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Education

Ph.D.	Soil fertility & chemistry University of Illinois at Urbana-Champaign	1983
M.S.	Soil microbiology & biochemistry Iowa State University	1977
B.S.	Agricultural science University of Illinois at Urbana-Champaign	1974
A.A.	General science Illinois Valley Community College	1972

Employment

1995-present	Professor, Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign
1994-1995	Professor, Department of Agronomy, University of Illinois at Urbana-Champaign
1989-1994	Associate Professor, Department of Agronomy, University of Illinois at Urbana-Champaign
1983-1989	Assistant Professor, Department of Agronomy, University of Illinois at Urbana-Champaign

Courses Taught

Introductory Soils (NRES 201), 2006-present (team-taught)
Soil Fertility and Fertilizers (NRES 488), 1995-present
Chemistry of Soil Fertility (NRES 572), 1983-present

Editorial Service

2014-present	Associate Editor, <i>Scientia Agricola (Piracicaba, Brazil)</i>
2014-present	Associate Editor, <i>Renewable Agriculture and Food Systems</i>
2002-2007	Editor, <i>Soil Science Society of America Journal</i>
1997-2001	Technical Editor, <i>Soil Science Society of America Journal</i>
1995-1996	Associate Editor, <i>Soil Science Society of America Journal</i>

Publications

Chapters in Books

- Bremner, J. M., and R. L. Mulvaney. 1978. Urease activity in soils. p. 149-196. *In* R. G. Burns (ed.) Soil enzymes. Academic Press, London.
- Mulvaney, R. L., and J. M. Bremner. 1981. Use of urease and nitrification inhibitors for control of urea transformations in soils. p. 153-196. *In* E. A. Paul and J. N. Ladd (ed.) Soil biochemistry, vol. 5. Marcel Dekker, New York.
- Mulvaney, R. L. 1991. Some recent advances in the use of nitrogen-15 for research on nitrogen transformations in soil. p. 283-296. *In* Stable isotopes in plant nutrition, soil fertility and environmental studies. International Atomic Energy Agency, Vienna, Austria.
- Mulvaney, R. L. 1993. Mass spectrometry. p. 11-57. *In* R. Knowles and T. H. Blackburn (ed.) Nitrogen isotope techniques. Academic Press, San Diego, CA.
- Hauck, R. D., J. J. Meisinger, and R. L. Mulvaney. 1994. Practical considerations in the use of nitrogen tracers in agricultural and environmental research. p. 907-950. *In* R. W. Weaver et al. (ed.) Methods of soil analysis. Part 2. Microbiological and biochemical properties. SSSA Book Ser. 5. Soil Sci. Soc. Am., Madison, WI.
- Mulvaney, R. L. 1996. Nitrogen – Inorganic forms. p. 1123-1184. *In* D. L. Sparks et al. (ed.) Methods of soil analysis. Part 2. Chemical properties. SSSA Book Ser. 5. Soil Sci. Soc. Am., Madison, WI.
- Mulvaney, R. L. 2008. Advances in methodology for research on nitrogen transformations in soil. p. 433-500. *In* W. R. Raun and J. S. Schepers (ed.) Nitrogen in agricultural systems. Agron. Monogr. 49. Am. Soc. of Agron., Madison, WI.

Peer-reviewed Journal Articles

- Mulvaney, R. L., and J. M. Bremner. 1977. Evaluation of antimetabolites for retardation of urea hydrolysis in soils. Soil Sci. Soc. Am. J. 41:1024-1027.
- Mulvaney, R. L., and J. M. Bremner. 1978. Use of *p*-benzoquinone and hydroquinone for retardation of urea hydrolysis in soils. Soil Biol. Biochem. 10:297-302.
- Mulvaney, R. L., and J. M. Bremner. 1979. A modified diacetyl monoxime method for colorimetric determination of urea in soil extracts. Commun. Soil Sci. Plant Anal. 10:1163-1170.
- Mulvaney, R. L., and L. T. Kurtz. 1982. A new method for determination of ¹⁵N-labeled

