



**WERA-103 Group Photo – 2018 Meeting in Fresno**

**ALP-MAP-CAP Proficiency Programs, SPAC**

Robert Miller, Colorado State University, Programs Coordinator

ALP Program

The Agricultural Laboratory Proficiency (ALP) program is the only accredited proficiency provider for agricultural lab testing in North America under ISO/IEC 17043 by ANAB. One hundred sixteen laboratories are enrolled in the program, with new laboratory participants from Washington state, California, Arkansas, South Dakota, Iowa and Canada. Nineteen laboratory site visits were conducted during 2017. New equipment has been purchased and improvements made to soil and botanical sample processing. ALP has grant projects underway SciAp to evaluate LIBS technology for soil TOC analysis. The program has an inventory of 168 soils with 14 new collections from: CA, IL, MN, IN and IA. 2018 soil collections are planned for AL, GA, TN, SC, NC, KY, WV, VT, QE and NY. A Greenhouse media/solutions proficiency program will launch April 2017.

Research articles

Wade, J., S.W. Culman, T. T. Hurisso, R.O. Miller, L. Baker, W.R. Horwath. 2018. Sources of variability that compromise mineralizable carbon as a soil health indicator. *Soil Sci. Soc. Am. J.* 82:243-252.

A. Sparda, R.O. Miller, G. Anderson, Y.P. Hsieh. 2017. Real-time Soil CO<sub>2</sub> Respiration Rate Determination and the Comparison between the Infrared Gas Analyzer and Microrespirometer (MicroRes) Methods. *Comm. Soil Plant Sci.* 48:2, 214-221.

Miller, R. O., M Lindaman. Soil Testing Laboratory Analytical Performance - Results of the ISTA-LAP Program. Division S8, Oct, 2017. SSSA.

ALP is a recognized proficiency provider by: qualified for NRCS 590 requirements; the Minnesota Dept of Agriculture; and is the sole provider of proficiency data for the Illinois Soil Testing Association Laboratory Accreditation Program (ISTA-LAP). ALP has sponsored: the WCC-103 Nutrient Management Workshop; 2017 SERA-6 Meeting; NCERA-13 Laboratory Workshop, and SSSA Leo Walsh Award reception in November 2017.

### MAP and CAP Programs

The Manure Analysis Proficiency (MAP) administered by the Minnesota Department of Agriculture (MDA) program has an enrollment of 74 labs enrolled. With the retirement of Jerry Floren the program is being re-structured and will be administered through MDA.

The Compost Analysis Proficiency (CAP) program has twenty laboratories enrolled. CAP has participated in USCC workshops and is partnering with Compost Council of Canada to develop a laboratory certification of testing labs in Canada in 2018. A proposal is being evaluated to add compost teas to the CAP proficiency program in 2018.

### Soil and Plant Analysis Council Activities

The 15th ISSPA meeting was held in May 14-19, 2017, in Nanjing, China. There were 220 participants and 42 oral paper presented. The 16th ISSPA is set to be held in Wageningen, The Netherlands, June 17-20, 2019. SPAC has joined with ASPAC and Agri-Lasa to form an international governance agreement.

### Research

Midwest corn K fertility research continues with support from WinField United, Climate Corp., Fluid Fertilizer Foundation, Nachurs, Soil View and Wilbur Ellis. Results from 2016 and 2017 show soil K base saturation is a better predictor of corn ear leaf K and stalk K at maturity than STK. Soil CEC and SOM-LOI were negatively correlated with ear leaf K and stalk K. A linear model of grain yield across seven states was been described by ear leaf N and Zn with an R<sup>2</sup> of 0.62.

### **Arizona WERA-103 report**

Jim Walworth, University of Arizona

### Publications - Book Chapters

- Bar-Tal, A., Saha, U. K., Raviv, M., & Tuller, M. (2017). Inorganic and Synthetic Organic Components of Soilless Culture and Potting Mixtures. In *Soilless Culture: Theory and Practice - 2nd Edition*. Elsevier.

