Bill Raun

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Birthplace: Minden, Nebraska, June 21, 1957

Marital Status: Married, Tanya Colclasure Raun

Foreign Language: Spanish, reading, writing, spoken fluency

**EDUCATION**

Ph.D. University of Nebraska, Lincoln, Nebraska

Dissertation Chairmen: Professor R.A. Olson and Dr. D.H. Sander

Major Field: Agronomy/Soil Science

Allied Fields: Statistics

Date: 1985

M.S. Oklahoma State University, Stillwater, Oklahoma

Thesis Chairman: Dr. R.L. Westerman

Major Field: Agronomy/Soil Fertility

Date: 1982

B.S. Oklahoma State University, Stillwater, Oklahoma

Major Advisor: Dr. W.W. Huffine

Major Field: Agronomy/Turf Management

Date: 1979

**PROFESSIONAL EXPERIENCE**

Jan. 2012-present: Editor, Agronomy Journal

Sep. 2010-present: Walter R. Sitlington Chair in Agriculture

June 2004-present: Regents Professor, Plant and Soil Sciences, Oklahoma State Univ.

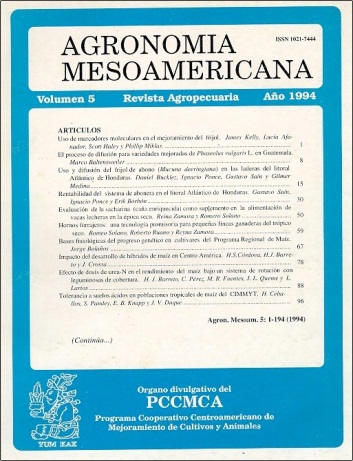
June 2006-Aug 2010: Melvin and Mary Jones Distinguished Professorship of Agronomic Sciences

June 1999-May 2004: Professor, Plant and Soil Sciences Dept., Oklahoma State Univ.

June 1996-May 1999: Associate Professor, Plant and Soil Sciences Dept., Oklahoma State Univ.

Dec. 1991-May 1996: Assistant Professor, Plant and Soil Sciences Dept., Oklahoma State Univ.

Responsibilities: Plan, budget, design and implement field and laboratory research in soil fertility and plant nutrition for M.S. and Ph.D graduate students. Develop sensor-based technologies for increased grain yields and nitrogen use efficiency in cereal crops. Continuous coordination of > 110 field experiments per year (short and long-term) addressing nutrient use efficiency in wheat, corn, alfalfa, cotton, switchgrass, sorghum, soybeans, and bermudagrass. Environmentally safe fertilization for cereal production, evaluation of alternative production practices, and characterization of N transformations in soils. Teaching graduate level 'soil plant nutrient cycling and environmental quality' and junior-senior level 'topics in precision agriculture', national and international project proposals for outside funding, and supervision of field and laboratory experiments conducted by graduate students.

June 1987-November 1991: Maize staff regional agronomist, CIMMYT, based in Guatemala City, Guatemala. Responsibilities: Developmental assistance via national programs in Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, Dominican Republic, Haiti and Cuba. Management of budget, distributed by project in nine countries. Coordination of agronomic research trials with 41 national program representatives. Research in maize/legume production systems, planning of projects, recommendations for future research needs, implementation of experiments and agronomy/statistics training. Coordination of Central America Maize National Program Committee. Co-founder of Agronomía Mesoamericana, ISSN 1021-7444, 1990- v.1-present, agronomic journal in Central America for the advancement of agricultural sciences, published biannually in Spanish (abstract in English). Also, preparation of science bulletins in Spanish relative to applied nutrients in tropical soils. Senior editor of the proceedings 'Manejo de Suelos Tropicales en Latinoamérica', technical editing and final preparation of 57 research articles pertaining to management of tropical soils (North Carolina State University).

December 1985-May 1987: Post-doctoral fellow, CIMMYT Wheat Program, based both in Texcoco, and Ciudad Obregon, Mexico. Responsibilities: Consulting on soil-related problems for wheat production, formal course training in soil fertility and statistics, research plot work in soil fertility, statistical analysis of agronomy program experiments, team interaction with bread wheat, durum wheat, triticale, wide crosses and cytogenetics programs within CIMMYT.

January 1983-December 1985: Research assistantship, Department of Agronomy, University of

Nebraska-Lincoln. Responsibilities: Research plot work, statistical analysis of various project experiments, maize and wheat plant tissue analysis, soil test correlation and calibration with plant tissue data and teaching for Professor R. A. Olson and Dr. D. H. Sander.

January 1981-December 1982: Research assistantship, Department of Agronomy, Oklahoma State University. Responsibilities: Research plot work on soil fertility experiments conducted throughout the state of Oklahoma, statistical and laboratory analysis for Dr. R. L. Westerman.

**TEAM LEADERSHIP**

2008-present: Team development of a new-age hand-planter for the third world capable of planting single seeds and by-plant placement of N fertilizer.

1992-present: Since joining OSU, worked with a large multidisciplinary group of scientists to develop the GreenSeeker sensor-based variable N rate fertilization system that increases nitrogen use efficiency by 15% in winter wheat and corn.

1991-present: Senior or co-PI on grants totaling >$8,300,000 from various competitive sources including USDA, Georgia-Pacific, USAID, NASA, OCAST, NRI, Farmland Industries, Potash Phosphate Institute, the Noble Foundation, and non-competitive funding.

1992-present: Coordinator of the Soil Fertility Research and Education Advisory Board, and that includes Administration and Annual Reporting on OK Senate Bill 314 and 432, $265,000/year.

1992-present: Major advisor for 75 completed graduate degrees (50 M.S., 25 Ph.D.). Currently advise 8 graduate students. Supervisor and research coordinator for 5 part time employees.

1987-1991: Successfully worked with National Program research leaders in 8 Central American countries to formally establish *Agronomia Mesoamericana*, Spanish agronomic journal for the advancement of agricultural sciences.

**CARREER GOALS**

* Deliver third world hand-planter for corn, sorghum, and rice capable of portioning seed (singles, multiples) and sidedress fertilization with urea.
* Refine sensor based technologies capable of increasing cereal grain yields and nutrient use efficiencies.
* Advance agronomic nutrient fertilization optimization algorithms (NFOA’s) that can be employed by both advanced and resource poor farmers for improved nutrient use.
* Refine precision corn leaf orientation systems that maximize light interception, optimize plant spacing and increase corn grain yields
* Deliver affordable and functional NDVI sensors for use in determining fertilizer N rates in cereals
* Implement integrated agronomic research projects across scientific fields consistent with environmental concerns.
* Enhance team-oriented research projects that are the product of the researchers themselves who want to work together and who want to make a contribution to our world. **RESUME SUMMARY**

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| **Publications Total** | |
| Refereed Journal Publications | 201 |
| Books | 3 |
| Book Chapters | 15 |
| Patents | 12 |
| Proceedings | 20 |
| Popular Press, Departmental Books | 35 |
| Abstracts | 277 |
| Web Sites | 9 |
| Research Bulletins | 28 |
| CIMMYT Research Papers | 9 |
| **Teaching** | |
| Soil Plant Nutrient Cycling and Environmental Quality 5813 | SP92,SP94,SP96,SP98,SP00,SP02,SP04,SP06,SP08,SP10,SP12,SP14,SP16, (avg. 17) |
| Senior Seminar 4571 | FA94 (20) |
| Seminar 5020 | SP94, FA94, SP95, SP05, FA05 (avg. 16) |
| Precision Agriculture 4213 | SP97, SP99, SP01, SP02, SP03, SP04, SP06, SP07,SP08,SP10,SP11(avg. 25) |
| Soil Nutrient Management 4234 | FA04, FA05, FA06, FA07, FA08 (avg. 35) |
| Research Methods 5112 | SP05,SP07,SP09, SP11,SP13,SP15 (avg. 14) |
| **Total** number of students (all classes) | **835** |
| **Professional Invitations** | |
| International Invitations, (paper required) | 11(9) |
| National Invitations, (paper required) | 14(8) |
| **Conferred Graduate Degrees as Major Advisor (81 total graduates)** | |
| Current M.S. and Ph.D. degrees in progress | 10 |
| Master of Science completed as Major advisor | 56 |
| Doctor of Philosophy completed as Major advisor | 25 |
| **Total** | **91** |
| **Competitive Grants And Proposals (61)** | |
| 1989-present | **$8,406,114** |
| **International Student Travel** | |
| Fully funded travel for faculty and graduate students traveling to Mexico, Uzbekistan, Kenya, Ethiopia, Zimbabwe, India, Turkey, Australia, Russia, and China to conduct sensor based N fertilization training with CIMMYT on short (1-week) and long-term (4 month) study. | 101 |
| **Miscellaneous** | |
| Years of service as Editor, Agronomy J. | 4 |
| Years of service as Technical Editor, Agronomy J. | 8 |
| Years of service as Associate Editor, Agronomy J. | 6 |
| Years of service as Associate Editor, J. Plant Nutrition | 5 |
| **TOTAL years editorial service** | **23** |
| Field Days and Workshops Coordinated | 8 |
| International Workshops Coordinated | 2 |
| International Agronomic Networks Established | 1 |
| Committee Member | 40 |
| Board Member, public/private organizations | 3 |
| National & International Awards | 20 |

**CAREER HIGHLIGHTS and IMPACT 1985-present**

* **1985:** Long-term trial that was initiated to evaluate residue management in spring wheat near Ciudad Obregon, Mexico is being continued today by CIMMYT staff
* **1987:** Legume interseeding trials started throughout Central America in a regional structure showed that *Vigna* spp could be grown under high shade within corn, thus decreasing soil erosion on marginal, highly sloping land.
* **1990:** Co-founder of **Agronomia Mesoamericana**, ISSN 1021-7444, agronomic journal in Central America for agricultural scientists
* **1992:** Initiated work with a multidisciplinary group (Engineering and Agronomy) to develop improved N fertilization for cereal crops
* **1993:** First to publish on the use and applications of stability analysis for interpreting treatment by environment interactions in agronomic experiments (Agron. J. 85:159).
* **1995:** Documented the presence of inorganic N buffering in wheat production that explained why NO3-N leaching was limited in these environments (Agron. J. 87:827).
* Used tritium-helium water dating techniques to partition NO3-N contamination into pre WWII and post WWII categories, consistent with the time (post WWII) when inorganic fertilizers were first used.
* **1996:** Published definitive data showing how spectral radiance measurements could be used for correcting in-season fertilizer N deficiencies in wheat. (Trans. ASAE 39:1623).
* **1997:** Consistent with work in corn documenting plant NH3 loses, work in wheat showed that losses approached 40 kg N/ha at average yield levels. (J. Plant Nutr. 20:389).
* **1998:** Microvariability work showed significant differences in soil-test properties in agricultural fields at distances less than 0.5 m apart (Soil Sci. Soc. Am. J. 62:683)
* **1999:** Long-term application of high N rates in continuous winter wheat showed that soil organic C could be significantly increased (Soil Tillage Res. 47:323)
* Published comprehensive review manuscript documenting nitrogen use efficiencies for cereal production world wide at 33% (Agron. J. 91:357)
* **2000:** Showed that forage production systems has much higher N use efficiencies since the plant was not allowed to approach maturity when plant losses increased (J. Plant Nutr. 23:1505).
* **2001:** Showed that final wheat grain yield levels could be predicted from mid-season NDVI readings collected from winter wheat over various years and locations and that could be used for adjusting fertilizer N rates (Agron. J. 93:131).
* **NTech Industries** formally established, and a joint venture agreement was initiated with Oklahoma State University to deliver the **GreenSeeker** sensing and agronomic technologies to farmers around the world.
* **2002:** Using mid-season prediction of yield, the response index, and N adjustments based on these values, NUE’s in wheat were increased by 15% over conventional practices (Agron. J. 94:815)
* Published comprehensive long-term trial work showing the value of using the response index as a guide for improved fertilizer N management (J. Plant Nutr. 26:249)
* **Sensor Based Nitrogen Rate Calculator** established on-line that includes 24 functional algorithms for various crops whereby farmers can obtain improved mid-season fertilizer recommendations (<http://www.soiltesting.okstate.edu/SBNRC/SBNRC.php>)
* **2003:** SOIL 5813 Class project results in the 4th “class project” to publish as a part of nutrient management instruction (J. Plant Nutr. 26:1561).
* Optical Sensing Nitrogen Management Group meets for the first time in Stillwater, OK. Focus on increased NUE for corn and wheat production included attendees from Oklahoma, Nebraska, Missouri, Minnesota, Illinois, Kansas, North Dakota, Iowa, Mexico, Canada, Virginia, and Maryland.
* **2004:** Automated calibration stamp developed as an alternative to sensors for use in determining optimum fertilizer N rates (Agron. J. 97:338)
* **2005:** Comprehensive publication of components that comprise the crop nitrogen algorithm (Commun. Soil Sci. Plant Anal. 36:2759), and recorded US Patent 6,880,291.
* Documented plant to plant variability that exceeded 2780 kg/ha in corn production over 3 countries, and 7 states, further enhancing the need for precision sensing technologies that treat this variability (Agron. J. 97:1603)
* International Network for Improving NUE established (<http://www.nue.okstate.edu/Nitrogen_Conference2003/2006_Regional_Trial.htm>)
* Over **1000 N Rich Strips** established in farmer fields in Oklahoma on over 125,000 acres. Using the Sensor Based N Rate Calculator, a net profit exceeding $10/acre has been realized for those farmers participating in this program.
* **2006:** NUE web site established in 1996 ([www.nue.okstate.edu](http://www.nue.okstate.edu)) receives its 70,000 hit, averaging 50 + per day. Site reports comprehensive information on how to improve nitrogen use efficiency in cereal production.
* Ramp Calibration Strip initiated to replace the calibration stamp for increased farmer adoption and improved N management in virtually all crops.
* **2007:** RAMP or N Rich Strips extended in over 2000 farmer fields with a service area exceeding 200,000 acres.
* 5th consecutive year, for Optical Sensing Nitrogen Management Group meeting, started in 2003, now hosted by Monsanto Co. Attendees have risen from 30 in 2003 to now over 75.
* **2008:** By-plant N fertilization strategy implemented in corn production systems that resulted in increased NUE.
* N Rich Strips adopted by Oklahoma Fertilizer Dealers throughout central and western portions of the state. Areas using the GreenSeeker sensor based N recommendations in many other regions in the US, and around the world have become extensive.
* OSU N fertilization methodology was fully endorsed by Dr. Norman Borlaug (1970 Nobel Peace Prize Recipient). Use of the OSU N fertilization approach in the US, and other parts of the world documented in various popular press sources (<http://www.nue.okstate.edu/International/GreenSeeker.htm>).
* **2009:** Published joint article with Dr. Norman Borlaug (CSA News, 54:21-22) on the importance of generational recommitment to education in the developing world. First iteration of the pocket sensor completed and tested. Seed orientation project initiated showing that leaf architecture could be controlled at planting.
* **2010:** Seed orientation at planting resulting in leaves perpendicular to the row (all plants) and increased corn grain yields. Development of seed orientation equipment initiated via a joint project with BAE. 67 NDVI Pocket Sensors, tested, with a new prototype now being used. Team development of new age hand planter for the third world.
* **2011:** Release of the Grain Protein Optimizer option on the Sensor Based Nitrogen Rate Calculator. Release of the NH3 loss calculator for guided urea applications.
* **2012:** Team development of a new-age hand-planter for the third world capable of planting single seeds and by-plant placement of N fertilizer.
* First year as Editor, of Agronomy Journal, the most prestigious agricultural journal in the world.
* On-line class (SOIL 5813) taught in the Department of Plant and Soil Sciences, that included 23 on-campus and 2 on-line students at Louisiana State University and the Noble Foundation.
* **2013:** Release of third world hand planter capable of holding 5000+ seeds and that can be singulated. Successful completion of first year as Editor, Agronomy Journal.
* On-line class (SOIL 5112) taught in the Department of Plant and Soil Sciences, that included 16 on-campus and 2 on-line.
* **2014:** Hosted International Hand Planter Workshop, January 16, 2014. Attendance in person and on-line included 89 people. Countries that attended the workshop on-line included Bangladesh, Burundi, Belize, Brazil, Colombia, El Salvador, Ethiopia, Guatemala, India, Kenya, Malawi, Mexico, Mozambique, Sierra Leone, Nepal, Philippines, Tanzania, Togo, Uganda, USA, Zambia, and Zimbabwe (<http://nue.okstate.edu/Hand_Planter/osu_hand_planter_workshop.html>)
* **2015:** 13th annual NUE conference hosted in Auburn, AL. Published class paper documenting the need to analyze years independently in long-term trials.
* **2016:** Published CSA News article on the Impact Factor in ASA journals, and what this means to science. Published joint paper with colleagues from the NUE group on the value of sensor based algorithms developed by land grant universities and that are available to all farmer at no cost. Documented wide scale variability in optimum N rates in maize, for the Central Great Plains.

From 1991 to present our project has completed on average, 20 significant products per year. Significant products that were summed for each year and reported above include refereed journal publications, graduate students receiving degrees, books published, chapters published, patents issued, workshops completed, web sites developed, grants obtained, classes taught, and proceedings published. Data reported above **does not** include popular press, abstracts, and extension bulletins. We complete, update, and report each year on outcome based goals, and a mechanism that ensures if funds were budgeted for a specific project, a completion document (publication, proceeding, etc.) was required. This has assisted in our being able to generate 1.5 significant products per month over a 23 year period.