- nitrous oxide. *Soil Sci. Soc. Am. J.* 46:1178-1184.
- Mulvaney, R. L., and L. T. Kurtz. 1984. Evolution of dinitrogen and nitrous oxide from nitrogen-15 fertilized soil cores subjected to wetting and drying cycles. *Soil Sci. Soc. Am. J.* 48:596-602.
- Mulvaney, R. L. 1984. Determination of ^{15}N -labeled dinitrogen and nitrous oxide with triple-collector mass spectrometers. *Soil Sci. Soc. Am. J.* 48:690-692.
- Nafziger, E. D., R. L. Mulvaney, D. L. Mulvaney, and L. E. Paul. 1984. Effect of previous crop on the response of corn to fertilizer nitrogen. *J. Fert. Issues* 1:136-138.
- Mulvaney, R. L. 1986. Comparison of procedures for reducing cross-contamination during steam distillations in nitrogen-15 tracer research. *Soil Sci. Soc. Am. J.* 50:92-96.
- Mulvaney, R. L., and C. W. Boast. 1986. Equations for determination of nitrogen-15 labeled dinitrogen and nitrous oxide by mass spectrometry. *Soil Sci. Soc. Am. J.* 50:360-363.
- Firkins, J. L., L. L. Berger, N. R. Merchen, G. C. Fahey, Jr., and R. L. Mulvaney. 1987. Ruminant nitrogen metabolism in steers as affected by feed intake and dietary urea concentration. *J. Dairy Sci.* 70:2302-2311.
- He, X. T., F. J. Stevenson, R. L. Mulvaney, and K. R. Kelley. 1988. Incorporation of newly immobilized ^{15}N into stable organic forms in soil. *Soil Biol. Biochem.* 20:75-81.
- Azam, F., R. L. Mulvaney, and F. J. Stevenson. 1988. Quantification and potential availability of non-symbiotically fixed ^{15}N in three contrasting soil types. *Biol. Fert. Soils* 7:32-38.
- Azam, F., R. L. Mulvaney, and F. J. Stevenson. 1988. Determination of in situ K_N by the chloroform fumigation-incubation method and mineralization of biomass N under anaerobic conditions. *Plant Soil* 111:87-94.
- He, X. T., F. J. Stevenson, R. L. Mulvaney, and K. R. Kelley. 1988. Extraction of newly immobilized ^{15}N from an Illinois Mollisol using aqueous phenol. *Soil Biol. Biochem.* 20:857-862.
- Boast, C. W., R. L. Mulvaney, and P. Baveye. 1988. Evaluation of nitrogen-15 tracer techniques for direct measurement of denitrification in soil: I. Theory. *Soil Sci. Soc. Am. J.* 52:1317-1322.
- Vanden Heuvel, R. M., R. L. Mulvaney, and R. G. Hoeft. 1988. Evaluation of nitrogen-15 tracer techniques for direct measurement of denitrification in soil: II. Simulation studies. *Soil Sci. Soc. Am. J.* 52:1322-1326.

