

[Faculty Vitae](#)

Name: Charles W. Rice

Highest Degree: Ph.D. from University of Kentucky received 1983

Date of Appointment: 1988

Rank: Professor

Budgeted Time (Tenths):

Research- Extension-	.8	Teaching- Directed Service-	.2
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Program Area: Soil Microbial Ecology

Significant Accomplishments 1993 to Present:

Soil Organic Matter

We have reported the first clear and direct demonstration of significant increases in soil C and N stocks following extended exposure to elevated atmospheric CO₂ under field conditions. Furthermore, the observed concomitant increases in soil N has significant ramifications regarding the potential for sustained increases in ecosystem productivity in an elevated CO₂ environment. Lastly, the fact that the reported increases occurred in undisturbed soils that already had relatively high C stocks is significant because it indicates that such soils are not only capable of accruing additional carbon but that, contrary to the current dogma, it is possible to measure the accrued carbon against a high background level of organic matter. The research findings on soil organic matter dynamics provide some innovative concepts on soil organic C and N formation and storage. His group has developed procedures for biological fractionation of soil organic matter. The labile fractions are more sensitive to environmental changes and management practices than the total soil organic matter. We are now using the stable isotopes of C to determine rates of turnover, loss, and accumulation of C from the atmosphere and different vegetation. The significance of these findings is that they will be better able to assess the long-term changes in soil organic matter as a result of climate, and crop and soil management that is important in maintaining the quality of our natural resource base.

Nitrogen mineralization

Another emphasis of the research is to increase the accuracy for estimating N mineralized from different organic sources. Using the fractionation procedure for soil organic matter the amount of labile N with monitoring of soil water and temperature can be used to predict N mineralized in the field. The goal is to provide a useful assessment tool for producers to account for N mineralized. Understanding and properly accounting for mineralized N could realize savings in N fertilizer application while reducing potential contamination of surface and ground water resources.

Denitrification

Our research on denitrifier ecology in subsoils has made important contributions to understanding the impact of cultivation on microbial ecology and the fate of nitrate in soils and groundwater. The unique feature of the subsoil denitrification research has been the comparison of N cycling and the microbial ecology between cultivated and native prairie soils. Surface application of animal wastes enhanced subsoil denitrification. Thus denitrification in the subsoil may reduce the amount of NO_3^- entering the groundwater under agricultural systems.

Extramural funding has totaled more than \$2.7 million for the soil microbiology program at KSU since 1993. The breadth of the research program also is evident by the interdisciplinary research with other soil and range scientists.

Goals for the Next Five Years:

My overall research goal is to study basic mechanisms in nutrient cycling, organic matter dynamics, and microbial ecology as they apply to agricultural and prairie ecosystems and environmental problems.

Specific goals are to:

Understand the N and C dynamics in prairie and agro-ecosystems to maintain soil quality.

Develop management practices that improve the synchrony between soil N availability and plant N demand for efficient use of nutrients with minimal environmental effects.

Study the ecology and activity of denitrifiers in the soil profile and to determine the regulatory factors important to denitrification. Denitrification results in inefficient use of N in plant production, but may be used to remediate nitrate contaminated groundwater.

Understand the factors that regulate the microbial ecology and activity in the soil

Publications:

Referee Journal Articles and Chapters	Since 1993	25	Total	38
Numbered Extension Publications	Since 1993	1	Total	1
Proceedings Papers	Since 1993	13	Total	38

Most Significant Publications Since 1993:

Rice, C. W., and K. L. Rogers. 1993. Denitrification in subsurface environments: Potential source for atmospheric N₂O. p. 121-132 In Rolston et al. (ed) Agricultural Ecosystem Effects on Radiatively Active Trace Gases and Global Climate Change. Soil Sci. Soc. Am., Madison, WI.

Rice, C. W., and F. O. Garcia. 1994. Biologically active pools of soil C and N in tallgrass prairie. pp. 201-208. In J. Doran et al. (ed) Defining soil quality for a sustainable environment. Spec. Pub. No. 35. Soil Sci. Soc. Am., Madison, WI.

Garcia, F. O., and C. W. Rice. 1994. Microbial biomass dynamics in tallgrass prairie. Soil Sci. Soc. Am. J. 58:816-823.