**JOURNAL PUBLICATIONS**

1. Olson, R. A., W. R. Raun, Yang Shou Chun and J. Skopp. 1986. Nitrogen management and interseeding effects on irrigated corn and sorghum and on soil strength. Agron. J. 78:856-862.
2. Raun, W. R., D. H. Sander and R. A. Olson. 1986. Emergence of corn as affected by source and rate of solution fertilizers applied with the seed. J. of Fert. Issues. 3(1):18-24.
3. McCallister, D. L., C. A. Shapiro, W. R. Raun, F. N. Anderson, G. W. Rehm, O. P. Engelstad, M. P. Russelle and R. A. Olson. 1987. Rate of phosphorus and potassium buildup/decline with fertilization for corn and wheat on Nebraska mollisols. Soil Sci. Soc. Am. J. 51:1646-1652.
4. Raun, W. R., R. A. Olson, D. H. Sander and R. L. Westerman. 1987. Alternative procedure for total phosphorus determination in plant tissue. Commun. Soil Sci. Plant Anal. 18:543-557.
5. Raun, W. R., D. H. Sander and R. A. Olson. 1987. Phosphorus fertilizer carriers and their placement for minimum till corn under sprinkler irrigation. Soil Sci. Soc. Am. J. 51:1055-1062.
6. Raun, W. R., D. H. Sander and R. A. Olson. 1989. Nitrogen fertilizer carriers and their placement for minimum till corn under sprinkler irrigation. Agron. J. 81:280-285.
7. Raun, W. R., H. J. Barreto, D. H. Sander and R. A. Olson. 1989. Frozen versus non-frozen sample preparation for plant tissue phosphorus analysis. Commun. In Soil Sci. Plant Anal. 20(1-2) 197-211.
8. Caceros, O.A., P. Gonzalez, I.Hidalgo, B. Moscoso and W.R. Raun. 1990. Ensayo exploratorio de métodos é interacciones de elementos en la aplicación de fertilizantes en el cultivo de maíz. Agron. Meso. 1:7-13.
9. Pierre, R., A. Robles, R. Celado, W.R. Raun and H.J. Barreto. 1990. Maize yield response to sulfur and phosphorus applied under different tillage systems in the Dominican Republic. Sulphur in Agriculture, Volume 14:16-19.
10. Raun, W. R., and R. L. Westerman. 1991. Nitrate-N and phosphate-P concentration in winter wheat at varying growth stages. J. of Plant Nutr. 14:267-281
11. Raun, W.R., and H.J. Barreto. 1991. Maize yield response as affected by sulfur, phosphorus and nitrogen as banded applications on a volcanic ash derived tropical soil. Commun. In Soil Sci. and Plant Anal. 22(15-16) 1661-1676.
12. Sosa, J.H., V.M. Mendoza, E.N. Ascencio, A.G. Alvarado, S. Bonilla and W.R. Raun. 1991. Efecto del calcio y azufre en el sistema maíz-frijol en ladera ante un nivel de nitrogeno y fósforo en El Salvador, 1989. Agron. Meso. 2:61-65.
13. Gordon, Roman, Andres Gonzalez, Jorge Franco, Nivaldo De Gracia, Adys de Herrera and William Raun. 1992. Evaluación de dosis y metodos de aplicación de azufre y su efecto residual en el cultivo de maíz en dos localidades de Azuero Panamá. Agron. Meso. 3:52-56.
14. Raun, W. R., H. J. Barreto, and R. L. Westerman. 1993. Use of stability analysis for long-term soil fertility experiments. Agron. J. 85:159-167.
15. Raun, W.R. and H.J. Barreto. 1993. Maize grain yield response to sulphur fertilization in Central America. Sulphur in Agriculture, Volume 16:26-30.
16. Westerman, R.L, R.K. Boman, W.R. Raun and G.V. Johnson. 1994. Ammonium and nitrate nitrogen in soil profiles of long-term winter wheat fertilization experiments. Agron. J. 86:94-99.
17. Guertal, E.A., W.R. Raun, R.L. Westerman and R.K. Boman. 1994. Applications of stability analysis for single-site, long-term experiments. Agron. J. 86:1016-1019.
18. Raun, W.R. and H.J. Barreto. 1995. Regional maize grain yield response to applied phosphorus in Central America. Agron. J. 87:208-213.
19. Sembiring, H., W.R. Raun, G.V. Johnson and R.K. Boman. 1995. Effect of wheat straw inversion on soil water conservation. Soil Sci. 159:81-89.
20. Boman, R.K., R.L. Westerman, W.R. Raun and M.E. Jojola. 1995. Time of nitrogen application: effects on winter wheat and residual soil nitrate. Soil Sci. Soc. Am. J. 59:1364-1369.
21. Boman, R.K., R.L. Westerman, W.R. Raun, and M.E. Jojola. 1995. Spring-applied nitrogen fertilizer influence on winter wheat and residual soil nitrate. J. Prod. Agric. 8:584-589.
22. Raun, W.R., and G.V. Johnson. 1995. Soil-plant buffering of inorganic nitrogen in continuous winter wheat. Agron. J. 87:827-834.
23. Johnson, G.V., and W.R. Raun. 1995. Nitrate leaching in continuous winter wheat: use of a soil-plant buffering concept to account for fertilizer nitrogen. J. Prod. Agric. 8:486-491.
24. Phillips, S.B., W.R. Raun and N.T. Basta. 1995. Use of reflectometry for determination of nitrate-nitrogen in well water. J. of Plant Nutr. 18:2569-2578.
25. Westfall, D.G., J.L. Havlin, G. Hergert and W.R. Raun. 1996. Nitrogen management in dryland cropping systems. J. Prod. Agric. 9:192-199.
26. Stone, M.L., J.B. Solie, W.R. Raun, R.W. Whitney, S.L. Taylor and J.D. Ringer. 1996. Use of spectral radiance for correcting in-season fertilizer nitrogen deficiencies in winter wheat. Trans. ASAE 39(5):1623-1631.
27. Altom, W., J.L. Rogers, W.R. Raun, G.V. Johnson and S.L. Taylor. 1996. Long-term rye-wheat-ryegrass forage yields as affected by rate and date of N application. J. of Prod. Agric. 9:510-516.
28. Solie, J.B., W.R. Raun, R.W. Whitney, M.L. Stone and J.D. Ringer. 1996. Optical sensor based field element size and sensing strategy for nitrogen application. Trans. ASAE 39(6):1983-1992.
29. Stone, Marvin L., John B. Solie, Richard W. Whitney, William R. Raun and Heather L. Lees. 1996. Sensors for detection of nitrogen in winter wheat. SAE Technical paper series. SAE Paper No. 961757. SAE, Warrendale PA.
30. Gavi, F., N.T. Basta and W.R. Raun. 1997. Wheat grain cadmium as affected by long-term fertilization and soil acidity. J. Environ. Qual. 26:265-271.
31. Boman, R.K., W.R. Raun, R.L. Westerman and J.C. Banks. 1997. Long-term nitrogen fertilization in short-season cotton: interpretation of agronomic characteristics using stability analysis. J. Prod. Agric. 10:580-585.
32. Taylor, S.L., G.V. Johnson and W.R. Raun. 1997. A field exercise to acquaint students with soil testing as a measure of soil fertility status and field variability. J. Nat. Resour. Life Sci. Educ. 26:132-135.
33. Kanampiu, F.K., W.R. Raun and G.V. Johnson. 1997. Effect of nitrogen rate on plant nitrogen loss in winter wheat varieties. J. of Plant Nutr. 20(2&3):389-404.
34. Gavi, F., W.R. Raun, N.T. Basta and G.V. Johnson. 1997. Effect of sewage sludge and ammonium nitrate on wheat yield and soil profile inorganic nitrogen accumulation. J. of Plant Nutr. 20(2&3):203-218.
35. Raun, William R., Gordon V. Johnson, Jeffory A. Hattey, Shannon L. Taylor and Heather L. Lees. 1997. Nitrogen cycle ninja, a teaching exercise. J. Nat. Resour. Life Sci. Educ. 26:39-42.
36. Phillips, S.B., W.R. Raun, and G.V. Johnson. 1997. Seasonal and long-term changes in well water nitrate-nitrogen. J. Environ. Qual. 26:1632-1637.

1. Raun, W.R., J.B. Solie, G.V Johnson, M.L. Stone, R.W. Whitney, H.L. Lees, H. Sembiring and S.B. Phillips. 1998. Micro-variability in soil test, plant nutrient, and yield parameters in bermudagrass. Soil Sci. Soc. Am. J. 62:683-690.
2. Sembiring, H., W.R. Raun, G.V. Johnson, M.L. Stone and S.B. Phillips. 1998. Detection of nitrogen and phosphorus nutrient status in bermudagrass using spectral radiance. J. Plant Nutr. 21:1189-1206.
3. Sembiring, H., G.V. Johnson and W.R. Raun. 1998. Extractable nitrogen using hot potassium chloride as a mineralization potential index. J. Plant Nutr. 21:1253-1271.
4. Sembiring, H., W.R. Raun and G.V. Johnson. 1998. Nitrogen accumulation efficiency: relationship between excess fertilizer and soil-plant biological activity in winter wheat. J. Plant Nutr. 21:1235-1252.
5. Sembiring, H., W.R. Raun, G.V. Johnson, M.L. Stone, J.B. Solie and S.B. Phillips. 1998. Detection of nitrogen and phosphorus nutrient status in winter wheat using spectral radiance. J. Plant Nutr. 21:1207-1233.
6. Raun, W.R., G.V. Johnson, S.B. Phillips and R.L. Westerman. 1998. Effect of long-term nitrogen fertilization on soil organic C and total N in continuous wheat under conventional tillage in Oklahoma. Soil & Tillage Res. 47:323-330.
7. Goedeken, Michael W., Gordon V. Johnson, William R. Raun and Steven B. Phillips. 1998. Soil test phosphorus crop response projections to variable rate application in winter wheat. Commun. Soil Sci. Plant Anal. 29:1731-1738.
8. Raun, W.R., G.V. Johnson, H. Sembiring, E.V. Lukina, J.M. LaRuffa, W.E. Thomason, S.B. Phillips, J.B. Solie, M.L. Stone and R.W. Whitney. 1998. Indirect measures of plant nutrients. Commun. In Soil Sci. Plant Anal. 29:1571-1581.
9. Raun, W.R., N.T. Basta, J.A. Hattey, H. Zhang, and G.V. Johnson. 1998. Changing departmental names from agronomy to plant, crop and soil sciences. J. Nat. Resour. Life Sci. Educ. 27:113-116.
10. Taylor, S.L., W.R. Raun, J.B. Solie, G.V. Johnson, M.L. Stone, and R.W. Whitney. 1998. Use of spectral radiance for correcting nitrogen deficiencies and estimating soil test variability in an established bermudagrass pasture. J. of Plant Nutr. 21:2287-2302.
11. Lukina, E.V., M.L. Stone and W.R. Raun. 1999. Estimating vegetation coverage in wheat using digital images. J. Plant Nutr. 22:341-350.
12. Taylor, S.L., M.E. Payton and W.R. Raun. 1999. Relationship between mean yield, coefficient of variation, mean square error and plot size in wheat field experiments. Commun. Soil Sci. Plant Anal. 30:1439-1447.
13. Raun, W.R., G.V. Johnson, and R.L. Westerman. 1999. Fertilizer nitrogen recovery in long-term continuous winter wheat. Soil Sci. Soc. Am. J. 63:645-650.
14. Mullen, R.W., W.E. Thomason and W.R. Raun. 1999. Estimated increase in atmospheric carbon dioxide due to worldwide decrease in soil organic matter. Commun. Soil Sci. Plant Anal. 30:1713-1719.
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16. Raun, W.R., and G.V. Johnson. 1999. Improving nitrogen use efficiency for cereal production. Agron. J. 91:357-363.
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85. Rutto, E., J.P. Vossenkemper, B.K. Chim, and W.R. Raun. 2011. Maize grain yield response to the distance nitrogen is placed away from the row. J. Exp. Agric.
86. Kanke, Yumiko, William Raun, John Solie, Marvin Stone, and Randal Taylor. 2012. Red edge as a potential index for detecting differences in plant nitrogen status in winter wheat. J. Plant Nutr. 35:1526-1541
87. Gutierrez, M., M.P. Reynolds, W.R. Raun, M.L. Stone, and A.R. Klatt. 2012. Indirect selection for grain yield in spring bread wheat in diverse nurseries worldwide using parameters locally determined in north-west Mexico. J. Agric. Sci. 150:23-43.
88. Martin, Kent L., William Raun, and John Solie. 2012. By-plant prediction of corn grain yield using optical sensor readings and measured plant height. J. Plant Nutr. 35: 1429-1439.
89. Lawles, Kyle, William Raun, Kefyalew Desta, and Kyle Freeman. 2012. Effect of delayed emergence on corn grain yields. J. Plant Nutr. 35:480-496.
90. Walsh, O., W.R. Raun, A. Klatt, and J.B. Solie. 2012. Effect of delayed nitrogen fertilization on maize (Zea mays L.) grain yields and nitrogen use efficiency. J. Plant Nutr. 35:538-555.
91. Solie, J.B., A.D. Monroe, W.R. Raun, and M.L. Stone. 2012. Generalized algorithm for variable nitrogen rate application in cereal grains. Agron. J. 104:378-387.
92. Rutto, E., B. Arnall, J.L. May, K. Butchee, and W. Raun. 2012. Ability of cotton (Gossypium hirsutum L.) to recover from early season nitrogen stress. J. Cotton Sci. 17:70-79.
93. Tremblay, N., M.Y. Bouroubi, C. Bélec, R. Mullen, N. Kitchen, W. Thomason, S. Ebelhar, D. Mengel, B. Raun, D. Francis, E.D. Vories, and I. Ortiz-Monasterio. 2012. Corn response to nitrogen is influenced by soil texture and weather. Agron. J. 104:1658-2671.
94. Crain, Jared, Kevin Waldschmidt, and W. Raun. 2013. Small scale spatial variability in winter wheat production. Commun. Soil Sci. Plant Anal. 44: 2830-2838. DOI:10.1080/00103624.2013.812735.
95. Boyer, Christopher N., B. Wade Brorsen, William R. Raun, D. B. Arnall, and J.B. Solie 2012. Efficiency of pre-plant, topdress, and variable rate application of nitrogen in winter wheat. J. Plant Nutr. 35:1776-1790.
96. Crain, Jared, Ivan Ortiz-Monasterio, and William R. Raun. 2012. Evaluation of a reduced cost, active, NDVI sensor for crop nutrient management. J. Sensors. Article ID 582028, 10 p. doi:10.1155/2012/582028.
97. Macnack, Natasha, and William R. Raun. 2013. Applied model for estimating potential ammonia loss from surface applied urea. Commun. Soil Sci. Plant Anal. 44:2055-2063.
98. Walsh, Olga, A.R. Klatt, J.B. Solie, C.B. Godsey and W.R. Raun, and 2013. Use of soil moisture data for refined GreenSeeker sensor based nitrogen recommendations in winter wheat (Triticum aestivum L.). J. Prec. Agric. 14:343-356.
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103. Santillano-Cazares Jesus, Angel Lopez-Lopez, Ivan Ortiz-Monasterio y W.R. Raun. 2013. Uso de sensores ópticos para la fertilización. Terra Latinoamericana. 31:95-103.
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105. Macnack, Natasha, Bee Chim Khim, Jeremiah Mullock, and William Raun. 2014. In season prediction of nitrogen use efficiency and grain protein in winter wheat, Triticum aestivum L.. Commun. Soil Sci. Plant Anal. 00:1-15. DOI:10.1080/00103624.2014.904337.
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107. Shi Yeyin, Ning Wang, Randal K. Taylor, William R. Raun, and James A. Hardin. 2013. Automatic corn plant location and spacing measurement using laser line-scan technique. Prec. Agric. 14:478-494.
108. Omara, Peter, Lawrence, Aula, Bill Raun, Randy Taylor, Adrian Koller, Eric Lam, Joshua Ringer, Jeremiah Mullock, Sulochana Dhital and Natasha Macnack. 2015. Hand planter for maize (Zea mays L.) in the developing world. J. Plant Nutr. DOI:10.1080/01904167.2015.1022186
109. Bushong, Jacob, Daryl B. Arnall and Bill Raun. 2014. Effect of preplant irrigation, nitrogen fertilizer application timing, and phosphorus, and potassium fertilization on winter wheat grain yield and water use efficiency. Int. J. of Agron.
110. Rutto, Emily, Cody Daft, Jonathan Kelly, Bee Khim Chim, Jeremiah Mullock, Guillerme Torres, and William Raun. 2014. Effect of delayed emergence on corn (Zea Mays L.) grain yield. J. Plant Nutr. 37:198-208.
111. Wyatt, Ethan, Jacob Bushong, Natasha Macnack, Jeremiah Mullock, Randy Taylor and William Raun. Influence of Droplet Size of Foliar Applied Nitrogen on Grain Protein Content of Hard Red Winter Wheat. 2016. Agron. J. (submitted).
112. Wyatt, Ethan, Jacob Bushong, Jeremiah Mullock, Natasha Macnack, Randy Taylor, and William Raun. 2014. Effect of adjuvant, nitrogen rate, and spray droplet size on protein content of hard red winter wheat (in press)
113. Bushong, Jacob T, Eric C. Miller, Jeremiah L. Mullock, D. Brian Arnall, and William R. Raun. 2014. Effect of irrigation and preplant nitrogen fertilizer source on maize in the southern Great Plains. Int. J. of Agronomy. <http://dx.doi.org/10.1155/2014/247835>
114. Bushong, Jacob T, Jeremiah L. Mullock, Eric C. Miller, William R. Raun, Arthur R. Klatt, and D. Brian Arnall. Development of an in-season estimate of yield potential utilizing optical crop sensors and soil moisture data for winter wheat. Prec. Agric. DOI 10.1007/s11119-016-9430-4.
115. Bushong, Jacob, D. Brian Arnall and William R. Raun. 2014. Effect of preplant irrigation, nitrogen fertilizer application timing, and phosphorus and potassium fertilization on winter wheat grain yield and water use efficiency. Int. J. of Agronomy. <http://dx.doi.org/10.1155/2014/312416>.
116. Koller, Adrian, Guilherme Torres, Michael Buser, Randy Taylor, William Raun and Paul Weckler. 2014. Relationship between maize kernel orientation and seed leaf azimuth follows Von Mises distribution. (accepted)
117. Torres, Guilherme M., Adrian Koller, Randy Taylor, and William R. Raun. 2014. Seed placement and leaf orientation effect on light interception and grain yield of maize (Zea mays L.). J. Exp. Agric.
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119. Kelly, J.P., Jared L. Crain, and W. R. Raun. 2015. By-plant prediction of corn (Zea mays L.) grain yield using height and stalk diameter. Commun. Soil Sci. Plant Anal. 46:564-575.
120. Macnack, Natasha and William Raun. 2015. Mid-Season Prediction of Grain Yield and Grain Protein in Winter Wheat (Triticum Aestivum L.) Using Different Spectral Indices. Precision Agriculture (accepted).
121. Raun, William, Melissa Golden, Bruno Figueiredo, Jagmandeep Dhillon, Mariana Ramos Del Corso, Nicole Remondet, Mame Diatite-Koumba, Shawntel Ervin, Daniel Alidekki, Ethan Driver, Bill Jones, James Lasquites, Samuel Zoca, Patrick Watkins, and Jeremiah Mullock. 2015. Relationship between mean square errors and wheat grain yields in long-term experiments. J. Plant Nutr. (accepted)
122. Li, Xiufen, Shiping Deng, Yan Wang, Bill Raun, and Ying Teng. 2015. Responses of soil bacterial and diazotrophic communities to century-long application of manure and chemical fertilizer under continuous winter wheat cultivation. Soil Biology and Biochemistry (accepted).
123. Omara, Peter, Natasha Macnack, and William Raun. 2015. Effect of Long-term Beef Manure Application on Soil Test Phosphorus, Organic Carbon and Winter Wheat Yield. J. Plant Nutr (in press)
124. Dhital, Sulochana and William Raun. 2016. Variability in optimum N rates for maize. Agron. J. (accepted)
125. Bushong, J.T., J.L. Mullock, E.C. Miller, W.R. Raun, and D.B. Arnall. 2016. Evaluation of mid-season sensor based nitrogen fertilizer recommendations for winter wheat using different estimates of yield potential. J. Prec. Agric. DOI 10.1007/s11119-016-9431-3.
126. Macnack, N., and W.R. Raun. 2016. Effect of long-term beef manure application on soil test phosphorus, organic carbon and winter wheat yield. J. Plant Nutr. (accepted)
127. Aula, L., Natasha Macnack, Peter Omara, Jeremiah Mullock and William Raun. 2016. Effect of Fertilizer Nitrogen (N) on Soil Organic Carbon, Total N and Soil pH in Long-Term Continuous Winter Wheat (Triticum aestivum L.). Commun. Soil Sci. Plant Anal. DOI: 10.1080/0010364.2016.1147047.
128. Franzen, D., N. Kitchen, K. Holland, J. Schepers, and W. Raun\* 2016. Algorithms for in-season nutrient management in cereals. Agron. J. 05/02/2016. doi:10.2134/agronj2016.01.0041.
129. Torres, Guilherme M., Adrian Koller, Randy Taylor and William R. Raun. 2016. Seed-oriented planting improves light interception, radiation use efficiency and grain yield of maize (Zea mays L.). Expl. Agric. Camb. Univ. Press. Doi:10.1017/S0014479716000326.
130. Bushong, J.T., J.L. Mullock, D.B. Arnall and W.R. Raun. 2016. Effect of Nitrogen Fertilizer Source on Maize (Zea mays L.) Optical Sensor Response Index Values in a Rain-fed Environment. Precision Ag.
131. Raun, W.R., Brett Holte, E.A. Guertal and Sue Ernst. 2016. Use of the impact factor in agriculture. CSA News, Am. Soc. Agron. July issue, Madison, WI.
132. Arnall, D.B., M. Abit, Randy Taylor and William Raun. 2016. Development of a sensor-based nitrogen rate calculator for cotton (Gossypium Hirsutum L.). Crop Sci. doi: 10.2135/cropsci2016.01.0049.
133. McFadden, Brandon, Wade Brorsen, and William Raun. 2016. Nitrogen Fertilizer Recommendations Based on Plant Sensing and Bayesian Updating. Precision Agriculture. (in review)
134. Koller, Adrian, Randy Taylor, Bill Raun, Paul Weckler and Michael Buser. 2016. Modeling and Validation of Corn Seed Orientation by Pushing. J. Biosystems Agric. Eng.
135. Haney, Elizabeth. Richard Haney, Michael White, Jeff Arnold, Raghavan Srinivasan and William Raun. 2016. Comparison of wheat yield simulated using four N cycling options in the Soil and Water Assessment Tool model. J. Biosystems Engineering.