### Publications - Peer-Reviewed Journal Articles

- Bidabadi, S. S., Dehghanipoodeh, S., & Wright, G. C. (2017). Vermicompost leachate reduces some negative effects of salt stress in pomegranate. *International Journal of Recycling of Organic Waste in Agriculture*, 6, 1–9.
- Blankinship, J., Morse, H., Marchus, K., & Schimel, J. (2018). Using extracellular polysaccharides to conserve soil water and nutrients. *APPLIED SOIL ECOLOGY*.
- Bronson, K. F., Hunsaker, D. J., Mon, J., Andrade-Sanchez, P., White, J. W., Conley, M. M., Thorp, K. R., Bautista, E. and Barnes, E. M. (2017). Improving Nitrogen fertilizer use efficiency in surface- and overhead sprinkler-irrigated cotton in the desert Southwest. *Soil Science Society of America Journal*, 81(6), 1401–1412.

- Brown, P. W., Poro, J., & Ebdon, J. S. (2017). Effects of Mowing Height of Cut and Nitrogen on FAO-56 PM Crop Coefficients for Recreational Turf in the Cool-Humid Region. *Crop Science*, 57:1.
- Carey, C. J., Blankinship, J. C., Eviner, V. T., Malmstrom, C. M., & Hart, S. C. (2017). Invasive plants decrease microbial capacity to nitrify and denitrify compared to native California grassland communities. *BIOLOGICAL INVASIONS*, 19(10), 2941–2957.
- Fitzsimmons, K., & Cerozi, B. (2017). Effect of dietary phytase on phosphorus use efficiency and dynamics in aquaponics. *Aquaculture International*, 1–12.
- Fitzsimmons, K., & Cerozi, B. (2017). Phosphorus dynamics modeling and mass balance in an aquaponics system. *Agricultural Systems*, 153, 94–100., 153, 94–100.
- Gebhardt, M., Fehmi, J. S., Rasmussen, C., & Gallery, R. E. (2017). Soil amendments alter plant biomass and soil microbial activity in a semi-desert grassland. *Plant and Soil*, 419, 53–70.
- Hawes, M. C., Huskey, D. A., Rivera, G. C., Chorover, J., Root, R., & Amistadi, M. K. (2017). Trapping of lead (Pb) by corn and pea root border cells. *Plant and Soil*, 10.
- Heerema, R. J., VanLeeuwen, D., Potter, M. T., Sherman, J. D., Comeau, M. J., & Walworth, J. L. (2017). Leaf Photosynthesis of Immature “Wichita” pecan trees is Improved by Soil-Application of Zinc-EDTA. *American Society for Horticultural Science*, 142(1), pp. 27–35.
- Hewins, D. B., Sinsabaugh, R. L., Archer, S. R., & Throop, H. L. (2017). Soil-litter mixing and microbial activity mediate decomposition and soil aggregate formation in a sandy shrub-invaded Chihuahuan Desert grassland. *Plant Ecology*, DOI 10.1007/s11258-017-0703-4.
- Pessaraki, M., Breshears, D. D., Walworth, J. L., Field, J. P., & Law, D. J. (2017). Candidate halophytic grasses for addressing land degradation: Shoot responses of *Sporobolus airoides* and *Paspalum vagenitum* to weekly increasing NaCl concentration. *Arid Land Research and Management*, 31(2), 169–181.
- Sanchez, C. A., Zerihun, D., Subramani, J., Badaruddin, M., & Bronson, K. (2017). Fertigation uniformity under sprinkler irrigation: evaluation and analysis. *Irrigation and Drainage Engineering Systems*, *Irrig Drain Sys Eng.* 10.4172/2168-9768.1000177.
- Sherman, J. D., Heerema, R. J., VanLeeuwen, D., & St.Hilaire, R. (2017). Optimal Manganese Nutrition Increases Photosynthesis of Immature Pecan Trees. *HortScience*, 52(4), 6.
- Walworth, J. L., Comeau, M. J., & Heerema, R. J. (2017). Soil-Applied ZnEDTA: Vegetative Growth, Nut Production and Nutrient Acquisition of Immature Pecan Trees Grown in an Alkaline, Calcareous Soil. *HortScience*, 52(2), 301–305.