- Mulvaney, R. L. 1988. Evaluation of nitrogen-15 tracer techniques for direct measurement of denitrification in soil: III. Laboratory studies. *Soil Sci. Soc. Am. J.* 52:1327-1332.
- Mulvaney, R. L., and R. M. Vanden Heuvel. 1988. Evaluation of nitrogen-15 tracer techniques for direct measurement of denitrification in soil: IV. Field studies. *Soil Sci. Soc. Am. J.* 52:1332-1337.
- Azam, F., R. L. Mulvaney, and F. J. Stevenson. 1989. Chemical distribution and fate of non-symbiotically fixed ^{15}N in three soils. *Soil Biol. Biochem.* 21:849-855.
- Azam, F., R. L. Mulvaney, and F. J. Stevenson. 1989. Synthesis of ^{15}N -labelled microbial biomass in soil *in situ* and extraction of biomass N. *Biol. Fertil. Soils* 7:180-185.
- Azam, F., R. L. Mulvaney, and F. J. Stevenson. 1989. Transformations of ^{15}N -labelled leguminous plant material in three contrasting soils. *Biol. Fertil. Soils* 8:54-60.
- Azam, F., F. J. Stevenson, and R. L. Mulvaney. 1989. Chemical extraction of newly immobilized ^{15}N and native soil N as influenced by substrate addition rate and soil treatment. *Soil Biol. Biochem.* 21:715-722.
- He, X. T., R. L. Mulvaney, and W. L. Banwart. 1990. A rapid method for total nitrogen analysis using microwave digestion. *Soil Sci. Soc. Am. J.* 54:1625-1629.
- Mulvaney, R. L., C. L. Fohringer, V. J. Bojan, M. M. Michlik, and L. F. Herzog. 1990. A commercial system for automated nitrogen isotope-ratio analysis by the Rittenberg technique. *Rev. Sci. Instrum.* 61:897-903.
- He, X. T., R. L. Mulvaney, and F. J. Stevenson. 1991. Transformations of chemically fixed liquid anhydrous ammonia by soil microorganisms. *Biol. Fertil. Soils* 11:145-150.
- Mulvaney, R. L., and Y. P. Liu. 1991. Refinement and evaluation of an automated mass spectrometer for nitrogen isotope analysis by the Rittenberg technique. *J. Automatic Chem.* 13:273-280.
- Vanden Heuvel, R. M., R. G. Hoef, R. L. Mulvaney, and B. R. Montgomery. 1991. Movement of nitrogen-15 labeled nitrate in large undisturbed columns of poorly drained soil. *Commun. Soil Sci. Plant Anal.* 22:809-826.
- Liu, Y. P., and R. L. Mulvaney. 1992. Diffusion of Kjeldahl digests for automated nitrogen-15 analysis by the Rittenberg technique. *Soil Sci. Soc. Am. J.* 56:1151-1154.
- Liu, Y. P., and R. L. Mulvaney. 1992. Automated nitrogen-15 analysis of ammonium in diffusion disks by the Rittenberg technique. *Soil Sci. Soc. Am. J.* 56:1185-1188.

- Liu, Y. P., and R. L. Mulvaney. 1992. Use of diffusion for automated nitrogen-15 analysis of soil extracts. *Commun. Soil Sci. Plant Anal.* 23:613-629.
- Mulvaney, R. L., F. Azam, S. N. Stein, and F. W. Simmons. 1992. Chloride interference in total nitrogen analysis by the Kjeldahl method. *Commun. Soil Sci. Plant Anal.* 23:1805-1813.
- Torbert, H. A., R. L. Mulvaney, R. M. Vanden Heuvel, and R. G. Hoelt. 1992. Soil type and moisture regime effects on fertilizer efficiency calculation methods in a nitrogen-15 tracer study. *Agron. J.* 84:66-70.
- Azam, F., F. W. Simmons, and R. L. Mulvaney. 1993. Immobilization of ammonium and nitrate and their interaction with native N in three Illinois Mollisols. *Biol. Fertil. Soils* 15:50-54.
- Saghir, N. S., R. L. Mulvaney, and F. Azam. 1993. Determination of nitrogen by microdiffusion in Mason jars. I. Inorganic nitrogen in soil extracts. *Commun. Soil Sci. Plant Anal.* 24:1745-1762.
- Azam, F., F. W. Simmons, and R. L. Mulvaney. 1993. Mineralization of N from plant residues and its interaction with native soil N. *Soil Biol. Biochem.* 25:1787-1792.
- Saghir, N. S., F. P. Mungwari, R. L. Mulvaney, and F. Azam. 1993. Determination of nitrogen by microdiffusion in Mason jars: II. Inorganic nitrogen-15 in soil extracts. *Commun. Soil Sci. Plant Anal.* 24:2747-2763.
- Stein, S. N., L. Li, R. L. Mulvaney, and F. W. Simmons. 1993. Determination of nitrogen by microdiffusion in Mason jars: III. Nitrogen and nitrogen-15 in Kjeldahl digests. *Commun. Soil Sci. Plant Anal.* 24:2765-2776.
- Torbert, H. A., R. G. Hoelt, R. M. Vanden Heuvel, R. L. Mulvaney, and S. E. Hollinger. 1993. Short-term excess water impact on corn yield and nitrogen recovery. *J. Prod. Agric.* 6:337-344.
- Azam, F., F. W. Simmons, and R. L. Mulvaney. 1994. Effect of ammonium fixation and displacement on the added nitrogen interaction in incubation experiments. *Biol. Fertil. Soils* 18:99-102.
- Azam, F., F. W. Simmons, and R. L. Mulvaney. 1994. The effect of inorganic nitrogen on the added nitrogen interaction of soils in incubation experiments. *Biol. Fertil. Soils* 18:103-108.
- Mulvaney, R. L., M. Ashraf, F. Azam, P. D. Brooks, and D. J. Herman. 1994. Evaluation of methods for nitrogen-15 analysis of inorganic nitrogen in soil extracts: I. Steam-distillation methods. *Commun. Soil Sci. Plant Anal.* 25:2187-2200.