**NOTE:** The majority of all recent refereed journal publications can be found on-line at <http://www.nue.okstate.edu/Index_Publications.htm>, including those in-press, and/or accepted.

**BOOKS**

1. Raun, W.R. 2003. The snake and the doctor. 1st Books, Bloomington, IN.
2. Schepers, J.S., and W.R. Raun. 2008. Nitrogen in Agricultural Systems. Agron. Monogr. 49. ASA, CSSA, SSSA, Madison, WI.
3. Raun, W.R., K.W. Freeman, R.W. Mullen, and R.L. Westerman. 2015. Soil Plant Nutrient Cycling and Environmental Quality. 5th Edition, Oklahoma State University, Stillwater, OK 74078.

**BOOK CHAPTERS**

1. Smyth T.J., W.R. Raun and Floria Bertsch. 1991. Manejo de Suelos Tropicales en Latinoamérica. Soil Science Department, North Carolina State University, Raleigh, NC.
2. Raun, W.R., S.L. Taylor and G.V. Johnson. 1994. Soil Fertility. p.93-100. *In* Charles J. Arntzen and Ellen M. Ritter (ed.) Encyclopedia of Agricultural Science. Vol. 4. Academic Press, Inc., San Diego, CA.
3. Johnson, G.V., W.R. Raun and B.R. Simons. 1998. Oklahoma Homeowner’s Handbook For Soil And Nutrient Management. Dept. of Plant and Soil Sciences. Oklahoma State University, Stillwater, OK.
4. Raun, W.R., G.V. Johnson, R.L. Westerman and J.A. Hattey. 1999. Wheat production in the great plains of north america. p. 263-272. *In* E.H. Satorre and G.A. Slafer (eds.) Wheat, Ecology and Physiology of Yield Determination. Food Products Press, Haworth Press, Inc. New York, NY.
5. Westerman, R.L., W.R. Raun and G.V. Johnson. 1999. Nutrient and water use efficiency. D175-189. *In* Malcolm E. Sumner (ed.) Handbook of Soil Science. CRC Press, Inc. Boca Raton, FL.
6. Raun, W.R., G.V. Johnson, and R.L. Westerman. 1996, 1998, 2000. Soil-plant nutrient cycling and environmental quality. Dept. of Plant and Soil Sciences, Okla. State Univ. Stillwater, OK (246 p.).
7. Johnson, G.V., W.R. Raun, H. Zhang and J.A. Hattey. 2000. Oklahoma soil fertility handbook. Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK.
8. Zhang, H., and W.R. Raun. 2006. Oklahoma soil fertility handbook. Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK.
9. Freeman, K.W., and W.R. Raun. 2007. Advances in nitrogen handling strategies to increase the productivity of wheat. p. 169-173. In H.T. Buck et al. (eds). Wheat production in stressed environments. Springer, AA Dordrecht, The Netherlands.
10. Raun, W.R., and J.S. Schepers. 2008. Nitrogen management for improved use efficiency. p.675-693. *In* J.S. Schepers and W.R. Raun (eds.) Nitrogen in agricultural systems. Agron. Monogr. 49. ASA, CSSA, SSSA, Madison, WI.
11. Meisinger, J.J., J.S. Schepers, and W.R. Raun. 2008. Crop nitrogen requirement and fertilization. p.563-612. *In* J.S. Schepers and W.R. Raun (eds.) Nitrogen in agricultural systems. Agron. Monogr. 49. ASA, CSSA, SSSA, Madison, WI.
12. Raun, William R., Ivan Ortiz-Monasterio, and John B. Solie. 2009. Temporally and spatially dependent nitrogen management for diverse environments. *In* Brett F. Carver (ed) Wheat:Science and Trade. Wiley-Blackwell Publishing: Chapter 10, 203-214.
13. Schepers, J.S., and W.R. Raun. 2010. Nitrogen sensors to fine tune the nutrient management decision making process. In Advances in Nitrogen Management for Water Quality, (eds) Jorge A. Delgado and Ronald F. Follett. Soil and Water Cons. Soc. Ankeny, IA. pp. 207-229
14. Girma, Kefyalew, and William Raun 2010. Nutrient and water use efficiency. *In* Jim Camberato (ed.) Handbook of Soil Science. CRC Press, Inc. Boca Raton, FL.
15. Stone, Marvin, and William Raun. 2015. Sensing Technology for Precision Crop Farming, *In* Precision Agriculture Technology for Crop Farming. Pg 21-54. DOI: 10.1201/b19336-3. CRC Press.
16. Zhang, Hailin and W.R. Raun. 2016. Oklahoma Homeowner’s Handbook For Soil And Nutrient Management. 3rd Edition. Dept. of Plant and Soil Sciences. Oklahoma State University, Stillwater, OK.

**PATENTS**

1. Raun, W.R., G.V. Johnson, J.B. Solie, and M.L. Stone. 2003. Process for in-season fertilizer nitrogen application based on predicted yield potential. US Patent No. 6,601,341 B2. Issued, August 5, 2003.
2. Stone, M.L., D. Needham, J.B. Solie, W.R. Raun, and G.V. Johnson. 2003. Optical spectral reflectance sensor and controller. US Patent No. 6,596,996 B1, Issued July 22, 2003.
3. Raun, W.R., G.V. Johnson, J.B. Solie, and M.L. Stone. 2004. A process for in-season fertilizer nitrogen application based on predicted yield potential. U.S. Patent. 10,195,138. (CIP of U.S. Patent 6,601,341).
4. Raun, W.R., G.V. Johnson, J.B. Solie, and M.L. Stone. April 19, 2005. A process for in-season fertilizer nitrogen application based on predicted yield potential. U.S. Patent. 6,880,291 B2, Issued, April 19, 2005.
5. Stone, M.L., D. Needham, J.B. Solie. W.R. Raun, and G.V. Johnson. 2005. Optical Spectral Reflectance Sensor and Controller. U.S. Patent. 6,855,933 B2, Cont. of 6,596,996, Issued Feb 15, 2005.
6. Raun, W.R., G.V. Johnson, J.B. Solie, M.L. Stone, K.W. Freeman. 2007. Use of within-field-element-size CV for improved nutrient fertilization in crop production. US Patent No. 7,188,450 B2. Issued, March 13, 2007.
7. Solie, J.B., M.L. Stone, W.R. Raun, 2009. Handheld optical sensor for measuring the normalized difference vegetative index in plants. Prov. Patent 61/219,053.
8. Solie, J.B., W.R. Raun, and A.D. Monroe. 2009. Method for variable rate nitrogen application for plants. Prov. Patent 61/219,057.
9. Solie, J.B., M.L. Stone, and W.R. Raun. 2010. Hand held optical sensor for measuring the normalized difference vegetative index in plants. Prov. Patent 12/820,669
10. Koller, A. Adrian, William R. Raun, and Randal K. Taylor. 2012. Singulating hand planter and fertilizer applicator. Serial No. 61/799,338. Disclosure, July 26, 2012.
11. Koller, A. Adrian, Randal K. Taylor, and William R. Raun. 2012. Seed orienting corn planter. Disclosure, March 28, 2012.
12. Koller, A., Adrian, Randal K. Taylor, and William R. Raun. 2015. US Utility Patent Appl. No. 14/776,848 (based on Int’l. Patent Appl. No. PCT/US2014/030400 filed 3/17/14). Singulating Hand Planter and Fertilizer Applicator. OSU Ref. No. 2013.01.

**SERVICE TO PROFESSIONAL SOCIETIES  
  
SSSA** Soil Science Society of America; **ASA** American Society of Agronomy

2011-present Editor, Agronomy Journal, ASA-SSSA-CSSA

2010-2011 Senior Associate Editor, Agronomy Journal, ASA-SSSA-CSSA

2010-present Associate Editor, Journal of Plant Nutrition

2001-2007 **Technical Editor-Soils**, Agronomy Journal, ASA-SSSA-CSSA (responsible for 12 Associate Editors and annually handled more than 80 manuscripts)

2003-2009 SSSA Rapid Response Team (S536.1)

2001-2004 SSSA Division S-8 Board Representative

1996-2001 Associate Editor, Agronomy Journal

2000-2001 Larson Hydro Memorial Scholarship Committee

1998-2000 ASA Membership Committee

**PROFESSIONAL ACTIVITIES**

Co-Chairman, Sensor Based Nutrient Management Community, ASA, 2012

International Plant Nutrition Institute (IPNI) Advisory Group, 2008

RESOURCE 21, Agriculture Advisory Board Member, Farmland Industries, 1997-1999

National Research Initiative Panel Member, USDA, Water Resources Assessment and Protection, 1995

National Research Initiative Panel Member, USDA/CSREES, WRAP, 1999

Member, Oklahoma Agribusiness Retailers Association (OARA), 1992-present

Farmland/University Fertilizer Advisory Board, 1992 - 2001

Advisor, Agronomy Graduate Student Organization, 1992 - 1995

National Research Council, Committee on Sustainable Agriculture for The Humid Tropics, 1990

Member of the American Association for the Advancement of Science, 1984

Member of the American Society of Agronomy, 1981-present

Member of the Soil Science Society of America, 1981-present

Member of the Crop Science Society of America, 2010-present

**AWARDS/Recognition**

Leo M. Walsh Soil Fertility Distinguished Lectureship, Phoenix, AZ, November 8, 2016

Excellence in Graduate Student Advising/Mentoring, Oklahoma State University, 2016

Graduate College Commencement Speaker, Oklahoma State University, 2015

Soil Science Society of America, Applied Research Award, 2015

Great Plains Soil Fertility Leadership Award, 2014

PrecisionAg Award of Excellence, Legacy Award, 2013

Pierre C. Robert Precision Agriculture Senior Scientist Award, 2010

Eminent Faculty Award, Oklahoma State University, 2009

ASA-CSSA-SSSA, Award of Excellence. Oklahoma Homeowner’s Handbook for Soil and Nutrient Management (E-1003), 2009

Gamma Sigma Delta Experienced Research Scientist Award, 2009

Sarkeys Distinguished Professor Award, Oklahoma State University, 2007

Werner L. Nelson Award for Diagnosis of Yield-Limiting Factors, American Society of Agronomy, 2006

Melvin D. and Mary E. Jones Distinguished Professorship of Agronomic Sciences, 2006

Regents Distinguished Research Award, Oklahoma State University, 2004

United States Dept. of Agriculture Secretary’s Honor Award, 2002 – GreenSeeker Research Team

Fellow, Soil Science Society of America, 2001

Fellow, American Society of Agronomy, 2000

Robert E. Wagner Award, Potash & Phosphate Institute, 1997

James A. Whatley Award, Oklahoma State University, 1996

Widaman Trust Distinguished Graduate Assistant, University of Nebraska, 1985

Gamma Sigma Delta, 1984

Sigma Xi, 1984

**INTERNATIONAL WORKSHOPS**

1. Raun, W.R., J.S. Schepers, G.V. Johnson, J.B. Solie, and M.L. Stone. 2003. Coordinated “Crop Nitrogen Algorithm Workshop” that included scientists from the USDA-ARS, Mexico, and Universities from Nebraska, Oklahoma, Kansas, Missouri, Virginia, and Colorado. May 19-20, 2003. Results from all presentations published simultaneously on the web, with a comprehensive summary.  
   <http://nue.okstate.edu/Nitrogen_Conference2003/Planning_Session.htm>
2. Schepers, J.S., J. Shanahan, G. Varvel, W. Wilhelm, N. Kitchen, W.R. Raun, and M.L. Stone. 2004. Coordinated “Crop Nitrogen Algorithm Workshop” that included scientists from the USDA-ARS, and Universities from Nebraska, Texas, Kentucky, Illinois, Minnesota, Oklahoma, Kansas, Missouri, Idaho, Colorado, Arizona, Canada, , Mexico. August 5-6, 2004. Results from all presentations published simultaneously on the web.  
   <http://nue.okstate.edu/Nitrogen_Conference2003/Planning_Session2004.htm>
3. Raun, W.R., and R.K. Taylor. 2014. Hand Planter Workshop included scientists from all over the world, January 16, 2014. Results from all presentations published on the web. All presentations were delivered live over the web to 22 different third world countries, including many in the US. <http://nue.okstate.edu/Hand_Planter/osu_hand_planter_workshop.html>

**INTERNATIONAL NETWORK FOR IMPROVING NUE**

1. The NUE network was first started in 2003 (Stillwater, OK). This international group has since met every year (14th annual conference to be held in Boise, ID, 2016). Result has been a network of collaborating scientists that now includes groups from Argentina, Canada, Mexico, China, and the USA. A combined effort of more than 75 scientists working in nitrogen management has accelerated progress needed for improving nitrogen use efficiency using precision sensing technologies.   
   <http://nue.okstate.edu/Conferences_Workshops.htm>

**FIELD DAYS and WORKSHOPS COORDINATED**

1. Variable rate technology field day. PI’s. Marvin Stone, John Solie, Richard Whitney, and Bill Raun. Conducted for research and industry groups involved in variable rate application of fertilizers. 107 people in attendance. Hennessey, OK, March 22, 1996.
2. Wheat Workshop. Jointly conducted with Gene Krenzer, Bob Hunger, Tom Royer, and Roger Gribble for CCA advanced training using hands-on examples in management, entomology, pathology, soil fertility and weed management. Lahoma, OK, May 15, 1998.
3. Wheat 2000 Workshop. Jointly conducted with Gene Krenzer, Bob Hunger, Tom Peeper, Jim Stritzke, Tom Royer, Ray Sidwell, and Aaron Guenzi for CCA advanced training using hands-on examples in management, entomology, pathology, soil fertility and weed management. Lahoma, OK, May 18, 2000.
4. CCA Hands-on Training, Jointly conducted with Gener Krenzer, Bob Hunger, Tom Royer, Ray Sidwell, John Solie, Tom Peeper, and Case Medlin. For CCA advanced training using hands-on examples of precision agriculture, soil fertility, entomology, pathology, and weed management. Lahoma, OK, May 16, 2002.
5. Wheat 2004 Workshop, CCA Hands-on Training, Jointly conducted with Gene Krenzer, Bob Hunger, Tom Royer, Ray Sidwell, John Solie, Tom Peeper, and Case Medlin. For CCA advanced training using hands-on examples of precision agriculture, soil fertility, entomology, pathology, and weed management. Lahoma, OK, May 20, 2004.
6. Sensor-Based N Rich Strip Workshop, Jointly conducted with John Solie, Marvin Stone, Kyle Freeman, Ross Love, and Carol Jones, for 35 attendees from Oklahoma, and Canada. Stillwater, OK January 11-12, 2005.
7. Sensor-Based N Rich Strip Workshop, Jointly conducted with John Solie, Marvin Stone, Kyle Freeman, Randy Taylor, Ross Love, Carol Jones, Hailin Zhang, and Jeff Edwards for 65 attendees from Oklahoma, Michigan, Kansas, and Canada. Stillwater, OK, January 19-20, 2006.
8. RAMP and N Rich Strip Training of Ag Educators in Oklahoma and Kansas. Jointly conducted with Randy Taylor, John Solie, Ross Love, Hailin Zhang, and Jeff Edwards for 70 attendees. Stillwater, OK January 18-19, 2007.
9. Annual International NUE Conference, Stillwater, OK, Aug 4-5, 2010 (attended by 100 scientists from all over the world)
10. Colorado State University Sensor Based N Rate Workshop. April 9-10, 2013 (attended by 5 scientists)

**R&D RESULTS IN INDUSTRY**

The first sensor-based N rate applicator was conceived, developed, tested, and shown at an OSU field day on March 22, 1996 (PI’s John Solie, Marvin Stone, Bill Raun and Gordon Johnson). From 1996 to 1998, informal discussions were held with John Deere Co., Toro Equipment, and Case IH, concerning the commercial application of this work but no formal agreement was made. Our OSU precision sensing team initiated discussions with John Mayfield (future president of NTech Industries) in the fall of 1998. From 1998 to 2001, continued research and development of the sensor-based variable N rate applicator developed at OSU took place. On October 15, 2001, NTech Industries was formally established and a joint venture was signed with OSU concerning the sale of sensor based N rate applicators combined with continued R&D at OSU. NTech is now owned by Trimble which is actively selling the GreenSeekerTM Hand-held sensors and field scale variable N rate applications. Hand held sensors are now used in *Canada, Mexico, Ecuador, Argentina, China, India, Turkey, Australia, Uzbekistan, Russia, Zimbabwe, Kenya, Ethiopia,* ***USA****: Idaho, Maryland, Virginia, Nebraska, Kansas, Missouri, Colorado, Iowa, Minnesota, Ohio, North Carolina, North Dakota, Kentucky, Tennessee, Colorado, South Dakota, Texas, California, Illinois, and Oklahoma*.