#### Proceedings

- Bronson, K. F., Norton, E. R., Andrade Sanchez, P., Hunsaker, D., Williams, C., & Thorp, K. (2017). Improving Nitrogen Management for Subsurface Drip Irrigated Cotton in Arizona. In 2017 Beltwide Cotton Conferences (pp. 147–149). National Cotton Council.
- Morgan, G., Frame, H., Dodds, D., Jones, A., Jones, M., Norton, E. R., Lewis, K., Robertson, B., Raper, T., & Nichols, B. (2017). Multi-Year Cotton Yield, Quality, and Plant Growth Response to Soil-Applied Potassium. In 2017 Beltwide Cotton Conferences (pp. 6–7). National Cotton Council.
- Walworth, J. L. (2017). Recent Advancements in Micronutrient Management in Pecans. In Proceedings of Simposio Internacional de Nogal Pecanero. Hermosillo, Son., MX.: INIFAP.

#### Extension & Other Publications

- Clark, N., Orloff, S., & Ottman, M. (2017). Fertilizing high yielding alfalfa in California and Arizona. *Better Crops with Plant Food*, 101(4), 21–23.  
[http://www.ipni.net/publication/bettercrops.nsf/0/B3D37D5A6F4A11C2852581D00057AA17/\\$FILE/BC-2017-4%20p21.pdf](http://www.ipni.net/publication/bettercrops.nsf/0/B3D37D5A6F4A11C2852581D00057AA17/$FILE/BC-2017-4%20p21.pdf)
- Faber, B., Walworth, J. L., Giraud, D. D., & Silva, D. (2017). Soil and Fertilizer Management. In *California Master Gardener Handbook, Second Edition* (pp. 37–82). Richmond, CA: University of California Agriculture and Natural Resources.
- Ottman, M. J., Diaz, D. E., Sheedy, M. D., & Ward, R. W. (2017). Nitrogen Fertilizer Rate Effect on Forage Sorghum Yield, Quality, and Tissue Nitrogen Concentrations at Maricopa, AZ, 2015. College of Agriculture and Life Sciences, University of Arizona.  
[https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1727-2017\\_0.pdf](https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1727-2017_0.pdf)
- Ottman, M. J., & Mostafa, A. M. (2017). Getting it right - phosphorus fertilizer use in Arizona alfalfa. Western Farm Press. [Authorship Type: Lead Author]
- Ottman, M. J., & Mostafa, A. M. (2017). Phosphorus Fertilizer for Alfalfa. College of Agriculture and Life Sciences, University of Arizona, Tucson.
- Rock, C. M., Mclain, J. E. T., & Joe, V. M. (2017). Compost Tea 101: What Every Organic Gardener Should Know. University of Arizona, Cooperative Extension. <http://hdl.handle.net/10150/625441>

#### Research

- A Study to Evaluate Production and Soil Salt Management for Drip Irrigated Alfalfa As Affected By Calcine and Lime. C.A. Sanchez. Sponsor: Midwestern BioAg, Inc.
- Bio Crusts, Grass Establishment, and Restoration of Working Rangelands. S. Archer. Sponsor: United States Department of Agriculture/Utah State University.
- Can the Yield of Late-Planted Small Grains be Compensated by Nitrogen Rates? M.J. Ottman. Sponsor: Arizona Grain Research and Promotion Council.
- Development of Economically Viable Variable Rate P Application Protocols for Desert Vegetable Production Systems. S.A. Sanchez. Sponsor: California Department of Food and Agriculture.
- Evaluating Effects of Organic Vs. Non-Organic Nutrient Solution, DLI, On Operational Ease, Crop Yield, Quality and Nutrient Culture Microbial Populations in a Hydroponic Multi-Tier Vertical Farm Facility. M. Kacira. Sponsor: Civic Farms LLC
- Evaluation of Cotton Yield, Quality, and Plant Growth Response to Soil-Applied Potassium II. Multi-Year Sites. E.R. Norton. Sponsor: Cotton, Incorporated.
- Evaluation of Nitrogen Fertility in Arizona Cotton Production Systems. E.R. Norton. Funded by USDA and IPNI.
- Evaluation of Several Fertility and Soil Amendment Treatments. E.R. Norton. Sponsor: AgroDyne Solutions.
- Field Evaluation and Demonstration of Controlled Release N Fertilizers in the Western United States. C.A. Sanchez. Sponsor: California Department of Food and Agriculture.
- Growth Response Potatoes and Growth Response on Specialty Crops. C.A. Sanchez. Sponsor: Heliae Development, LLC.
- Improved Nutrient Management for Arizona Pecans. J.L. Walworth. Sponsor: United States Department of Agriculture/Arizona Department of Agriculture.