Rice, C.W., F.O. Garcia, C.O. Hampton, and C.E. Owensby. 1994. Soil microbial response in tallgrass prairie to elevated CO₂. Plant Soil 165:67-74.

Rice, C.W., J.L. Havlin, and J.S. Schepers. 1995. Rational nitrogen fertilization in intensive cropping systems. Fert. Res. 42:89-97.

Sotomayor, D., and C.W. Rice. 1996. Denitrification beneath grassland and cultivated soils. Soil Sci. Soc. Am. J. 60:1822-1828.

Omay, A.B., C.W. Rice, L.D. Maddux, and W.B. Gordon. 1997. Changes in soil microbial and chemical properties under long-term crop rotation and fertilization. Soil Sci. Soc. Am J. 61: 1672-1678.

Ajwa, H.A., C.W. Rice, and D. Sotomayor. 1998. Carbon and nitrogen mineralization in tallgrass prairie and agricultural profiles. Soil Sci. Soc. Am J. 62:942-951.

Sotomayor, D. and C.W. Rice. 1999. Soil air CO₂ and N₂O concentrations in profiles under tallgrass prairie and cultivation. J. Environ. Qual. 28:784-793.

Smith, M.D., D.C. Hartnett, and C.W. Rice. 2000. Effects of long-term fungicide applications on microbial processes in tallgrass prairie soil. Soil Biol. Biochem. (In Press).

Graduate Student Involvement:

Students Graduated Since 1993	M.S.	4	Ph.D.	6
Current Students	M.S.	2	Ph.D.	8
Current Member of Advisory Committee	M.S.	3	Ph.D.	10

Grant Activity:

Most Common Sources of Extramural Support (ex. NSF, Sorghum Commission, NRI, Industry, Variety Performance):

NSF

NIGEC-DOE

USDA-NRI

Proposals Submitted Since January 1, 1997:	Number	22	\$ 4,200,000
Funded	Number	16	\$ 2,000,000

Current dollars (grant or contract) available to support your work \$2,000,000

Most Significant Funded Projects Since 1993:

Fecal coliform contamination in Kansas River basins: Source, monitoring and development of best management practices. Kansas State Agencies. Co-PI with G. Marchin (Biol), J. Harner and K. Mankin (Biol. & Agric. Eng.), and R. Jones (Ag. Econ.). 1 October 1997 - 30 September 2000. \$258,736.

Belowground carbon allocation and cycling in tallgrass prairie and wheat ecosystems. DOE-NIGEC. PI. \$112,000.

Implementation of best management practices in the Blue River Basin of KS and NE. USDA-Fund for Rural America. PI. Co-PI Dan Devlin and Brian Benhem (Univ. Of Nebraska). 1 January 1998 - 31 December 2000. \$400,000

Biotic Interactions of Grassland Plants: Above- and belowground Linkages. NSF. Co-PI with David C. Hartnett, Timothy C. Todd, and Gail T. Wilson. 1 January 1999 - 31 December 2001. \$215,000.

Land cover change in the Great Plains: Predicting impacts of regional forest expansion on biogeochemical processes. NASA. Co-PI with L.C. Johnson, J.M Briggs, J.M. Blair, and J. Ham. July 1997 - June 2000. \$485,000

Teaching:

Courses Taught:

Course Number	Title	Most Recent Enrollment
AGRON 645	Soil Microbiology	33
AGRON 955	Soil Microbial Ecology	11

Number of Undergraduate Research Assistants: 1

Number of Undergraduate Advisees: N/A

Service Activities:

Departmental Committees :

Scholarships (Graduate) Committee, 1996 - Present

Department Head Advisory Committee, 1998 - Present, Chair 1999-Present

International Committee, 1998- Present

Awards Committee, 1998 - Present

Agronomy Web Team, 199-Present

Agronomy Experimental Field Committee, 1999-Present

Agronomy Farm/Ashland Advisory Committee, 1998 - Present

College Committees :

College Committee on Planning, 1999-Present

KCARE Executive Committee, 1997-Present

Water Quality Group, KCARE, Chair, 1997-Present

MIAC - Natural Resources Program Committee, 1997 - Present

University Committees :

Graduate Council, 1997-2001

Graduate Student Affairs Subcommittee, 1999-2000

Professional :

SSSA Board Representative S-3, 1999-2003

SSSAJ Editorial Board Associate Editor for Division S-3 (Jan. 1996 - Dec. 2001)