**WEB SITES DEVELOPED and MAINTAINED**

1. Raun, W.R., J.B. Solie, D.B. Arnall, and M.L. Stone. 1996-present. Improving nitrogen use efficiency for winter wheat production. [www.nue.okstate.edu](http://www.nue.okstate.edu).Okla. Agric. Exp. Sta. Stillwater, OK. (hits to date, >110,000)
2. Raun, W.R., R.L. Westerman and G.V. Johnson. 1998-present. Soil fertility research and education. [www.dasnr.okstate.edu/fertilizer\_checkoff](http://www.dasnr.okstate.edu/fertilizer_checkoff).Okla. Agric. Exp. Sta. Stillwater, OK. (hits to date, 2530)
3. Raun, W.R., J.B. Solie, M.L. Stone, G.V. Johnson and R.W. Whitney. 1998-present. Precision agriculture in Oklahoma. [www.dasnr.okstate.edu/precision\_ag](http://www.dasnr.okstate.edu/precision_ag)*.* Okla. Agric. Exp. Sta. Stillwater, OK. (hits to date, 12,405)
4. Raun, W.R., G.V. Johnson, E.G. Krenzer, W.E. Thomason, R. Hunger, T. Royer, R. Gribble, R. Sidwell, G. Cuperus, A. Goforth, J. Hise. 2000-2002. Wheat 2000 Workshop. [www.dasnr.okstate.edu/wheat2000](http://www.dasnr.okstate.edu/wheat2000). Okla. Agric. Exp. Sta. Stillwater, OK.
5. Raun, W.R., G.V. Johnson, and R.L. Westerman. 2000-present. Soil plant nutrient cycling and environmental quality. <http://soil5813.okstate.edu>. Okla. Agric. Exp. Sta. Stillwater, OK.
6. Raun, W.R., J.B. Solie, G.V. Johnson, and M.L. Stone. 2000-present. Precision Agriculture, SOIL 4213. <http://soil4213.okstate.edu>. Okla. Agric. Exp. Sta. Stillwater, OK. (hits to data, 7454)
7. Raun, W.R., and D.B. Arnall. 2004-present. Soil Nutrient Management, SOIL 4234. <http://soil4234.okstate.edu>. Okla. Agric. Exp. Sta. Stillwater, OK. (hits to date, 4,473)
8. Raun, W.R. 2005-present. Research Methods in Plant and Soil Sciences, SOIL 5112. Okla. Agric. Exp. Sta. Stillwater, OK. [www.nue.okstate.edu/Research\_Methods/Research.html](http://www.nue.okstate.edu/Research_Methods/Research.html)
9. Raun, W.R., and R.K. Taylor, 2013. OSU Singulating Hand Planter for the Third World. Okla. Agric. Exp. Sta. Stillwater, OK. <http://nue.okstate.edu/Hand_Planter.htm>

**GRANTS AND PROPOSALS**

1. Olson, R.A., W.R. Raun and D.H. Sander. 1983-85. Placement of phosphorus and nitrogen fertilizers for minimum till corn under sprinkler irrigation. Responsible for annual reports submitted to the Tennessee Valley Authority. Grant funded for $32500.
2. Raun, W.R., D.H. Sander and R.A. Olson. 1984. Response of irrigated corn yields to nitrogen sources applied with a urease inhibitor. Grant funded by Allied Chem. Co., for $2500 in 1984 and $2500 in 1985.
3. Raun, W.R., 1988. Methods of applying sulfur for maize grown on volcanic ash derived soils in Central America. Submitted to The Sulphur Institute, February 1988. Grant funded for $5000, November 1988, $5000, November 1989 and $5000, November 1990.
4. Raun, W.R., and T.J. Smyth. 1989. Phosphorus source and method evaluation for Central America. Submitted to Texasgulf Export Corporation, January, 1989. Grant funded, August, 1989 for $55,000.
5. CRP-CIMMYT. 1991. Jointly obtained additional funding for the new agronomic journal 'Agronomía Mesoamericana' from the European Economic Community ($80,000 for the period 1991-1994).
6. Basta, N.T., W.R. Raun, E.R. Allen, G.V. Johnson and M.P. Anderson. 1993. Impact of long-term cropping on cadmium in wheat and evaluation of agroecosystem Cd bioavailability indicators. Submitted to the OSU-Targeted Research Initiative, June 1, 1993 for $7740. Grant funded, August, 1993.
7. Raun, W.R. and G.V. Johnson. 1993. Effect of timing of residue and fertilizer nitrogen incorporation on N use efficiency in winter wheat. Submitted to Farmland Industries Inc., November 18, 1993 for $24,000. Funded for $24000, February 9, 1994.
8. Raun, W.R., G.V. Johnson and R.K. Boman. 1994. Prediction of inorganic nitrogen buffering capacities in continuous cropping production systems. Submitted to OSU-Targeted Research Initiative, June 10, 1994 for $11000. Funded for $11000, July 7, 1994.
9. Stone, M.L., J.B. Solie, R.W. Whitney and W.R. Raun. 1994. Precision real-time split application of nitrogen based on crop needs. Submitted to OSU-Targeted Research Initiative, June 10, 1994 for $15100. Funded for $15,100, July 7, 1994.
10. Gillen, R.L., W.R. Raun and F.T. McCollum. 1994. Effects of grazing management on rangeland soils. Submitted to OSU-Targeted Research Initiative, June 10, 1994 for $5,067. Funded for $5067, July 7, 1994.
11. Raun, W.R., and S.L. Taylor. 1994. Long-term rye-wheat-ryegrass forage yields as affected by rate and date of N application. Project analysis submitted to the Noble Foundation, January, 1994 for $10000. Funded for $10,000, September, 1994.
12. Raun, W.R., and S.L. Taylor. 1995. Changes in soil test indices in a long-term rye-wheat-ryegrass forage production system as affected by rate and date of N application. Project analysis submitted to the Noble Foundation, February, 1995 for $10,000. Funded for $10,000, March, 1995.
13. Westerman, R.L., G.V. Johnson and W.R. Raun. 1989 - present. Continuation of soil fertility research and education project, SB-314.
14. Raun, W.R., G.V. Johnson, M.L. Stone, J.B. Solie, R.W. Whitney. 1995. Implementation of sensor based variable rate technology for bermudagrass production in south central Oklahoma, October, 1995 for $100,000. Funded for $100,000, November, 1995.
15. Raun, W.R., G.V. Johnson and S.B. Phillips. 1996. Use of tritium/helium-3 groundwater dating in north-central Oklahoma well water. Submitted to Environmental Institute for Water and Energy Research, February, 1996. Funded for $8925, April, 1996.
16. Johnson, G.V., and W.R. Raun. 1996. Calibration of phosphorus fertilization for winter wheat forage production. Submitted to the Noble Foundation, February, 1996 for $10,000. Funded for $10000, May, 1996.
17. Raun, W.R., J.B. Solie, G.V. Johnson, M.L. Stone, R.W. Whitney, H. Sembiring and H.L. Lees. 1996. Field element size for soil phosphorus and potassium in continuous production systems. Submitted to the Potash Phosphate Institute, September 1996. Funded for $2000, December, 1996, $2000 in 1997, $2,000 in 1998.
18. Raun, W.R., M.L. Stone, J.B. Solie, G.V. Johnson and R.W. Whitney. 1997. Development of sensor-based technologies for detecting in-season nitrogen deficiencies in winter wheat and bermudagrass. Submitted to the Noble Foundation, February 1997. Funded for $150,000, April, 1997.
19. Solie, J.B., M.L. Stone, R.W. Whitney, J. Baird, G.V. Johnson, W.R. Raun and K. Conway. 1997. Development of optical sensor based variable rate technology for turfgrass management. Submitted to John Deere and Co., February 1997. Funded for $300,000, April, 1997.
20. Raun, W.R. and G.V. Johnson. 1997. Effect of Nitrogen Rate, Method of Application and Residue Management on N Use Efficiency and Estimated N Loss in Winter Wheat. Submitted to Farmland Industries Inc., May 1997 for $16000. Funded for $16,000, June 1997.
21. Raun, W.R., J.B. Solie and G.V. Johnson. 1998. Development of spectral indices to improve nitrogen use efficiency in wheat: Breaking the 50% use efficiency barrier. Submitted to International Research Support Program (IRSP), February, 1998, Funded for $4,000, March, 1998.
22. Raun, W.R., and M.L. Stone. 1999. Continued development of spectral indices to predict yield potential and improve nitrogen use efficiency in wheat. Submitted to International Research Support Program (IRSP), February, 1999, Funded for $4,000, March, 1999.
23. Stone, M.L., J.B. Solie, W.R. Raun and G.V. Johnson. 1999. Sensor-based, in-season estimated yield for winter wheat and bermudagrass. Submitted to the Noble Foundation, February 1999. Funded for $50,000, April, 1999.
24. Johnson, G.V., A.R. Klatt, R.F. Elliott, M.L. Stone, J.B. Solie and W.R. Raun. Application of in-season estimated yield for variable rate nitrogen application. Submitted to the Noble Foundation, February 2000. Funded for $175,000, April 2000.
25. Solie, J.B., M.L. Stone, R. Elliott, G.V. Johnson, A.R. Klatt and W.R. Raun. Field Scale Applicator and System for In-Season Fertilizer Nitrogen Application Based on Optically Sensed Predicted Yield. Submitted to the OSU Targeted Research Initiative Program, February 2000. Funded for $20,000, April 2000.
26. Raun, W.R., J.B. Solie and A.R. Klatt. Continued Development of Spectral Indices to Predict Yield Potential and Improve Nitrogen Use Efficiency in Wheat. Submitted to the OSU International Research Support Program (IRSP), February 2000, Funded for $4000, March, 2000.
27. Raun, W.R, J.B. Solie, M.L. Stone, G.V. Johnson, R. Elliott, A.R. Klatt, K.D. Sayre and M. Reynolds. System for In-Season Fertilizer Nitrogen Application Based on Predicted Yield. Submitted to the National Research Initiative (NRI) Competitive Grants Program, January 2000. Submitted for $468,929, funded for $382,000, December 1, 2000.
28. Smith, Michael W., W.R. Raun and G.V. Johnson. Nitrogen strategies to reduce pecan alternate bearing. Submitted to OCAST, spring 2000. Funded for $80,656, June, 2000.
29. Raun, W.R., G.V. Johnson, J.B. Solie, M.L. Stone, K.D. Sayre, M.P. Reynolds, and S.B. Phillips. 2001. Field testing of a sensor-based applicator for nitrogen and phosphorus fertilization. Submitted to Application of Geospatial and Precision Technologies, NASA (CSREES, Cooperative State Research, Education, and Extension Services), Competitive Grants Program, March, 2001 for $656,240, funded for $575,000, September 1, 2001.
30. Schepers, J.S., J.F. Shanahan, D.D. Francis, K.H. Holland, W.R. Raun, G.V. Johnson, J.B. Solie, M.L. Stone, and Chunsheng Hu. 2003. Crop Sensor-Based Nitrogen Management to Protect Water Quality. Submitted to OICD for $109,000, Funded for $109,000, June, 2003.
31. Raun, W.R, and K.W. Freeman. 2003. Fall and Spring Applied Urea-N Sources for Winter Wheat Production. Submitted to Georgia-Pacific, September 2003 for $23,800, funded for $23,800, October, 2003.
32. Raun, W.R. Funding for Post-Doctoral Fellow, Agricultural Division. Submitted to the Noble Foundation, September 2003, Funded in April of 2004 for $125,000.
33. Raun, W.R., G.V. Johnson, and R.L. Westerman. Soil Fertility Research and Advisory Board. Senate Bill 314, established in November of 1989 and initially established by Dr. Robert L. Westerman, total since 1989-present, $3,738,833.
34. Raun, W.R., J.B. Solie, M.L. Stone, H. Zhang, J. Lamb, and G. Randall. 2004. Laser measured height and NDVI coefficient of variation for by-plant, real-time, variable nitrogen rate application in corn. Submitted to United States Dept. of Agric., NRI, for $759,255, March, 2004.
35. Raun, W.R., J. Mosali, J.B. Solie, D. Redfearn, M.L. Stone, J. Ball, and W. Altom. 2004. Improving Bermudagrass Forage Pasture Production via Sensor Based Methods of Identifying Weed Species and Methods of Control. Submitted to the Noble Foundation, July 2004, Funded for $37,500, August 2004.
36. Raun, W.R., K.D. Sayre, R. Gupta, J.B. Solie, M.L. Stone, K. Freeman, K. Martin, and I. Ortiz-Monasterio. 2004. Technological Extension of Sensor-Based Nitrogen Fertilization Algorithms for Increased Cereal Production and Use Efficiency. Submitted to USAID via CIMMYT, for $185,613 August 2004, Funded for $120,000, Jan 2005.
37. Raun, W.R., J.B. Solie, M.L. Stone, and H. Zhang. 2005. Sitlington Enriched Graduate Scholarship, Precision Agriculture By-Plant Methodology. Submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2005.
38. Stone, M.L., W.R. Raun, J.B. Solie, H. Zhang, and G. Brown. 2005. Improved Nitrogen Fertilization and Use Efficiency for Wheat and Corn in Northern Italy. Submitted to Fondazione Cassamarca for $25,000, July 2005.
39. Raun, W.R., J.B. Solie, M.L. Stone, and H. Zhang. 2006. Sitlington Enriched Graduate Scholarship, RAMP and New VRT Applicator. Submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2006.
40. Brorsen, W., F. Epplin, J. Solie, and W. Raun. 2006. Economics of Precision Sensing Technologies in Oklahoma Wheat. TIP, OAES. Funded for $27,392, January, 2006.
41. Taylor, R., B. Woods, R. Gribble, W. Raun, J. Solie, M. Stone, H. Zhang. 2006. Extension of the GreenSeeker Sensor Based Nitrogen Rate Recommendations for Corn and Wheat Farmers in Oklahoma. TIP, OAES. Funded for $21,000, January, 2006.
42. Weckler, P., W. Raun, G. Bell, J. Solie, M. Stone, N. Maness, B. Morgan, R. Taylor. 2006. Development of laser-based biosensor technologies. TIP, OAES, Funded for $50,000, January 2006.
43. Zhang, Hailin, and W.R. Raun. 2006. Extension of RAMP Technology for Improved N fertilization. Centennial Scholars Program, 21st Century Plant Enterprises. Funded for $60,000, February 2006.
44. Raun, W., K. Freeman, B. Arnall, and R. Teal. 2006. Precision Sidedress UAN Application for Corn Production. Submitted to the Fluid Fertilizer Foundation for $3000, Funded, February 2006.
45. Arnall, D.B., and W.R. Raun. 2006. Evaluation of foliar N sources for corn production. Submitted to Tesenderlo Kerley Co. for $4000, funded for $4000, March 2006.
46. Raun, W.R., J.B. Solie, R. Taylor, H. Zhang, and A. Sutherland. 2007. Relationship between fractional water indices from the Mesonet and estimated yield potential using mid-season Greenseeker readings. Sitlington Enriched Graduate Scholarships, submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2007.
47. Raun, W.R., J.B. Solie, A. Sutherland, and R. Taylor. 2007. Real-Time Use of Mesonet Weather Data for Refined GreenSeeker Sensor Based N Recommendations in Winter Wheat. TIP, OAES-OCES. Funded for $61,422, February 2007.
48. Wang, Ning, Chad Godsey, Hailin Zhang, Randy Taylor, Bill Raun, and John Solie. 2008. Smart field data acquisition system for precision agriculture. TIP, OAES-OCES. Funded for $44,615, February 2008.
49. Raun, W.R., Ning Wang, Randy Taylor and John Solie. 2008. By-plant N fertilization strategy for corn production. Sitlington Enriched Graduate Scholarships, submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2008.
50. Raun, W.R., J.B. Solie, M.L. Stone, R. Taylor, and D.B. Arnall. 2008. Development and delivery of the second generation optical pocket sensor for maximizing nitrogen use efficiency in cereal production systems. Oklahoma Conservation Commission. Funded for $133,000, June 2008.
51. Arnall, D.B., W.R. Raun, D. Edmonds, Yumiko Kanke, and Brian Arnall. 2008. Evaluation of 521G43 and Nitamin 30L Foliar N Products for Winter Wheat Production. Funded for $19,077, October, 2008.
52. Raun, W.R., D. Edmonds, D.B. Arnall, and Y. Kanke. 2009. Evaluation of 521G43 and Nitamin 30L Foliar N Products for Winter Wheat Production. Georgia Pacific. Funded for $19,077, January 2009.
53. Raun, W.R., J.B. Solie, R.K. Taylor, M. Stone, D.B. Arnall, and N. Wang. 2009. Development and testing of the Optical Pocket Sensor. Sitlington Enriched Graduate Scholarships, submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2009.
54. Raun, W.R., D.B. Arnall. 2010. Coordination of the 2010 NUE Workshop in Stillwater, OK. Support for $1500 sought from Monsanto, Co., Funded for $1500, January 2010.
55. Raun, W.R., D.B. Arnall. 2010. Coordination of the 2010 NUE Workshop in Stillwater, OK. Support for $1000 sought from Bayer Crop Science., Funded for $1500, January 2010.
56. Raun, W.R., D.B. Arnall. 2010. Coordination of the 2010 NUE Workshop in Stillwater, OK. Support for $2000 sought from Trimble., Funded for $1000, January 2010.
57. Raun, W.R., D.B. Arnall. 2010. Coordination of the 2010 NUE Workshop in Stillwater, OK. Support for $1500 sought from Ag Leader., Funded for $1500, January 2010.
58. Raun, W.R., D.B. Arnall. 2010. Coordination of the 2010 NUE Workshop in Stillwater, OK. Support for $2000 sought from John Deere., Funded for $1000, February 2010.
59. Raun, W.R., R.K. Taylor, N. Wang. 2011. Use of measured stalk diameter for improved prediction of yield. Sitlington Enriched Graduate Scholarships, submitted for $5000/year, 3 years, 2 students, funded for $30,000, Feb, 2011.
60. Raun, W.R., Randy Taylor, Adrian Koller, and Brian Arnall. 2012. Development of a new third world hand planter. Submitted to AGCO corporation for $20,000, funded for $20,000, April, 2012
61. Khosla, Raj, William Raun, Timothy Shaver, Luis Longchamps, Robin Reich and Bruce Bosely. 2013. The 4R Nutrient Stewardship with Proven Techniques and Technologies to Enhance Nutrient Use Efficiency, Productivity and Environmental Sustainability. NRCS-CIG Grant. OSU portion funded for $96,000, Nov, 2013.
62. Raun, W.R., R.K. Taylor, N. Wollenhaupt. 2014. Refinement/Extension of the OSU-AGCO Singulating Hand Planter. Submitted to TBDC-OSU for $31,000, funded for $30,000, May 1, 2014.
63. Raun, W.R., and R.K. Taylor. 2016. Stage Testing and Delivery of the OSU Hand Planter. Sitlington Enriched Graduate Scholarships, submitted for $5000/year, 3 years, 2 students, funded for $15,000, Feb, 2016.