- Late Season N Application Method Effect on Grain Protein. M.J. Ottman. Sponsor: Arizona Grain Research and Promotion Council.
- Nickel Nutrition of Arizona Pecans. J.D. Sherman and J.L. Walworth. Sponsor: United States Department of Agriculture/Arizona Department of Agriculture.
- Nitrogen Fertility Evaluations. E.R. Norton. Sponsor: USDA-ARS and IPNI.
- Quantifying Variability in Arizona Pecan Water Use. S.A. Papuga, P.W. Brown and J.L. Walworth. Sponsor: United States Department of Agriculture/Arizona Department of Agriculture.
- Quantitative Assessments of Water and Salt Balance for Cropping Systems in Lower Colorado River Irrigation Districts. S.A. Sanchez. Sponsor: Yuma County Agricultural Water Coalition.
- Quantitative Assessments of Water and Salt Balance for Cropping Systems in Lower Colorado River Irrigation Districts. C.A. Sanchez. Sponsor: Bureau of Reclamation.
- Reclamation of Saline-Sodic Fairway Soils. P.W. Brown and J.L. Walworth. Sponsor: United States Golf Association.
- Spinach Water and Salt Management. C.A. Sanchez. Sponsor: United States Department of Agriculture/Arizona Department of Agriculture.
- Understanding the Water and Salt Balance of Summer Cropping Systems and the Impacts of Fallow Based Water Transfers. C.A. Sanchez. Sponsor: The Walton Family Foundation/Environmental Defense Fund.
- Water and Salt Balance for Durum Wheat Systems. C.A. Sanchez. Sponsor: Arizona Grain Research and Promotion Council.
- Water and Salt Balance for Lettuce Thinning Irrigation. C.A. Sanchez. Sponsor: Arizona Iceberg Lettuce Research Council.

### **California WERA-103 report**

T. K. Hartz, University of California

#### **Significant developments in nutrient management issues**

State regulation of agricultural N use continues to become more stringent. Concern over nitrate loading to groundwater has lead the Regional Water Quality Control Boards in the Central Valley and Central Coast regions (the main agricultural areas) to require annual nitrogen use reporting; individual growers are required to report total nitrogen application (all sources, including fertilizer, organic amendments and nitrate in irrigation water). The Regional Boards will compare N application (A) with the estimated amount of N removed in harvested products (R). The expressed intent on the part of the Regional Boards is to use this information (A-R, or A/R) to rank the efficiency of individual growers. However, lawsuits and political pressure groups continue to challenge the Regional Water Boards to set even stricter reporting requirements, and potentially to set limits on N loading rates. Given the wide assortment of crops produced in California, developing defensible estimates for N removed with harvest will be a significant task. To start that process Dr. Daniel Geisseler of UC Davis produced a literature survey:

([https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Geisseler\\_Report\\_2016\\_12\\_02.pdf](https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Geisseler_Report_2016_12_02.pdf)).