- Azam, F., R. L. Mulvaney, and F. W. Simmons. 1995. Effects of ammonium and nitrate on mineralization of nitrogen from leguminous residues. *Biol. Fertil. Soils* 20:49-52.
- Greenan, N. A., R. L. Mulvaney, and G. K. Sims. 1995. A microscale method for colorimetric determination of urea in soil extracts. *Commun. Soil Sci. Plant Anal.* 26:2519-2529.
- Herman, D. J., P. D. Brooks, M. Ashraf, F. Azam, and R. L. Mulvaney. 1995. Evaluation of methods for nitrogen-15 analysis of inorganic nitrogen in soil extracts. II. Diffusion methods. *Commun. Soil Sci. Plant Anal.* 26:1675-1685.
- Sims, G. K., T. R. Ellsworth, and R. L. Mulvaney. 1995. Microscale determination of inorganic nitrogen in water and soil extracts. *Commun. Soil Sci. Plant Anal.* 26:303-316.
- Torbert, H. A., D. W. Reeves, and R. L. Mulvaney. 1996. Winter legume cover crop benefits to corn: rotation vs. fixed-nitrogen effects. *Agron. J.* 88:527-535.
- Khan, S. A., R. L. Mulvaney, and C. S. Mulvaney. 1997. Accelerated diffusion methods for inorganic-nitrogen analysis of soil extracts and water. *Soil Sci. Soc. Am. J.* 61:936-942.
- Mulvaney, R. L., S. A. Khan, and C. S. Mulvaney. 1997. Nitrogen fertilizers promote denitrification. *Biol. Fertil. Soils* 24:211-220.
- Mulvaney, R. L., S. A. Khan, G. K. Sims, and W. B. Stevens. 1997. Use of nitrous oxide as a purge gas for automated nitrogen isotope analysis by the Rittenberg technique. *J. Automatic Chem.* 19:165-168.
- Mulvaney, R. L., S. A. Khan, W. B. Stevens, and C. S. Mulvaney. 1997. Improved diffusion methods for determination of inorganic nitrogen in soil extracts and water. *Biol. Fertil. Soils* 24:413-420.
- Crawford, J. J., G. K. Sims, R. L. Mulvaney, and M. Radosevich. 1998. Biodegradation of atrazine under denitrifying conditions. *Appl. Microbiol. Biotechnol.* 49:618-623.
- Khan, S. A., R. L. Mulvaney, and P. D. Brooks. 1998. Diffusion methods for automated nitrogen-15 analysis using acidified disks. *Soil Sci. Soc. Am. J.* 62:406-412.
- Rhine, E. D., G. K. Sims, R. L. Mulvaney, and E. J. Pratt. 1998. Improving the Berthelot reaction for determining ammonium in soil extracts and water. *Soil Sci. Soc. Am. J.* 62:473-480.
- Bichat, F., G. K. Sims, and R. L. Mulvaney. 1999. Microbial utilization of heterocyclic nitrogen from atrazine. *Soil Sci. Soc. Am. J.* 63:100-110.