**COMPETITIVE GRANT TOTAL** (1985-present): $3,399,871

**LEGISLATIVE GRANT TOTAL** (1989-present):$5,023,243

**GRANT TOTAL, all sources:** **$8,421,114**

**TEACHING AND SOFTWARE DEVELOPMENT**

1. Soil fertility and statistics training with CIMMYT Wheat trainees at the B.S. level having diverse backgrounds in agricultural research. Teaching focused on experimental design for 'On Farm Research' programs. Soil fertility and statistics taught in Spanish and English.
2. Barreto, H. J., and W. R. Raun. 1988. MST Data Assistant, Integrated Data Management System. Software program for data entry and transformations. Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), Apdo. Postal 6-641. Mexico D.F. 06600
3. Soil-Plant Nutrient Cycling and Environmental Quality, Plant and Soil Sciences 5813, (3 hours), spring semester, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016. Subject matter includes the study of relationships between soil nutrient supply/plant response and associated theoretical applications, nutrient cycling for N, P, K and S, applied techniques for determining fertilizer response and yield goals, and dynamics of soil organic C. Supplemental text prepared for class use, and that is published on the web (<http://soil5813.okstate.edu>).
4. Seminar, Plant and Soil Sciences 5020, (1 hour). Taught in the spring 1994, fall 1994, spring 1995, fall 2005, spring 2005. Designed for formal presentation of M.S. and Ph.D. research topics in agronomic sciences.
5. Senior Seminar, Plant and Soil Sciences 4571, (1 hour), fall semester, 1994. Exiting course for seniors in agronomy that addresses current issues in soil and crop science. Formal reporting on specific topics is required. Strengths and weaknesses of their B.S. program is discussed.
6. Precision Agriculture, Plant and Soil Sciences 4213 (3 hours), spring semester, 1997, 1999, 2001, 2002, 2004, 2006, 2007, 2008, 2010, 2011. Taught over the web (<http://soil4213.okstate.edu>) with the Department of Biosystems and Agricultural Engineering. Address the use of indirect measures for nutrient analyses, applications of GPS and GIS, sensor-based technologies employing visible and non-visible portions of the spectra, use of geostatistics in determining field element size, methods of establishing critical nutrient levels, and resultant recommendations.
7. Soil Nutrient Management 4234 (4 hours), fall semester 2004, 2005, 2006, 2007, 2008, 2009. Taught over the web (<http://soil4234.okstate.edu>). Junior-Senior level class that includes nutrient deficiencies, and nutrient management for cereal crops, and turfgrass. Added topics include soil testing, Bray’s mobility concept, micronutrients in agriculture, and comprehensive study of nitrogen cycling and interrelationships of crop management with the environment.
8. Research Methods 5112 (2 hours) spring semesters 2005, 2007, 2009, 2011, 2013, 2015. Also taught over the web. (<http://www.nue.okstate.edu/Research_Methods/Research.html>). Biometrical and statistics applications for M.S. and Ph.D. students in Biological Sciences.

**GRADUATE STUDENT THESES:** (Major Advisor)

1. Attefat, Mehdi. 1992. Leaching and Contamination of NO3-N in Agricultural and Nonagricultural Systems. M.S. Thesis.
2. Ascencio, Edgar Noel. 1992. Sequential measurements of soil ammonium-N and nitrate-N from two long-term wheat fertility experiments with variable N rates. M.S. Thesis.
3. Sembiring, Hasil. 1993. Effect of surface residue inversion on moisture conservation. M.S. Thesis.
4. Jojola, Michael E. 1994. Accuracy and precision of total nitrogen using automated dry combustion. M.S. Thesis.
5. Ascencio, Edgar Noel. 1995. Sequential measurements of soil NH4-N and NO3-N from two long-term fertility experiments with variable N rates, and distribution of soil profile NO3-N under flooded conditions using a bromide tracer. Ph.D. Dissertation.
6. Kanampiu, Fred, 1995. Effect of nitrogen rate on plant nitrogen loss in winter wheat varieties and glutamine synthetase activity. Ph.D. Dissertation.
7. Gavi-Reyes, Francisco. 1995. Effect of applied sewage sludge, ammonium nitrate and phosphorus on yield of winter wheat, soil profile inorganic nitrogen accumulation and cadmium uptake. Ph.D. Dissertation.
8. Ball, Jeff B. 1995. Effect of nitrogen rate, method of application and residue management on estimated N loss in winter wheat. M.S. Thesis.
9. Phillips, Steven B. 1995. Seasonal and long-term variability in well water nitrate-nitrogen. M.S. Thesis.
10. Taylor, Shannon L. 1996. Bermudagrass forage yield response to high rates of applied urea and ammonium nitrate and the use of spectral radiance for estimating nitrogen deficiencies and soil variability. M.S. Thesis
11. Chen, Jing. 1997. Winter wheat and cheat response to foliar fertilizer nitrogen application. M.S. Thesis.
12. Keahey, Dale, Alan. 1997. Improving fertilizer nitrogen use efficiency using alternative legume interseeding in continuous corn production systems. M.S. Thesis.
13. Lees, Heather, L. 1997. I. Development of field standards for variable rate technology and II. Estimating gaseous nitrogen losses from *Triticum aestivum* L. using 15N. M.S. Thesis.
14. Sembiring, Hasil. 1997. Management of nitrogen and phosphorus experiments using spectral radiance and soil N mineralization in winter wheat and bermudagrass. Ph.D. dissertation.

1. Thomason, Wade E. 1998. I. Winter wheat fertilizer nitrogen use efficiency in grain and forage production systems and II. Detection of nitrogen deficiencies in cotton using spectral radiance measurements and cotton response to topdress applications. M.S. Thesis
2. Lukina, Erna V. 1998. Effect of row spacing, N rate and growth stage on spectral radiance in winter wheat. M.S. Thesis.
3. LaRuffa, Joanne M. 1999. Optimum field element size for maximum yields in winter wheat using variable nitrogen rates. M.S. Thesis.
4. Phillips, S.B. 1999. I. Alfalfa yield response to method and timing of applied phosphorus, II. Effect of dual applied phosphorus and gypsum on wheat forage and grain yield. Ph.D. Dissertation.
5. DeLeon, Micah. 1999. Determination of phosphorus nutritional status using spectral response. M.S. Thesis.
6. Dennis, Jeremy. 1999. Winter wheat and cheat response to late-season foliar nitrogen applications. M.S. Thesis.
7. Woolfolk, Curt W. 2000. Influence of late-season foliar nitrogen applications on grain protein win winter wheat. M.S. Thesis.
8. Cossey, Doug. 2000. Relationship between ammonium and nitrate in wheat plant tissue and estimated plant nitrogen loss. M.S. Thesis.
9. Mullen, R.W. 2001. Effect of foliar nitrogen on wheat quality and cheat reduction. M.S. Thesis.
10. Wynn, K. 2001. Effect of long-term application of biosolids and ammonium nitrate on winter wheat yield, nitrogen uptake, and heavy metal accumulation. M.S. Thesis.
11. Thomason, W.E. 2001. I. Production system techniques to increase nitrogen use efficiency in winter wheat, II. Switchgrass response to harvest frequency, and time, and rate of applied nitrogen. Ph.D. Dissertation.
12. Lukina, E.V. 2001. I. Evaluation of alternative methods for determining estimated yield. II. Use of In-Season Estimates of Yield for topdress applications of fertilizer nitrogen in winter wheat. Ph.D. Dissertation.
13. Freeman, Kyle W. 2002. Late-season prediction of wheat grain yield and grain protein. M.S. Thesis.
14. Teal, Roger T. 2002. Effect of tillage and anhydrous ammonia application on nitrogen use efficiency of hard red winter wheat. M.S. Thesis
15. Moges, Shambel. 2002. Use of red and green NDVI for yield prediction in winter wheat. M.S. Thesis.
16. Mullen, Robert. 2002. I. Estimation of nitrogen mineralization in soils from long-term application of fertilizer and its effect on winter wheat response to topdress nitrogen, II. Use of in-season sensor derived response indices to predict the response index at harvest. Ph.D. Dissertation.
17. Humphreys, Micah 2003. Indirect estimates of soil electrical conductivity for improved prediction of yield. M.S. Thesis.
18. Hodgen, Paul. 2003. I. Use of a response index and in-season predicted yield to determine topdress nitrogen needs, II. Relationship between the response index determined in-season and at harvest. M.S. Thesis.
19. Lawles, Jason. 2004. Peanut yield response to foliar applied phosphorus. M.S. Thesis.
20. Mosali, Jagadeesh. 2004. Effect of foliar application of phosphorus on winter wheat grain yield, and Use of in-season reflectance for predicting yield potential. Ph.D. Dissertation.
21. Girma, Kefyalew. 2004. I. Identification of optical spectral signatures for detecting cheat and ryegrass in winter wheat. II. Determination of optimum rate and growth stage for foliar applied phosphorus in corn. Ph.D. Dissertation.
22. Morris, Keri, 2004. Mid-season recovery to nitrogen stress in winter wheat. M.S. Thesis.
23. Arnall, Brian, 2004. Relationship between coefficient of variation measured by spectral reflectance and plant density at early growth stages. M.S. Thesis.
24. Teal, Roger, 2005. I. Influence of hybrid, population and nitrogen rate on plant spectral prediction of corn yield, II. Effect of tillage and anhydrous ammonia application on nitrogen use efficiency of hard red winter wheat. Ph.D. Dissertation.
25. Martin, Kent, 2005. Expression of spatial variability in corn (Zea Mays L.) as influenced by growth stage using optical sensor measurements. M.S. Thesis.
26. Freeman, Kyle, 2005. Influence of beds and row spacing in winter wheat, and by-plant prediction of corn forage yield. Ph.D. Dissertation.
27. Moges, Shambel. 2005. Yield potential estimation in grain sorghum (Sorghum bicolor L.), and effects of plant height, sensing angle and height on yield prediction of corn (Zea mays L.). Ph.D. Dissertation.
28. Mack, Clint. 2006. Validation of nitrogen calibration strip technology for prescribing accurate topdress nitrogen fertilizer. M.S. Thesis.
29. Lawles, Kyle. 2006. Effect of delayed emergence on corn grain yield. M.S. Thesis.
30. Walsh, Olga S. 2006. Effect of delayed nitrogen fertilization on corn grain yields. M.S. Thesis.
31. Tubana, Brenda. 2007. Adjusting mid-season nitrogen using a sensor-based optimization algorithm to increase use efficiency in corn. Ph.D. Dissertation.
32. Chung, Byungkyun. 2007. Evaluation of spatial resolutions for predicting corn grain yield. 2007. Ph.D. Dissertation.
33. Holtz, Starr. 2007. Total nitrogen uptake as a function of time in corn and winter wheat. M.S. Thesis.
34. Dotson, Clint, 2007. Effect of nitrogen fertilizer rate and placement on corn grain yield. M.S. Thesis.
35. Turner, Pamela. 2008. Indirect measurement of crop plant height using sonar. M.S. Thesis.
36. Edmonds, Daniel. 2008. Maize grain yield response to variable row nitrogen fertilization. M.S. Thesis.
37. Arnall, Brian. 2008. I. Development of a yield prediction model for mid-season nitrogen recommendations of cotton (Gossypium hirsutum L.), II. Use of by-plot CV’s for refining mid-season fertilizer nitrogen rates. Ph.D Dissertation.
38. Daft, Cody. 2008. By-plant nitrogen response as function of delayed emergence in corn (Zea mays L.). M.S. Thesis.
39. England, Brandon, 2008. Stream and flat fan topdress application of urea ammonium nitrate in winter wheat (Triticum aestivum L.). M.S. Thesis.
40. Desta, Birehane, 2009. Identification of spectral bands for detecting nitrogen and phosphorus deficiencies in winter wheat. M.S. Thesis.
41. Walsh, Olga, 2009. I. Real-time use of soil moisture data for refined Greenseeker sensor based nitrogen recommendations in winter wheat. II. Effect of foliar P fertilization on corn grain yield and phosphorus use efficiency. Ph.D. Dissertation.
42. Kanke, Yumiko, 2009. Red-edge as a potential index for detecting differences in plant nitrogen status in winter wheat. M.S. Thesis.
43. Vossenkemper, Jake. 2009. Maize (Zea mays L.) Grain Yield Response to Nitrogen Applied at Different Distances Away from the Row. M.S. Thesis.
44. Torres, Guilherme. 2010. Effect of Foliar Phosphorus and Surfactants on Winter Wheat (Triticum aestivum L.) Grain yield. M.S. Thesis.
45. Waldschmidt, Kevin. 2011. Effect of Plant Population and Nitrogen Rate on Spectral Properties and Grain Yield of Winter wheat. M.S. Thesis.
46. Kelly, Jonathan. 2011. By Plant Prediction of Corn (Zea mays L.) Grain Yield Using Height and Stalk Diameter. M.S. Thesis.
47. Rutto, Emily. 2011. Ability of cotton to recover from early season nitrogen stress, and maize (Zea mays L.) grain yield response to distance nitrogen is placed away from the row. Ph.D. Dissertation.
48. Mohammed, Yesuf, 2012. Nutrient sources and harvest frequency for quality dual purpose switchgrass (Panicum virgatum l.) production, and the effect of ph, nitrogen and phosphorus on biomass and quality of two teff (Eragrostis teff (zucc) trotter) varieties. Ph.D Dissertation.
49. Macnack, Natasha, 2012. In season prediction of nitrogen use efficiency and grain protein in winter wheat (Triticum aestivum L.). M.S. Thesis.
50. Crain, Jared, 2012. Evaluation of the Oklahoma State University NDVI pocket sensor. M.S. Thesis.
51. Chim, Bee, 2012. Effect of seed distribution and population on maize (Zea mays L.) grain yield. M.S. Thesis.
52. Mullock, Jeremiah, 2012. By-plant sidedress nitrogen in corn (Zea mays l.) based on plant height and normalized difference vegetation index. M.S. Thesis.
53. Torres, Guilherme. 2012. Precision planting of maize (Zea mays L.). Ph.D Dissertation.
54. Wyatt, Ethan. 2013. Effect of droplet size and nitrogen rate on protein content of hard red winter wheat (Triticum aestivum L.). M.S. Thesis.
55. Dhital, Sulochana. 2013. Influence of foliar sulfur, chloride and nitrogen on winter wheat (Triticum aestivum L.) grain yield and total nitrogen. M.S. Thesis.
56. Omara, Peter. 2013. Effect of seed distribution and population on maize (Zea mays L.) grain yield. M.S. Thesis.
57. Bushong, Jacob. 2014. I. Utilizing soil moisture data with optical sensors to determine nitrogen fertilizer recommendations in winter wheat, II. Alternative nitrogen fertilization strategies for maize in a water limited environment. PhD. Dissertation.
58. Miller, Eric, 2014. I. Nitrogen and water use efficiency as influenced by maize hybrid and irrigation, II. Predicting pre-plant nitrogen applications to maize using indicator crop N-rich reference strips. Ph.D Dissertation.
59. Macnack, Natasha. Effect of Fertilizer Nitrogen (N) on Soil Organic Carbon, Total N and Soil pH in Long-Term Continuous Winter Wheat. 2014. PhD. Dissertation.
60. Mullock, Jeremiah. 2014. I. Effect of preplant nitrogen distance from corn rows on grain yield and nitrogen uptake. II. Development of a winter wheat sensor-based nitrogen rate algorithm for Kansas and Oklahoma. PhD. Dissertation.
61. Aula, Lawrence, 2014. Effect of Fertilizer Nitrogen (N) on Soil Organic Carbon, Total N and Soil pH in Long-Term Continuous Winter Wheat M.S. Thesis.
62. Dhillon, Jagmandeep. 2016. Evaluation of Drum Cavity Size and Planter Tip on Singulation and Plant Emergence in Maize (Zea mays L.). M.S. Thesis.
63. Driver, Ethan. 2016. M.S. Thesis. Optimum Preplant Nitrogen rates in Winter Wheat (Triticum aestivum L.) and Maize (Zea mays L). M.S. Thesis.
64. Ramos Del Corso, Mariana. 2016. I. Soil Organic Carbon (SOC), Total Nitrogen (TN), and Soil pH, in long term Continuos Winter Wheat (Triticum Aestivum L.) Experiment. II. Evaluation of Foliar UAN and Timing on Grain Yield and Nitrogen Concentration in Winter Wheat (Triticum aestivum L.). M.S. Thesis.
65. Dhital, Sulochana. 2016. PhD. Dissertation.
66. Figueiredo, Bruno. 2016. M.S. Thesis.
67. Schlobohm, Ryan. 2016. M.S. Thesis.
68. Golden, Melissa. 2016. Seasonal Changes on NDVI and the Prediction of Wheat Grain Yield. M.S. Thesis
69. Remondet, Nicole. 2016. Seasonal Changes in Estimated Nitrogen Response in

Winter Wheat (Triticum aestivum L.). M.S. Thesis

1. Alideki, Daniel. 2016. Influence of Tillage and Side dress Nitrogen on Maize (Zea Mays L.) plant stand and Grain yield using Greenseeder Hand Planter with altered drum cavity sizes. M.S. Thesis
2. Weymeyer, Gwen. 2017. M.S. Thesis
3. Nambi, Eva. 2017. M.S. Thesis

