirine Ketterings Dr. Ketterings is an Associate Professor in the Department of Animal Science at Cornell University teaching a farm nutrient management course. She also established and lead the Cornell Nutrient Management Spear Program (NMSP) the colleges applied research, teaching and extension program for field crop fertilizer and manure management, that aims to improve dairy industry awareness of crop nutrient needs, crop quality, management of organic wastes, environmentally sound nutrient management practices, and overall soil fertility management. Dr. Ketterings completed her PhD in Environmental Sciences at Ohio State University. Her areas of interest are nutrient management for field crops, soil fertility, extension education, on-farm research and agricultural environmental management. She is a member of the American Society of Agronomy and the Soil Science Society of America.

Dr. Nathan Nelson Dr. Nelson is an Associate Professor in Soil Fertility and Nutrient Management at Kansas State University. His interest in soil fertility and nutrient management extends to both agricultural production and environmental quality. In his work as Assistant Professor of Agronomy at K-State, he focuses primarily on finding ways to increase the efficiency of phosphorus applications in agriculture. One of the main goals is to reduce phosphorus runoff into surface waters. Another is to make sure agricultural producers get good value for the money spent on fertilizer nutrients. Dr. Nelson's research also focuses on measuring the environmental impacts of other nutrients, such as nitrogen, at the watershed scale. He is a member of the American Society of Agronomy and the Soil Science Society of America.