- Mulvaney, R. L., and S. A. Khan. 1999. Use of diffusion to determine inorganic nitrogen in a complex organic matrix. *Soil Sci. Soc. Am. J.* 63:240-246.
- Xue, Y., D. A. Kovacic, M. B. David, L. E. Gentry, R. L. Mulvaney, and C. W. Lindau. 1999. In situ measurements of denitrification in constructed wetlands. *J. Environ. Qual.* 28:263-269.
- Khan, S. A., R. L. Mulvaney, and R. G. Hoeft. 2000. Direct-diffusion methods for inorganic-nitrogen analysis of soil. *Soil Sci. Soc. Am. J.* 64:1083-1089.
- Khan, S. A., R. L. Mulvaney, K. Strle, and B. P. Horgan. 2000. Evaluation of diffusion for inorganic-nitrogen analysis of natural water and wastewater. *J. Environ. Qual.* 29:1890-1895.
- Prunty, L., J. S. Bell, and R. L. Mulvaney. 2000. Fertilizer ^{15}N presence in lysimeter drainage water. *J. Environ. Eng.* 126:439-445.
- Stevens, W. B., R. L. Mulvaney, S. A. Khan, and R. G. Hoeft. 2000. Improved diffusion methods for nitrogen and ^{15}N analysis of Kjeldahl digests. *J. AOAC Int.* 83:1039-1046.
- Horgan, B. P., R. L. Mulvaney, and B. E. Branham. 2001. Determination of atmospheric volume for direct field measurement of denitrification in soil cores. *Soil Sci. Soc. Am. J.* 65:511-516.
- Khan, S. A., R. L. Mulvaney, and R. G. Hoeft. 2001. A simple soil test for detecting sites that are nonresponsive to nitrogen fertilization. *Soil Sci. Soc. Am. J.* 65:1751-1760.
- Mulvaney, R. L., and S. A. Khan. 2001. Diffusion methods to determine different forms of nitrogen in soil hydrolysates. *Soil Sci. Soc. Am. J.* 65:1284-1292.
- Mulvaney, R. L., S. A. Khan, R. G. Hoeft, and H. M. Brown. 2001. A soil organic nitrogen fraction that reduces the need for nitrogen fertilization. *Soil Sci. Soc. Am. J.* 65:1164-1172.
- Moran, K. K., R. L. Mulvaney, and S. A. Khan. 2002. A technique to facilitate diffusions for nitrogen-isotope analysis by direct combustion. *Soil Sci. Soc. Am. J.* 66:1008-1011.
- Horgan, B. P., B. E. Branham, and R. L. Mulvaney. 2002. Mass balance of ^{15}N applied to Kentucky bluegrass including direct measurement of denitrification. *Crop Sci.* 42:1595-1601.
- Horgan, B. P., B. E. Branham, and R. L. Mulvaney. 2002. Direct measurement of denitrification using ^{15}N -labeled fertilizer applied to turfgrass. *Crop Sci.* 42:1602-1610.