**MAJOR ADVISOR, GRADUATE DEGREE PROGRAMS, 1991-present**

Name Country Degree Completion Date

1. Attefat, Mehdi Iraq M.S 1992
2. Ascencio, Edgar Noel. El Salvador M.S. 1992
3. Sembiring, Hasil. Indonesia M.S. 1993
4. Jojola, Michael E. USA M.S. 1994
5. Ascencio, Edgar Noel. El Salvador Ph.D. 1995
6. Kanampiu, Fred Kenya Ph.D. 1995
7. Gavi-Reyes, Francisco Mexico Ph.D. 1995
8. Ball, Jeff B. USA M.S. 1995
9. Phillips, Steven B. USA M.S. 1995
10. Taylor, Shannon L. USA M.S. 1996 \*\*
11. Chen, Jing China M.S. 1997
12. Keahey, Dale, Alan. USA M.S. 1997
13. Lees, Heather, L. USA M.S. 1997 \*\*
14. Sembiring, Hasil Indonesia Ph.D. 1997 \*\*\*
15. Thomason, Wade USA M.S. 1998
16. Lukina, Erna V. Uzbekistan M.S. 1998
17. LaRuffa, Joanne M. USA M.S. 1999 \*\*
18. Phillips, Steven B. USA Ph.D. 1999 \*\*\*
19. Dennis, Jeremy USA M.S. 1999
20. DeLeon, Micah Argentina M.S. 1999
21. Cossey, Doug USA M.S. 1999
22. Woolfolk, Curt USA M.S. 1999
23. Mullen, R.W. USA M.S. 2001 \*\*
24. Lukina, Erna, V. Uzbekistan Ph.D. 2001 \*\*\*
25. Thomason, Wade USA Ph.D. 2001 \*\*\*
26. Wynn, Kathie J. USA M.S. 2001
27. Freeman, Kyle W. USA M.S. 2002 \*\*
28. Teal, Roger USA M.S. 2002
29. Moges, Shambel Ethiopia M.S. 2002
30. Mullen, R.W. USA Ph.D. 2003 \*\*\* **†**
31. Humphreys, M. USA M.S. 2003
32. Hodgen, Paul USA M.S. 2003
33. Lawles, Jason USA M.S. 2004
34. Mosali, Jagadeesh India Ph.D. 2004
35. Brixey, Keri USA M.S. 2004
36. Arnall, Brian USA M.S. 2004
37. Girma, Kefyalew Ethiopia Ph.D. 2004 \*\*\*
38. Martin, Kent USA M.S. 2005 \*\*
39. Freeman, Kyle W. USA Ph.D. 2005 \*\*\*
40. Teal, Roger USA Ph.D. 2005 β
41. Moges, Shambel Ethiopia Ph.D. 2005
42. Mack, Clinton USA M.S. 2007
43. Lawles, Kyle USA M.S. 2007
44. Byungkyun, Chung Korea Ph.D. 2007
45. Tubana, Brenda Philippines Ph.D. 2007 β \*\*\*
46. Holtz, Starr USA M.S. 2007 \*\*
47. Walsh, Olga Russia M.S. 2007
48. Dotson, Clint USA M.S. 2007
49. Arnall, Brian USA Ph.D. 2008 \*\*\*
50. Turner, Pam USA M.S. 2008
51. Edmonds, Daniel USA M.S. 2008 \*\*£
52. England, Brandon USA M.S. 2008
53. Daft, Cody USA M.S. 2008
54. Walsh, Olga Russia Ph.D. 2009 \*\*\*
55. Desta, Birehane Ethiopia M.S. 2009
56. Kanke, Yumiko Japan M.S. 2009 Σ € \*\*
57. Vossenkemper, Jacob USA M.S. 2010
58. Torres, Guilherme Brazil M.S. 2010 \*\*
59. Kelly, Jonathan USA M.S. 2011 \*\*
60. Waldschmidt, Kevin USA M.S. 2011
61. Rutto, Emily Kenya Ph.D. 2011 \*\*\*€
62. Macnack, Natasha Suriname M.S. 2012
63. Mohammed, Yesuf Ethiopia Ph.D. 2012
64. Mullock, Jeremiah USA M.S. 2012
65. Chim, Bee Malaysia M.S. 2012 \*\*
66. Crain, Jared USA M.S. 2012
67. Torres, Guilherme Brazil Ph.D. 2013 \*\*\*
68. Dhital, Sulochana Nepal M.S. 2013
69. Wyatt, Ethan USA M.S. 2013
70. Omara, Peter Uganda M.S. 2013
71. Bushong, Jake USA Ph.D. 2014 \*\*\*
72. Macnack, Natasha Suriname Ph.D. 2014 β
73. Dhital, Sulochana Nepal M.S. 2014
74. Miller, Eric USA Ph.D. 2014
75. Mullock, Jeremiah USA Ph.D. 2015
76. Aula, Lawrence Uganda M.S. 2014
77. Dhillon, Jagmandeep India M.S. 2016
78. Figueiredo, Bruno Brazil M.S. 2016 ‡
79. Dhital, Sulochana Nepal Ph.D. 2017 ‡
80. Dhillon, Jagmandeep India Ph.D. 2018 ‡
81. Ramos Del Corso, M. Brazil M.S. 2016 ‡
82. Golden, Melissa USA M.S. 2017 ‡
83. Remondet, Nicole USA M.S. 2017 ‡
84. Alideki, Daniel Uganda M.S. 2017 ‡
85. Schlobohm, Ryan USA M.S. 2017 ‡
86. Driver, Ethan USA M.S. 2016 ‡
87. Weymeyer, Gwen USA M.S. 2017 ‡
88. Nambi, Eva Uganda M.S. 2017 ‡

\*\* Outstanding M.S. student, Department of Plant and Soil Sciences

\*\*\* Outstanding Ph.D. student, Department of Plant and Soil Sciences  
£ Phoenix award winner, Outstanding M.S. Student, Oklahoma State University  
β Williams Outstanding Ph.D Thesis Award Recipient  
Σ Williams Distinguished Fellowship Recipient  
€ Graduate College Research Fellowship Recipient

‡ Current graduate student

**†** 2004 Emil Truog, SSSA Recipient (outstanding SOILS Ph.D student international, SSSA)

Research Thesis (M.S.) and/or Dissertation (Ph.D) required for all degrees.

Since 1992, 60% of the students receiving the outstanding M.S. and/or Ph.D student award in the Department of Plant and Soil Sciences have come from the soil fertility project.

**PROFESSIONAL INVITATIONS**

1. ASA-SSSA-CSSA meetings, Phoenix, AZ, November 8, 2016. Invited speaker, Leo M Walsh Soil Fertility Distinguished Lectureship.
2. Workshop on Long-Term Nutrient Management Studies. March 2, 2016, Denver, CO.
3. New Age Hand Planter for the Developing World. OSU Soil Biology Symposium, December 5, 2015, Stillwater, OK
4. Value of the “Nitrogen Cycle Ninja” exercise, 1996-present, February 6, 2015. Growmark, Bloomington, Indiana
5. Agronomy in the Context of Conservation Agriculture: Nutrient Management. Beyond Diagnostics: Insights and Recommendations for Remote Sensing Workshop; Mexico City, Mexico, December 16, 2013, Bill and Melinda Gates Foundation. Presentation delivered by Eric Miller.
6. InfoAG conference, Springfield Illinois, July 16, 2013. PrecisionAg Award of Excellence, Legacy Award, Speaker.
7. FertBio Conference, Maceio Brazil, September 17-21, 2012. Keynote Speaker.
8. NeATA Conference, Grand Island, NE, February 9-10, 2011.
9. 10th Annual International Precision Agriculture Conference, Denver, CO, July 18-21, 2010. Keynote Speaker, Opening Plenary Session.
10. ASA-SSSA-CSSA meetings, Pittsburgh, PA, Nov 4, 2009. Invited speaker, “Strategies for improving nutrient use efficiency in corn and small grains.”
11. ASA-SSSA-CSSA meetings, New Orleans, LA, Nov 3, 2007. Invited speaker, “Nitrogen Management for Wheat and Corn, What you Shouldn't Do.
12. ASA-SSSA-CSSA meetings, Indianapolis, IN, Nov 4, 2006. Invited speaker,
13. ASA-SSSA-CSSA meetings, Salt Lake City, UT, Nov 6-10, 2005. Invited speaker “What New Equipment Is Available to Improve N-Use Efficiency?”
14. 7th International Wheat Conference, Mar de Plata, Argentina, November 27-December 2, 2005. K.W. Freeman and W.R. Raun. Advances in nitrogen handling strategies to increase the productivity of wheat
15. AAPRESID Rosario, Argentina, August 10-13, 2004. Invited speaker “Aumentando la eficiencia del uso de nitrogeno en cereales.
16. ASA-SSSA-CSSA meetings, Denver, CO, Nov 2-6, 2003. Invited symposium speaker '’Variable Nitrogen Management of Field Crops.’
17. Great Plains Soil Fertility Workshop, Denver, CO, March 7-8, 2000. Invited symposium speaker ‘In-season fertilizer nitrogen application based on predicted yield potential.’
18. ASA-SSSA-CSSA meetings, Salt Lake City, Utah, October 31-November 4, 1999. Invited symposium speaker 'Implementing Diagnostic Tools for Nitrogen.
19. Intensive Wheat Management Conference, March 4-5, 1998, Denver, Colorado. Invited symposium speaker, 'Sensor based nutrient management.'
20. 5th International Symposium on Soil & Plant Analysis, August 2-7, 1997, Bloomington, Minnesota. Invited symposium speaker, Testing for the future: New Technologies.
21. The American Society for Horticultural Science (ASHS), July 23-26, 1997, Salt Lake City, Utah. Invited symposium speaker, ‘Soil-plant inorganic N buffering and indirect measures of nutrient analyses.’
22. CIMMYT, Ciudad Obregon, Mexico, February 9-12, 1997. Cooperation with Dr. Ken Sayre on methods to improve N-use efficiency in wheat using estimated plant N loss and spectral radiance measurements.
23. KSU/Farmland Industries Crop Production Update, Manhattan, Kansas. Invited speaker in 1994, 1995 and 1996 to discuss ‘Soil-plant inorganic N buffering,’ ‘Use of foliar fertilizers for cheat control in winter wheat,’ and ‘Applications of sensor-based technologies for detecting nutrient deficiencies.’
24. ASA-SSSA-CSSA meetings, Indianapolis, IN, November 1996. Invited symposium speaker ‘Enhancing soil testing and recommendations to meet the future.’
25. Great Plains Soil Fertility Workshop, Denver, CO, March, 1996. Invited symposium speaker ‘Use of spectral radiance for detecting in-season N deficiencies in winter wheat.’
26. ASA-SSSA-CSSA meetings, Cincinnati, OH, November, 1993. Invited symposium speaker, ‘Methods of improving research plot uniformity in long-term experiments.’
27. Andean Region Agriculture, Caracas, Venezuela, December, 1990. Invited symposium speaker, ‘Improved methods of phosphorus placement in volcanic ash soils.’
28. PCCMCA, San Salvador, El Salvador, March, 1990. Invited symposium speaker, ‘Applications of experimental designs in field experiments.’
29. CIAT, Cali, Colombia, January, 1989. Invited to participate in the strategic planning of ‘Agronomic Research in the IARC’s.
30. PCCMCA, San Pedro Sula, Honduras, March, 1989. Invited symposium speaker, ‘Legume Interseeding in Maize production
31. PCCMCA, San Jose, Costa Rica, March 1988. Invited symposium speaker, ‘Use of zero-tillage in the tropics and adverse impacts of burning.’

**CIMMYT RESEARCH PAPERS**

1. Raun, W. R., and K. D. Sayre. 1986. Use of line-source experiments for wheat genotype screening and yield stability analysis. CIMMYT Wheat Program, Mexico D.F.
2. Raun, W. R., and K. D. Sayre. 1986. Interplot competition; bias in observed grain yield as affected by different neighboring wheat and triticale genotypes. CIMMYT Wheat Program, Mexico D.F.
3. Sayre, K. D., and W. R. Raun. 1986. Evaluation of irrigation timing, and nitrogen rate on the effects of yellow berry in 38 different durum wheat genotypes. CIMMYT Wheat Program, Mexico D.F.
4. Sayre, K. D., and W. R. Raun. 1986. Yield trial of selected bread wheat, durum wheat, triticale and barley genotypes under salt stress. CIMMYT Wheat Program, Mexico D.F.
5. Sayre, K. D., and W. R. Raun. 1986. Durum wheat salt tolerance, Guaymas, Mexico. CIMMYT Wheat Program, Mexico. D.F.
6. Wall, P. C., P. Hobbs, D. A. Saunders, M. A. McMahon, W. R. Raun and R. L. Westerman. 1986. Integrated cultural and chemical control of *Avena fatua* and *Phalaris minor* in spring wheat. CIMMYT Wheat Program, Mexico. D.F.
7. Proyectos Colaborativos en Agronomía, Desarrollo y Mejoramiento de Germoplasma en Maíz. 1989. CIMMYT, Guatemala City, Guatemala.
8. Análisis de los Ensayos Regionales de Agronomía. 1990. Programa Regional de Maíz Para Centro América, Panamá y El Caribe. CIMMYT, Guatemala City, Guatemala.
9. Análisis de los Ensayos Regionales de Agronomía. 1991. Programa Regional de Maíz Para Centro América, Panamá y El Caribe. CIMMYT, Guatemala City, Guatemala.

**POPULAR PRESS and DEPARTMENTAL PUBLICATIONS**

1. Boman, R.K., J.J. Sloan, R.L. Westerman, W.R. Raun and G.V. Johnson. 1992. Using phosphorus fertilizers to maintain wheat forage and grain yields on acid soils. Better Crops. 76:(4) 16-19.
2. Raun, W.R. and E.N. Ascencio. 1992. Azufre: Estas considerando este elemento en su regimen de fertilización?. (technical brochure in Spanish for the Sulphur Institute, Washington D.C.)
3. Westerman, R.L. 1992. Soil Fertility Research Highlights, Efficient Use of Fertilizers. Okla. Agric. Exp. Sta., Agronomy 92-1. 223 pages.
4. Horn, G.W., W.R. Raun, G.A. Highfill, C. Bown and R.K. Boman. 1993. Evaluation of bloat potential of cattle as affected by N and K fertilization in continuous winter wheat. Animal Science Research Report, Oklahoma State University.
5. Johnson, G.V. (ed). 1993. Oklahoma soil fertility handbook. Prepared 2½ chapters included in this 8 chapter volume. Also assisted in compiling and editing the handbook.
6. Raun, W.R., R.K. Boman, S.L. Taylor, R.L. Westerman, G.V. Johnson and E.A. Guertal. 1993. Soil Fertility Research Highlights. Okla. Agric. Exp. Sta., Agronomy 93-1. 266 pages.
7. Johnson, G.V., and W.R. Raun. 1994. Oklahoma soil fertility research, applications for nutrient management and the environment, 1989-1993. Okla. Agric. Exp. Sta., Agronomy 94-2. 50 pages.
8. Boman, R.K., S.L. Taylor, W.R. Raun, G.V. Johnson, D.J. Bernardo and L.L. Singleton. 1996. The Magruder plots, a century of wheat research in Oklahoma. Okla. Agric. Exp. Sta., Agronomy 96-1. 69 pages.
9. Raun, W.R., J.B. Solie, G.V. Johnson, M.L. Stone, R.W. Whitney, H.L. Lees, H. Sembiring and S.L. Taylor. 1997. Small scale variation in soil test phosphorus and bermudagrass yield. Better Crops. 81:(1) 14-16.
10. Stone, M.L., W.R. Raun, G.V. Johnson, J.B. Solie, R.W. Whitney, H. Sembiring, J.M. LaRuffa and E.V. Lukina. 1997. Sensing nitrogen deficiencies in winter wheat and bermudagrass. Better Crops. 81:(4) 15-16.
11. Sembiring, H., J.M. LaRuffa, S.B. Phillips, E.V. Lukina, W.E. Thomason, J. Chen, H.L. Lees, D.A. Keahey, J.L. Dennis, D.A. Cossey, M.W. Goedeken, S.L. Norton, B.M. Howell, M.J. DeLeon, S.L.Taylor, J.B. Solie, M.L. Stone, R.W. Whitney, N.T. Basta, J.A. Hattey, H. Zhang, R.L. Westerman, G.V. Johnson and W.R. Raun. 1997. Soil Fertility Research Highlights. Okla. Agric. Exp. Sta., 364 pages.
12. Goedeken, Mick, Gordon Johnson and Bill Raun. 1998. Expectations of precision phosphate management. Better Crops. 82:(1) 28-31.
13. Zhang, Hailin, Gordon Johnson, Bill Raun, Nick Basta and Jeff Hattey. 1998. OSU Soil Test Interpretations. F-2225. Okla. Coop. Ext. Serv. Okla. State Univ. Stillwater, OK.
14. Basta, N.T., W.R. Raun and F. Gavi. 1998. Wheat grain cadmium under long-term fertilization and continuous winter wheat production. Better Crops. 82:(2) 14-15.
15. Raun, W.R., G.V. Johnson, M.L. Stone, J.B. Solie, W.E. Thomason, and E.V. Lukina. 1999. In-season prediction of yield potential in winter wheat. Better Crops. 83:(2) 24-25.
16. LaRuffa, J.M., G.V. Johnson, S.B. Phillips and W.R. Raun. 1999. Sulfur and chloride response in Oklahoma winter wheat. Better Crops: 83(4):28-30.
17. Mullen, R.W., G.V. Johnson, J.F. Stritzke, J.L. Caddel, S.B. Phillips and W.R. Raun. 2000. Alfalfa yield response to method and rate of applied phosphorus. Better Crops: 84(3):18-23.
18. Lukina, E.V., K.W. Freeman, R.W. Mullen, K.J. Wynn, W.E. Thomason, Roger Teal, Jagadeesh Mosali, Tao Feng, D.E. Needham, C.N. Washmon, J.B. Solie, M.L. Stone, N.T. Basta, J.A. Hattey, H. Zhang, S. Deng, J.M. Shaver, R.L. Westerman, G.V. Johnson and W.R. Raun. 2000. Soil Fertility Research Highlights. Okla. Agric. Exp. Sta., 342 pages.
19. Mullen, R.W., G.V. Johnson, J.F. Stritzke, J.L. Caddel, S.B. Phillips and W.R. Raun. 2001. Alfalfa responds to high P rates, P banding. Fluid Journal. Winter, 9-11.
20. Mullen, R.W., K.W. Freeman, G.V. Johnson, and W.R. Raun. 2001. The Magruder plots, long-term wheat fertility research. Better Crops: 85(4):6-8.
21. Mullen, R.W., W.R. Raun, and G.V. Johnson. 2003. Sensor-based N management strategy. Fluid Journal 11(3):12-13.
22. Johnson, Gordon, and Bill Raun. 2003. Sensor-based N management. In Southern Plant Nutrition Management Conference, Rasnake, M. (ed.). Olive Branch, Mississippi, Oct 7-8. Samuel Roberts Noble Foundation.
23. Raun, W.R., G.V. Johnson, J.B Solie, M.L. Stone, K.L. Martin, and K.W. Freeman. 2004. In-Season Fertilizer N Rates using Predicted Yield Potential and the Response Index. Better Crops 88(2): 8-11.
24. Zhang, H., and W.R. Raun. 2004. Chloride and Sulfate Status in Oklahoma Soils. Southern Plant Nutrition Management Conference Proceedings. October 5-6. Olive Branch, MS.
25. Melchiori, Ricardo, Octavio Caviglia, Augustin Bianchini, Nelson Faccendini, y William Raun. 2005. Utilizacion de sensors remotos para fertilizacion nitrogenada en maiz. Simposio de Fertilidad en Rosario, PPI, Rosario, Argentina.
26. Raun, W.R., G. Johnson, S. Phillips, W. Thomason, J. Dennos, and D. Cossey. 2006. Late-season applied N can increase alfalfa yields. Fluid Journal. 14 (2): 20-23.
27. Girma, K., B. Raun, H. Zhang, and J. Mosali. 2006. What about foliar P on corn and winter wheat? Fluid Journal. 14(3):17-19.
28. Raun, W.R., and R.W. Mullen. 2008. Long-term field experiments around the world, special supplement to celebrate 100 years of agronomy journal. 2008 Calendar, American Society of Agronomy.
29. Edmonds, D.E., M.C. Daft, W.R. Raun, J.B. Solie, and R.K. Taylor. 2008. Determining mid-season nitrogen rates with ramp calibration strip technology. Better Crops. 92:16-18.
30. Walsh, Olga, Yumiko Kanke, Daniel Edmonds and Bill Raun. 2009. Improving mid-season nitrogen recommendations for winter wheat using soil moisture data. Better Crops. 93:26-27.
31. Borlaug, Norman, Christopher Dowswell, Bill Raun, and Ed Runge. 2009. A generational recommitment to abolishing world hunger. CSA News, April, 54:21-22.
32. Desta, Birehane, Brian Arnall, and Bill Raun. 2009. The evolution of reference strips in Oklahoma. Okla. Coop. Ext. Service. PSS-2558.
33. Torres, Guilherme, Brian Arnall and Bill Raun. 2009. Effect of weather conditions on yields at Lahoma, Oklahoma. Current Report CR-2176. Okla. Coop. Ext. Serv., Stillwater, OK.
34. Raun, Bill, John Solie, Jerry May, Hailin Zhang, Jonathan Kelly, Randy Taylor, Brian Arnall, and Ivan Ortiz-Monasterio. 2010. Nitrogen Rich Strips for wheat, corn, and other crops. E-1022. Oklahoma State University, Stillwater, OK.
35. Arnall, Brian, Bill Raun. 2013. Impact of sensor based nitrogen management on yield and soil quality. Current Report. Okla. Coop. Ext. Serv. CR2270.
36. Taylor, Randy, Bill Raun, Nyle Wollenhaupt, Eric Lam, and Edgar Ascencio. 2014. The Greenseeder, User Manual. Okla. State Univ.

**RESEARCH BULLETINS**

1. Olson, R. A., W. R. Raun and G. J. Teichmeier. 1984. High yield corn-soybeans-wheat rotation study. Soil Science Research Report, University of Nebraska. pp. 18.1-18.2
2. Raun, W. R., D. H. Sander and R. A. Olson. 1984. Response of irrigated corn yields to nitrogen sources applied with a urease inhibitor. Soil Science Research Report, University of Nebraska. pp. 10.1-10.3.
3. Raun, W. R., D. H. Sander and R. A. Olson. 1984. Pressure injection of UAN for irrigated corn. Soil Science Research Report, University of Nebraska. pp. 7.1-7.6.
4. Raun, W. R., R. A. Olson and D. H. Sander. 1984. Emergence of corn as affected by source and rate of solution fertilizers applied with the seed. Soil Science Research Report, University of Nebraska. pp. 21.1-21.4.
5. Allen, E.A., G.V. Johnson and W.R. Raun. 1992. Banding phosphate in wheat: a temporary alternative to liming. Fertilizer Checks. Agron. Dept., Oklahoma State University.
6. Johnson, G.V., W.R. Raun and E.A. Allen. 1992. Fertilizer use and nitrates in groundwater. Fertilizer Checks. Agron. Dept., Oklahoma State University.
7. Raun, W.R., G.V. Johnson, R.K. Boman and E.R. Allen. 1992. Accumulation of ammonium and nitrate in soils cropped to continuous winter wheat. Fertilizer Checks. Agron. Dept., Oklahoma State University.
8. Johnson, G.V., and W.R. Raun. 1994. Nitrogen fertilizers for Oklahoma (facts and myths). Okla. Coop. Extension. Serv. L-245.
9. Raun, W.R and G.V. Johnson. 1994. Use of urea in winter wheat, forage and pasture production systems. Okla. Coop. Extension Serv. L-244.
10. Johnson, G.V., W.R. Raun and S.L. Taylor. 1996. Oklahoma fertilizer checkoff, research in fertilizer use and efficiency and environmental protection. Okla. Coop. Extension Serv. L-262.
11. Johnson, G.V., W.R. Raun, M.L. Stone, J.B. Solie and R.W. Whitney. 1996. Sensor-based variable rate technology in Oklahoma. Okla. Coop. Extension Serv. L-279.
12. Stone, Marvin, John Solie, Richard Whitney, Bill Raun and Gordon Johnson. 1996. Sensor-based-precision-agriculture at OSU. Okla. Coop. Extension Serv. PT 96-10.
13. Johnson, G.V., and W.R. Raun. 1996. Long-tern winter wheat grain yield trends. Okla. Coop. Extension Serv. PT 96-12.
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User experience with more than 30 different software packages for data management, data analysis, desktop publishing and graphics. Thirty years of operational experience with SAS (Statistical Analysis System).

Operational experience with various colorimeters, x-ray diffraction and atomic absorption spectrophotometers, dry combustion for total N and organic C in soil and plant tissue, automated flow injection analyses systems for determination of NH4-N, and NO3-N, inductive coupled plasma spectrometers and stable isotope ratio mass spectrometry.

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239. Effect of Foliar Application of Phosphite on Growth and Yield of Corn. Apurba Sutradhar 1, Brian Arnall 1, Kefyalew Desta2, Jagadeesh Mosali3, Muaid S. Ali1, Michael Reinert1, and Ma Lourdes Edano1,(1) Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK 74075, USA (2) Department of Crop and Soil Sciences, Washington State University-IAREC, Prosser, WA 99350, USA (3) Staff Scientist, Crops and soils, The Samuel Roberts Noble Foundation, Ardmore, OK 73401. 2012. Cincinnati, OH.
240. By-Plant Prediction of Maize (Zea Mays L.) Yield Using Stalk Diameter and Plant Height. Natasha Macnack1, Jeremiah Mullock 1, Jonathan Kelly 2, J Ortiz-Monasterio 1 and Bill Raun1 (1) Plant and Soil Sciences, Oklahoma State University, Stillwater, OK (2) Max Birney Aerial Spray Inc. Sublette KS. (3) International Maize and Wheat Improvement Center. 2012. Cincinnati, OH.
241. World Phosphorus Use Efficiency for Cereal Crops. Guilherme Torres, Natasha Macnack, Jeremiah Mullock, Bee K. Chim and William Raun, Plant and soil sciences, Oklahoma State University. 2012. Cincinnati OH.
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244. Evaluation of New OSU NDVI Pocket Sensor Prototype. Jared Crain1, J Ortiz-Monasterio2, William Raun1, Jonathan Kelly1 and Jeremiah Mullock1, (1)368 Agricultural Hall, Oklahoma State University, Stillwater, OK(2)International Maize and Wheat Improvement Center. 2011. San Antonio, TX.
245. Precision Planting of Corn to Manipulate Leaf Geometry. Guilherme Torres1, Jeremiah Mullock2, Bee K. Chim3 and William Raun3, (1)Plant and Soil Sciences, Oklahoma State University, Stillwater, OK(2)Oklahoma State University, Stillwater, OK(3)Plant and soil sciences, Oklahoma State University. 2011. San Antonio, TX.

1. Extracting Additional Information From Active Sensor Data. James Schepers, USDA-ARS, Lincoln, NE and William R. Raun, Plant and Soil Sciences, Oklahoma State University. 2011. San Antonio, TX.

1. Maize (Zea mays L.) Grain Yield and Nitrogen Uptake Response to Preplant Nitrogen Placement at Different Distances Away From the Row. Jeremiah Mullock1, Jacob Bushong1, Bee Chim2, Bill Raun1, and Randy Taylor3, (1) Plant and Soil Sciences, Oklahoma State University, (2) Crop, soil and Environmental sciences, Virginia Tech,(3) Bio-systems and Agricultural Engineering, Oklahoma State University, 2012. Cincinnati, OH. 2012.

1. Effect of Seed Distribution and Population On Maize (Zea mays L.) Grain Yield. Bee Khim Chim1, William Raun2, Jeremiah Mullock2, Emily Ruto2, Guilherme Torres2, Sulochana Dhital2 and Natasha Macnack2, (1) Crop, soil and Environmental sciences, Virginia Tech,(2) Plant and Soil Science, Oklahoma State University. 2012. Cincinnati, OH.

1. Effect of Foliar Application of Phosphite on Growth and Yield of Corn. Apurba Sutradhar 1, Brian Arnall 1, Kefyalew Desta2, Jagadeesh Mosali3, Muaid S. Ali1, Michael Reinert1, and Ma Lourdes Edano1,(1) Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK 74075, USA (2) Department of Crop and Soil Sciences, Washington State University-IAREC, Prosser, WA 99350, USA (3) Staff Scientist, Crops and soils, The Samuel Roberts Noble Foundation, Ardmore, OK 73401. 2012. Cincinnati, OH.

1. By-Plant Prediction of Maize (Zea Mays L.) Yield Using Stalk Diameter and Plant Height. Natasha Macnack1, Jeremiah Mullock 1, Jonathan Kelly 2, J Ortiz-Monasterio 1 and Bill Raun1 (1) Plant and Soil Sciences, Oklahoma State University, Stillwater, OK (2) Max Birney Aerial Spray Inc. Sublette KS. (3) International Maize and Wheat Improvement Center. 2012. Cincinnati, OH.
2. World Phosphorus Use Efficiency in Cereal Crops. Guilherme Torres1, Natasha Macnack1, Bee Chim2, Jeremiah Mullock1, and William Raun1. (1) Plant and Soil Sciences, Oklahoma State University, Stillwater, OK. (2) Crop, Soil and Environmental Sciences, Virginia Tech. 2012. Cincinnati, Ohio.
3. Mid-Season Prediction of Grain Protein in Winter Wheat Using Ground Based Sensor Measurements and Weather Data. Natasha Macnack1, Jacob Bushong1, Sulochana Dhital1, and William Raun1. (1) Plant and Soil Sciences, Oklahoma State University, Stillwater, OK. 2013. Tampa, Florida.
4. Influence of Foliar Sulfur, Chloride and Nitrogen On Winter Wheat Grain Yield and Total Nitrogen (TRITICUM AESTIVUM L.). Sulochana Dhital1 Jeremiah L. Mullock1, William R. Raun1, Bee Khim Chim2. (1) Oklahoma State University (2) Crop, Soil and Environmental Sciences, Virginia Tech. 2013. Tampa, Florida.
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6. Evaluating the Effects of Droplet Size and Nitrogen Rate on Protein Content of Hard Red Winter Wheat. Ethan C. Wyatt1, Jeremiah Mullock1, William R. Raun1, and Randy K. Taylor. Department of Plant and Soil Sciences, Oklahoma State University, Bio-Systems and Agricultural Engineering, Oklahoma State University, Stillwater, OK. 2013. Tampa, Florida.
7. Predicting Pre-Plant Nitrogen Applications to Corn Using Indicator Crop N-Rich Reference Strips. Eric C. Miller, Jeremiah L. Mullock, Jacob T. Bushong, William R. Raun. Plant and Soil Sciences, Oklahoma State University, Stillwater OK. 2013. Tampa, Florida
8. Effect of N Source, Method and Timing Of Application, and Irrigation On Corn In a Water Limited Environment. Jacob T. Bushong, Jeremiah L. Mullock, Eric C. Miller, William R. Raun. Plant and Soil Sciences, Oklahoma State University, Stillwater, OK. 2013. Tampa, Florida.
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10. Drivers and Dynamic of Nitrogen Mineralization in Soil. Jo’Nee Collins, Shiping Deng, Xiufen Li, Yan Wang and William R. Raun. Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK. 2013. Tampa, Florida.
11. Jeremiah L. Mullock, Oklahoma State University; Natasha Elizabeth Macnack, Oklahoma State University; Bruno Morandin Figueiredo, Oklahoma State University; William R. Raun, Oklahoma State University 442-3 Poster #1310, 2014.
12. Foliar Sulfur, Chloride and Nitrogen on Winter Wheat GRAIN YIELD and TOTAL Nitrogen. Sulochana Dhital, Oklahoma State University; William R. Raun, Oklahoma State University, Stillwater, OK. 2014.
13. Maize Hand Planter and Fertilizer Applicator for the Developing World. William R. Raun, Randy Taylor, Nyle C. Wollenhaupt, Bruno Morandin Figueiredo, Lawrence Aula, Oklahoma State University, Stillwater, OK. 2014.
14. Delivering Online Soil Science Courses at the Oklahoma State University. Sergio Manacpo Abit Jr., Oklahoma State University; William R. Raun, Oklahoma State University; D. Brian Arnall, Oklahoma State University, Stillwater, OK. 2014.
15. Maize Hand Planter and Fertilizer Applicator for the Developing World, William R. Raun1, Randy Taylor2, Nyle C. Wollenhaupt3, Bruno Morandin Figueiredo4 and Lawrence Aula4, (1)368 Agricultural Hall, Oklahoma State University, Stillwater, OK (2) BAE. 2014.
16. Xiufen Li1, Shiping Deng1, William R. Raun2, Yan Wang1 and Ying Teng3, (1)Plant and Soil Sciences, Oklahoma State University, Stillwater, OK(2)368 Agricultural Hall, Oklahoma State University, Stillwater, OK.2014.
17. In Season Application of Nitrogen and Sulfur in Wheat. Bruno Morandin Figueiredo, Oklahoma State University, Stillwater, OK and William R. Raun, 368 Agricultural Hall, Oklahoma State University, Stillwater, OK. 2014.
18. Reserve Program (CRP), or Continuous Winter Wheat Cultivation. Xiufen Li, Oklahoma State University; Shiping Deng, Oklahoma State University; William R. Raun, Oklahoma State University; Yan Wang, Oklahoma State University. 2014.
19. The Promise, Challenges and Lessons Learned in Delivering Online Soil Science Courses at the Oklahoma State University. II November 5, 2014 Long Beach Convention Center, Exhibit Hall ABC Share | Sergio Manacpo Abit Jr.1, William R. Raun2 and D. Brian Arnall1, (1)Oklahoma State University, Stillwater, OK(2)368 Agricultural Hall, Oklahoma State University, Stillwater, OK. 2014.
20. Influence of Foliar Sulfur, Chloride and Nitrogen on Winter Wheat GRAIN YIELD and TOTAL Nitrogen. Sulochana Dhital, 052 Agricultural Hall, Oklahoma State University, Stillwater, OK and William R. Raun, 368 Agricultural Hall, Oklahoma State University, Stillwater, OK. 2014.
21. Effect of Preplant/Early Irrigation, Nitrogen and Population Rate on Winter Wheat Grain Yield. Sulochana Dhital, William R. Raun, Bruno Morandin Figueiredo, Jeremiah Mullock. 2015. Minneapolis, MN.
22. Dominant Bacterial Phyla in Soils Under 18-114 Years of Wheat Cultivation. Xiufen Lie, Shiping Deng, William Raun. 2015, Agronomy Abstracts, ASA. Minneapolis, MN.
23. Effect of Micronutrient Fertilizer on Winter Wheat Yield. Bruno Figueiredo, William Raun. 2015, Agronomy Abstracts, ASA. Minneapolis, MN.
24. Evaluation of Soil Phosphorus Index for No-till Wheat Production in Oklahoma. Patrick Watkins, Brian Arnall, Bill Raun. 2015, Agronomy Abstracts, ASA. Minneapolis, MN
25. Relationship Between Mean Square Errors and Wheat Grain Yields in Long-Term Experiments. Mellissa Golden, Bill Raun. 2015, Agronomy Abstracts, ASA. Minneapolis, MN.
26. Long Term Wheat Fertility Trials at Oklahoma State University. Ryan Schlobohm, Bill Raun. 2015, Agronomy Abstracts, ASA. Minneapolis, MN.
27. Adoption of a New-Age Hand Planter for the Developing World. Bill Raun, Randy Taylor. 2015, Agronomy Abstracts, ASA. Minneapolis, MN.
28. Evaluation of Drum Cavity Size and Planter-tip on Singulation and Plant Emergence in Maize (Zea mays L.). Dhillon, Jagmandeep, Bill Raun. 2015. Agronomy Abstracts, ASA. Minneapolis, MN.

**FUNDS RAISED SPECIFICALLY FOR INTERNATIONAL EXPERIENCE FOR OSU GRADUATE STUDENTS AND FACULTY**

|  |  |  |  |
| --- | --- | --- | --- |
| Graduate Students who have been and short (1 to 2 week) and long-term (4-month) study at the International Maize and Wheat Improvement Center (CIMMYT), and other regions in the world, 1995-present. | | | |
| **Date** | **Location** | **Personnel** | **Purpose** |
| Jan-95 | Ciudad Obregon, MX | Bill Raun | Initial discussions for collaborative sensor work |
| Feb-97 | Ciudad Obregon, MX | Bill Raun | Long-term student involvement |
| Jan-99 | Ciudad Obregon and Texcoco, MX | Steve Phillips, Joanne LaRuffa, Wade Thomason, Sherry Britton, Joe Vadder, Gordon Johnson, John Solie, Dick Whitney | IRSP 98, 2-wheel tractor, refine INSEY, wheat bed planter |
| Sep-99 | Texcoco, MX | Erna Lukina | IRSP 98, use of EY |
| Aug-00 | Texcoco, MX | Marvin Stone, Kyle Freeman, Robert Mullen, Roger Teal, Dwayne Needham, Kathy Wynn, Carly Washmon | IRSP 99, refine INSEY, sensor design for plant breeding |
| Jan-Apr-01 | Ciudad Obregon, MX | Kyle Freeman | 4-month OSU representation, NRI grant 200-03530 |
| Apr-01 | Ciudad Obregon, MX | Kyle Freeman | Wheat Harvest |
| Jul-01 | El Batan, MX | Jagadeesh Mosali, Shambel Moges, Micah Humphreys, Paul Hodgen, Carly Washmon | IFAFS Grant |
| Jan-Apr-02 | Ciudad Obregon, MX | Paul Hodgen | 4-month OSU representation for IFAFS Grant |
| Jun-02 | El Batan, Tlaltizapan, MX | Robert Mullen, Kyle Freeman | Deliver hand-held sensor, initiate corn sensing program |
| Aug-02 | Texcoco, MX | Bill Raun | Work for 5-months on the development of a corn algorithm for N |
| Nov-02 | El Batan, MX | Keri Brixey, Jason Lawles, Kyle Freeman | Corn harvest, sensed earlier in June by Kyle Freeman and Robert Mullen, delivery of 3 new Greenseeker sensors. |
| Jan-04 | Ciudad Obregon, MX | Kyle Freeman, Brian Arnall, and Kody Featherston | Collect by-plot CV data for improved prediction of yield potential |
| July-04 | New Delhi, India | Kent Martin | Train CIMMYT Rice-Wheat Consortium staff in the use of hand-held sensors for improved N fertilization |
| July 04 | Beijing, China | Kyle Freeman | Training of Chinese National Academy of Sciences Personnel in the use of hand-held sensors |
| July 05 | New Delhi, India | Kent Martin, Brian Arnall | Workshop for CIMMYT and National Program scientists |
| July 05 | Esperance, Australia | Kyle Freeman | Work with David and Sally Cox on the extension of Sensor Based N Rate Technologies for Wheat in South West Australia |
| Sep 05 | El Batan, MX | Olga Walsh, Brenda Tubana, Starr Holtz, Chung Byungkyun, Clint Mack, Kyle Lawles, D. Zavodny | Sensor Based N Workshop for CIMMYT and National Program Staff |
| Oct 05 | Ankara, Turkey | Kyle Freeman, Roger Teal | Sensor Based N Workshop for CIMMYT and National Program Staff |
| Sep 05 | Beijing, China | Brian Arnall, Carol Jones, Hailin Zhang | Sensor Based N Workshop for CIMMYT and National Program Staff |
| Nov 05 | Mar de Plata, Argentina | Kyle Freeman | Invited Presentation, 7th International Wheat Conference |
| Jan 06 | El Batan, MX | Brian Arnall, Joe Biggerstaff | Workshop with PATRONATO Farmers and Ivan Ortiz-Monasterio |
| Mar 06 | Ciudad Obregon, Mexico | Kefyalew Girma | Yield Potential Symposium |
| Jul 06 | New Delhi, India | Kent Martin | Follow up work with CIMMYT and NARS on Greenseeker Technology |
| Aug 06 | Beijing, China, and Urgench, Uzbekistan | Brian Arnall, Starr Holtz | Sensor Based Nitrogen Workshop using Greenseeker |
| Aug 06 | Adelaide, Australia | Brenda Tubana | Sensor Based Nitrogen Workshop using Greenseeker Technology |
| Jan 07 | Ciudad Obregon, MX | Brenda Tubana, Starr Holtz, Pam Turner, Clint Dotson, Luke Hanks | SBNRC workshop with Ivan-Ortiz Monasterio, CIMMYT and the Patronato |
| Apr 07 | Ciudad Obregon, MX | John Solie, Bill Raun | Dr. Norman Borlaug endorses GreenSeeker N management approach for Mexico |
| Jan 08 | Harare, Zimbabwe | Daniel Edmonds, Cody Daft | GreenSeeker Sensor N workshop with CIMMYT |
| Feb 08 | Tashkent, Uzbekistan | Daniel Edmonds | ICARDA, CIMMYT Sensor N workshop |
| Feb 08 | Ciudad Obregon, MX | Brian Arnall, Randy Taylor | Installation of a GreenSeeker RT200 system for spring wheat |
| Mar 08 | Samara, Russia | Daniel Edmonds | GreenSeeker Sensor Training |
| Nov 08 | Harare, Zimbabwe | Daniel Edmonds, Cody Daft | GreenSeeker Training and Extension |
| Jan 09 | Ciudad Obregon | Yumiko Kanke, Daniel Edmonds, Jared Crain | Side-view sensor readings |
| Feb 09 | Nairobi, Kenya | Jake Vossenkemper, Jerry May, Yumiko Kanke | GreenSeeker Training and Extension |
| Jan 10 | Ciudad Obregon, MX | Jonathan Kelly, Guilherme Torres | Collaborative work with Ivan Ortiz-Monasterio on spectral readings in wheat and corn |
| Jan 11 | Ciudad Obregon, MX | Bee Khim, Jeremiah Mullock, Kevin Waldschmidt, Katy Butchee, Dillon Butchee | Collaborative work with Ivan Ortiz-Monasterio on spectral readings in wheat and corn |
| March 12 | Ciudad Obregon, MX | Michael Reinert, Jake Bushong, Jorge Rascon, Jared Crain, Wesley Porter | Greenseeker 2 evaluation versus the pocket sensor, with CIMMYT |
| Jan 13 | Ciudad Obregon, MX | Jeremiah Mullock, Eric Miller, Jacob Bushong, Natasha Macnack, Sulochana Dhital, Candi Byani, Ethan Wyatt | Sensor testing, Hand Planter delivery |
| January 16 | Ciudad Obregon, MX | Katie McCauley, Jagmandeep Dhillon, Eva Nambi, Daniel Aliddeki, Ethan Driver, Bruno Figueiredo,  Gwen Wehmeyer, Andi Nichols | Collection of CV data, Greenseeker, variety evaluation |
|  |  |  |  |
| **Total** | **40** | **110** |  |

**November 21-December 6, 1998:** OSU-Team member, Sanliurfa, Turkey.  Su-Yapi, GAP, World Bank irrigation development project.  Assessment of crop production practices combined with established irrigation, resulting in a crop system recommendation.