- Marsh, K. L., R. L. Mulvaney, and G. K. Sims. 2004. A technique to recover tracer as carboxyl-carbon and α -nitrogen from amino acids in soil hydrolysates. *J. AOAC Int.* 86:1106-1111.
- Marsh, K. L., R. L. Mulvaney, and S. A. Khan. 2004. Use of diffusion for enzymatic determination of urea-nitrogen in soil extracts. *Commun. Soil Sci. Plant Anal.* 35:691-702.
- Mulvaney, R. L., S. A. Yaremych, S. A. Khan, J. M. Swiader, and B. P. Horgan. 2004. Use of diffusion to determine soil cation-exchange capacity by ammonium saturation. *Commun. Soil Sci. Plant Anal.* 35:51-67.
- Marsh, K. L., G. K. Sims, and R. L. Mulvaney. 2005. Availability of urea to autotrophic ammonia-oxidizing bacteria as related to the fate of ^{14}C - and ^{15}N -labeled urea added to soil. *Biol. Fertil. Soils* 42:137-145.
- Stevens, W. B., R. G. Hoeft, and R. L. Mulvaney. 2005. Fate of nitrogen-15 in a long-term nitrogen rate study: I. Interactions with soil nitrogen. *Agron. J.* 97:1037-1045.
- Stevens, W. B., R. G. Hoeft, and R. L. Mulvaney. 2005. Fate of nitrogen-15 in a long-term nitrogen rate study: II. Nitrogen uptake efficiency. *Agron. J.* 97:1046-1053.
- Mulvaney, R. L., S. A. Khan, and T. R. Ellsworth. 2006. Need for a soil-based approach in managing nitrogen fertilizers for profitable corn production. *Soil Sci. Soc. Am. J.* 70:172-182.
- Khan, S. A., R. L. Mulvaney, T. R. Ellsworth, and C. W. Boast. 2007. The myth of nitrogen fertilization for soil carbon sequestration. *J. Environ. Qual.* 36:1821-1832.
- Kwon, H.-y., R. J. M. Hudson, and R. L. Mulvaney. 2009. Characterization of the organic nitrogen fraction determined by the Illinois soil nitrogen test. *Soil Sci. Soc. Am. J.* 73:1033-1043.
- Mulvaney, R. L., S. A. Khan, and T. R. Ellsworth. 2009. Synthetic nitrogen fertilizers deplete soil nitrogen: A global dilemma for sustainable cereal production. *J. Environ. Qual.* 38:2295-2314.
- Henning, S. W., B. E. Branham, and R. L. Mulvaney. 2013. Response of turfgrass to urea-based fertilizers formulated to reduce ammonia volatilization and nitrate conversion. *Biol. Fertil. Soils* 49:51-60.
- Henning, S.W., R.L. Mulvaney, and B.E. Branham. 2013. Factors affecting foliar nitrogen uptake by creeping bentgrass. *Crop Sci.* 53:1778-1783.

- Otto, R., R. L. Mulvaney, S. A. Khan, and P. C. O. Trivelin. 2013. Quantifying soil nitrogen mineralization to improve fertilizer nitrogen management of sugarcane. *Biol. Fertil. Soils* 49:893-904.
- Khan, S. A., R. L. Mulvaney, and T. R. Ellsworth. 2014. The potassium paradox: Implications for soil fertility, crop production and human health. *Renewable Agric. Food Syst.* 29:3-27.
- Khan, S. A., R. L. Mulvaney, and T. R. Ellsworth. 2015. Further insights into why potassium fertility is a paradox. *Renew. Agric. Food Syst.* 30:120-123.
- Vieira-Megda, M. X., E. Mariano, J. M. Leite, H. C. J. Franco, A. C. Vitti, M. M. Megda, S. A. Khan, R. L. Mulvaney, and P.C. O. Trivelin. 2015. Contribution of fertilizer nitrogen to the total nitrogen extracted by sugarcane under Brazilian field conditions. *Nutr. Cycl. Agroecosyst.* 101:241-257.
- Guimarães, G. G. F., R. L. Mulvaney, S. A. Khan, R. B. Cantarutti, and A. M. Silva. 2016. Comparison of urease inhibitor N-(n-butyl) thiophosphoric triamide and oxidized charcoal for conserving urea-N in soil. *J. Plant Nutr. Soil Sci.* 179:520-528.
- Guimarães, G. G. F., R. L. Mulvaney, R. B. Cantarutti, B. C. Teixeira, and L. Vergutz. 2016. Value of copper, zinc, and oxidized charcoal for increasing forage efficiency of urea N uptake. *Agric. Ecosyst. Environ.* 224:157-165.
- Mulvaney, R. L., R. Otto, K. L. Griesheim, K. Su, and P. C. O. Trivelin. 2016. Leaching methods can underestimate mineralization potential of soils. *Commun. Soil Sci. Plant Anal.* 47:1701-1708.
- Otto, R., E. Mariano, R. Mulvaney, S. Khan, B. Nastaro-Boschiero, S. Tenelli, and P. C. Trivelin. 2018. Effect of previous soil management on sugarcane response to nitrogen fertilization. *Sci. Agric.* (in press).