**Extension 2008**  
  
January 17, 2008. Stillwater, OK. “Myths and Facts associated with Nitrogen Use Efficiency.” In Service Training, Stillwater Fair Grounds.

January 25, 2008. Salina, KS. “By-Plant N Management Strategies.” Presented to the KARI.

March 4, 2008. Norman, OK. Use of soil moisture for improved yield prediction, presented to the Oklahoma Mesonet Group.

April 24, 2008. Stillwater, OK. Presentation to Calvin Burgess and Dominion Farms on the use of sensor based N technologies for Kenya.

May 14-15, 2008. Vernon TX, Agri-Pro Field Day, “Nitrogen rich strips for improved N management in Cereals.

May 16, 2008. Lahoma, OK, “Improving your bottom line in wheat N management”, Lahoma Field Tour.

June 26, 2008. Guest lecture on Precision Agriculture in Oklahoma to Chapingo undergraduates visiting Dr. David Henneberry. Approximately 110 in attendance.

July 22, 2008. No-till Rotation Crops and Fertilizer Informational Workshop, Weatherford, OK. GreenSeeker program and the benefits that can be gained.

July 30-Aug 2, 2008. NUE Conference, Manhattan, KS. 75 Attendees for a meeting addressing university and industry needs in precision agriculture to improve N rate recommendations.

August 19, 2008. Estes Chemical Training Session, Stillwater, OK. Comprehensive GreenSeeker sensor training for 9 Estes Chemical employees.

September 11, 2008. Guest Lecture, AGED 4713, International Agriculture and Poverty in Today’s World. 40 in attendance

October 14, 2008. Departmental Seminar, “Cereal Nitrogen Use Efficiency in Sub Saharan Africa. 25 in attendance.

October 21-25, 2008. Taught all lectures for SOIL 2224 due to Dr. Hattey’s trip to Kenya.

November 5-6, 2008. Exhibitor and OSU representative, OARA meetings, Oklahoma City, OK.  
  
**Extension 2009**

Made all contacts with Hans Braun (Director of the Wheat Program, CIMMYT) and Mahmood Ozmanzai (CIMMYT wheat breeder located in Afghanistan). They will now be working with the Oklahoma National Guard on a seed dissemination project partially funded by USAID.

August 16, 2009. Adoption of new technologies in the 3rd World. Presented to the Oklahoma Army National Guard, Deployment to Afghanistan.

August 26, 2009. PaSS update for area agronomists.

OARA Meetings, November 6, 2009, Oklahoma City, OK. GreenSeeker Sensor update presentation. Also, OSU Exhibitor.

December 5, 2009. Soil [fertility and N Rich Strips for Wheat](http://sunup.okstate.edu/video/12-5-09/seg1.html). Aired on SUNUP

December 16, 2009. S, Micronutrients and K, presented at the OSU 2009 Crops School, Stillwater, OK.

**Extension 2010**

June 21, 2010. Sensor Based Technology Developed at OSU, ASFFPCO Conference, Oklahoma City, OK (downtown Sheraton)

June 25, 2010. Precision Agriculture at OSU, Chapingo Student Program, Mexico, Stillwater, OK.

Raun, Bill, John Solie, Jerry May, Hailin Zhang, Jonathan Kelly, Randy Taylor, Brian Arnall, and Ivan Ortiz-Monasterio. 2010. Nitrogen Rich Strips for wheat, corn, and other crops. E-1022. Oklahoma State University, Stillwater, OK.

Raun, Bill. Improved Sensor Based Nitrogen Management. November 4, 2010. OARA Annual Meetings, Oklahoma City, OK.

Raun, Bill, December 15, 2010. Optimizing winter wheat grain protein. OSU Winter Crops School.

**Extension 2011**

February 9, 2011. OSU N Rate Algorithm. Presented at the NeATA conference, Grand Island, NE.

February 10, 2011. Making a case for by-plant N management. Presented at the NeATA conference, Grand Island, NE.

November 8-9. OARA meetings, Oklahoma City.

December 13, 2011. Winter Crops School, Stillwater, OK.

**Extension 2012**  
December 12, 2012. Presentation, Winter Crops School, Stillwater, OK

**Extension 2013**  
December 16, 2012. Presentation, Winter Crops School, Stillwater, OK

**Extension 2014**October 7, 2014. Hand Planter Presentation, Agricultural Entrepreneurs 2014

November 6, 2014, Global Horticulture Workshop, Wes Watkins Center

**Extension 2015**

February 6, 2015, Value of the “Nitrogen Cycle Ninja” exercise, 1996-present, Growmark, Bloomington, Indiana

July 30, 2015, Hunger and Horticulture, Invited speaker, FAPC, Stillwater, OK

December 5, 2015,New Age Hand Planter for the Developing World. OSU Soil Biology Symposium, Stillwater, OK

**2010 Safety Training**

2nd quarter, May 6, 2010, Tornado Safety Tips

2nd quarter, July 1, 2010, Tornado Safety Tips

3rd quarter, August 12, 2010, Safety Training Module

4th quarter, October 11, 2010, Safety Training Module (suspicious package)

**2011 Safety Training**

1st quarter, February 4, 2011, Crime Prevention

2nd quarter, April 25, 2011, Back Safety Module

3rd quarter, July 28, 2011, Hazard Communication  
4th quarter, November 3, 2011, Asbestos Awareness

**2012 Safety Training**  
1st quarter, February 28, 2012, How did that accident happen?

2nd quarter, April 11, 2011, Bicycle Safety for All of us (attended Scott Nutt seminar).

2nd quarter, April 18, 2011, Bicycle Safety for All of us

3rd quarter, July 23, 2012, Hazard Communication Safety Training

4th quarter, November 7, 2012, Safety is Everybody’s Business

4th quarter, December 13, 2012, Safety is Everybody’s Business

**2013 Safety Training**

1st quarter, February 28, 2013, Hazard Communication, Your Right to Know

2nd quarter, May 21, 2013, Why Back Safety is Important

3rd quarter, August 8, 2013, Bites, Stings, Burns

4th quarter, October 17, 2013, Hazard Communication, Your Right to Know Quiz

**2014 Safety Training**

1st quarter, February 13, 2014, Shop Safety Training

2nd quarter, May 13, 2014, How did that Accident Happen?

3rd quarter, August 14, 2014, New Employee Safety Training  
4th quarter, November 12, 2014, Why Back Safety is Important

**2015 Safety Training**

1st quarter, February 12, 2015, Farm and Field Labeling

2nd quarter, May 21, 2015, Tornado’s

3rd quarter, August 7, 2015, Your Right to Know

4th quarter, October 29, 2015, Walking on Ice

**2016 Safety Training**

1st quarter, January 13, 2016, Electrical Safety Module

2nd quarter, May 4, 2016, Tractor Safety Module

3rd quarter,

4th quarter,

**INTERNATIONAL and OSU AWARD NOMINATIONS**

Candidate Award Year(s) nominated Received

Gordon V. Johnson Fellow, SSSA 1995 1995

Gordon V. Johnson Werner L. Nelson, ASA 1997, 1998 1998

Gordon V. Johnson Soil Science, App. Res SSSA 2001, 2002, 2003

James R. Brown Fellow, SSSA 1998 1998

Nicholas T. Basta James Whatley Award, OSU 1997, 1998 1998

Nicholas T. Basta Environmental Quality-ASA 2000- 2007

Nicholas T. Basta Fellow, ASA 2002, 2003 2003

Nicholas T. Basta Fellow, SSSA 2002, 2003, 2004 2004

R. L. Westerman Soil Science, App. Res SSSA 1997, 1998, 1999, 2000

Jefforey Jacobsen Fellow, ASA 1998, 1999, 2000 2000

Jefforey Jacobsen Fellow, SSSA 2001, 2002, 2004, 2005 2005

Charles Taliaferro Fellow, ASA 1999 1999

Charles Taliaferro Fellow, CSSA 1999, 2000 2000

John Caddel Fellow, ASA 1999, 2000, 2001, 2002

John Caddel Fellow, CSSA 1999, 2000

Jeffory A Hattey Merrick Foundation Teaching 1997, 1998

Jeffory A. Hattey AMOCO Teaching Award 1998

Jeffory A. Hattey GSD Award, OSU 1999 1999  
Jeffory A. Hattey NACTA Teacher Fellow Award 2000 2000  
Jeffory A. Hattey SSSA Soil Science Education 2007, 2008, 2009, 2010 2010

Arthur Klatt International Service ASA 1999-2012

Steven B. Phillips Emil Truog Award, SSSA 2000

Eugene Krenzer Agronomic Extension ASA 2000, 2001

Ken Sayre Fellow, ASA 2001, 2002

Gyles Randall Werner L. Nelson, ASA 2001, 2002 2002

Sam Fuhlendorf James Whatley Award, OSU 2000, 2001 2001

Shiping Deng James Whatley Award, OSU 2001, 2002, 2003, 2004 2004

Hailin Zhang Agronomic Extension ASA 2002-2015

Hailin Zhang Fellow, ASA 2006, 2007, 2008 2008  
Hailin Zhang Fellow, SSSA 2007, 2008, 2009 2009

Hailin Zhang Sarkeys Distinguished Prof 2004

Hailin Zhang James Whatley Award, OSU 2005 2005

Brian Carter ASA, Fellow 2002

Brian Carter SSSA, Fellow 2002

Robert Mullen SSSA, Clark Soil Biology 2002

Robert Mullen SSSA Emil Truog Award 2004 2004

James Schepers SSSA Professional Service 2003 2003  
James Schepers SSSA Intl. Soil Science 2005-2015 2015  
John Lamb ASA Fellow 2005-2007 2007

John Lamb SSSA Fellow 2005-2013

Kyle Freeman SSSA Emil Truog Award 2006  
Brian Arnall ASA Larsen Memorial 2006, 2007  
Newell Kitchen ASA Fellow 2006, 2007 2007  
Newell Kitchen SSSA Fellow 2008 2008  
Kefyalew Girma Syngenta ASA 2006  
Kefyalew Girma ASA Young Crop Scientist 2007  
Jeff Edwards ASA Early Career Award 2007 2007  
Richard Ferguson ASA Werner Nelson 2007, 2008, 2009 2010 2010  
Mike Stewart ASA Fellow 2007, 2008, 2009

David Porter ASA Fellow 2009 2009  
David Porter CSSA Fellow 2010 2010  
Brian Arnall Emil Truog Award 2009  
Chad Godsey Early Career Prof. Award 2009, 2010, 2011 2011

Raj Khosla ASA Fellow 2011 2011  
Raj Khosla SSSA Fellow 2011 2011

Peter Scharf ASA Fellow 2012-2015

Peter Scharf SSSA Fellow 2012

Dave Franzen ASA Fellow 2012, 2013 2013

Dave Franzen SSSA Fellow 2012

Jeff Edwards Young Crop Scientist 2012

Brian Arnall Young Crop Scientist 2014 2014

Wade Thomason Carl Sprengel ASA 2015  
Jeremiah Mullock Emil Truog SSSA 2015

Randy Taylor OSU Regents Professor 2015

Brian Arnall Pierre Robert ISPA 2016

**TOTAL 134 33**

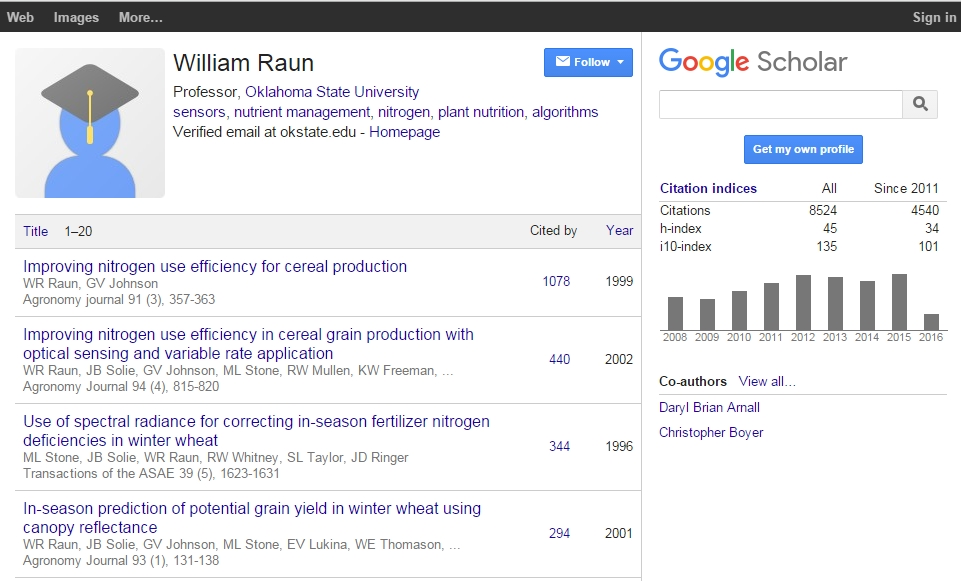
8th most cited paper for Agronomy Journal, 1897 - 2015, Agron. J. 91:357-363. (<https://www.soils.org/publications/aj/most-cited>)

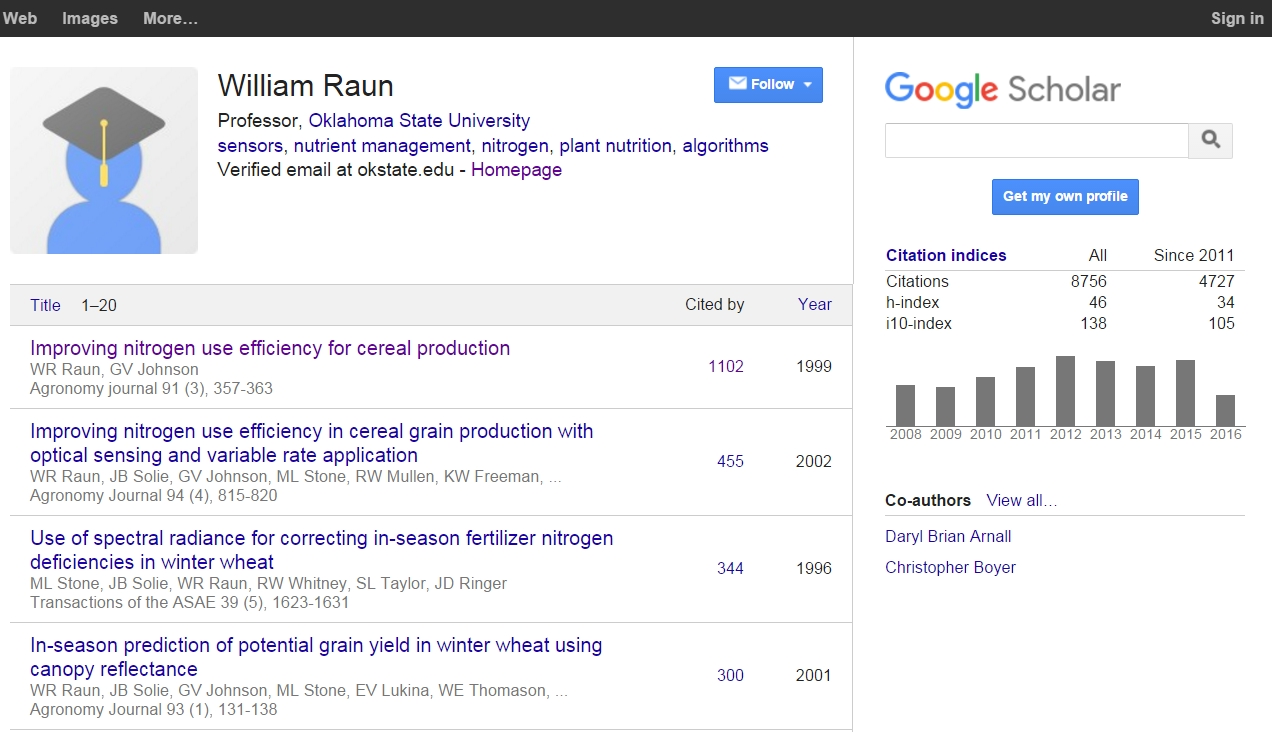
Table 1. Agronomy Journal most cited articles, founded in 1908, updated, April 7, 2016.



Figure 1. H-index (author-level metric) measuring productivity and citation impact for publications coming from scientists.

April 2016



June, 2016

Web of Science: July 1, 2016