The California Department of Agriculture (CDFA) launched the 'Healthy Soils Initiative' (<https://www.cdfa.ca.gov/oefi/healthysouils/>). This is an effort to incentivize the use of soil building

techniques such as cover cropping, addition of organic amendments, and reduced tillage. The intent behind this initiative is less to safeguard soil resources than it is to advance other governmental goals. California's GHG regulatory scheme is putting pressure on all industries, and agriculture is seen as a segment that may not only be able to reduce their GHG emissions, but may also have a significant potential to sequester carbon in soils. However, a recently published paper (Almaraz et al., 2018, *Sci. Adv.* 4:eao3477) suggested that agricultural NO<sub>x</sub> emissions are significantly higher than previously assumed, complicating this picture. The Healthy Soils Initiative dovetails with another state regulation governing the disposal of urban landscape waste, which can no longer be put in landfills; the initiative is intended to incentivize the agricultural use of urban green waste compost, which has potential implications for nutrient management.

The University of California is comprehensively engaged in nutrient management issues that link crop and animal production methods with air and water quality concerns. A prime example of that engagement is the development and delivery of a nitrogen management training program for Certified Crop Advisors; the CDFA has mandated that CCAs attend this program in order to become certified to sign off on farm management plans required under water quality regulations. To date approximately 800 CCAs have been trained. Another important UC project is the continuing development of CropManage, an on-line decision aid for irrigation and nitrogen fertilizer management (<http://ucanr.edu/blogs/CropManage/>). The program currently covers a range of horticultural crops, including romaine lettuce, iceberg lettuce, broccoli (summer and winter plantings), cauliflower (summer and winter plantings), cabbage (red and green), spinach (baby, teen, bunch), celery, leaf lettuce, baby lettuce, mizuna, peppers and berries (strawberry, raspberry and blackberry). Work continues to add other crops, most notable processing tomato and almond.

### **Ongoing research**

The CDFA Fertilizer Research and Education Program (FREP) continues to be the primary funding source for nutrient management research. Additionally, several commodity groups (most notable the California Almond Board and the California Leafy Green Research Board) continue funding nutrient-related research, primarily regarding environmental stewardship issues. NRCS has funded a group of Central Valley Water Quality Coalitions through a large Conservation Innovation Grant to model N losses to groundwater throughout the Central Valley using the SWAT model developed by Texas A&M and USDA.

### **Conference Proceedings**

25th Annual Fertilizer Research and Education Program Conference Proceedings. California Dept. of Food & Agriculture. Nov. 1-2, 2017. Modesto, CA. 95 pages.

[https://www.cdfa.ca.gov/is/ffldrs/frep/pdfs/2017\\_Proceedings\\_FREP.pdf](https://www.cdfa.ca.gov/is/ffldrs/frep/pdfs/2017_Proceedings_FREP.pdf)

California Plant and Soil Conference, 2017 Conference Proceedings, Jan. 31-Feb. 1, Fresno, CA. 144 pages.

California Chapter American Society of Agronomy. <http://calasa.ucdavis.edu/files/257056.pdf> .

California-based nutrient management web resources

CDFA FREP Database: The California Department of Food & Agriculture's Fertilizer Research and Education Program (FREP) has created a searchable database of its projects funded since its inception in 1990.

<http://www.cdfa.ca.gov/is/frep/default.aspx>.

Additionally, FREP has added additional crop modules to its crop fertilization modules, summarizing crop-specific research on nutrient management. <http://apps.cdfa.ca.gov/frep/docs/Guidelines.html> .

**CCA study guide:**

A study guide for aspirants to the California Certified Crop Advisor program:

[http://www.wrcca.org/files/file\\_gallery/201706\\_CCA\\_study\\_guide\\_master\\_Revised\\_June\\_2017.pdf](http://www.wrcca.org/files/file_gallery/201706_CCA_study_guide_master_Revised_June_2017.pdf)

**A website on nutrient management and water quality issues:**

[http://agwaterstewards.org/index.php/practices/nutrient\\_management](http://agwaterstewards.org/index.php/practices/nutrient_management)

**Powerpoint presentations** and other material developed as part of a UC-led CCA nitrogen training program:

<http://ciwr.ucanr.edu/NitrogenManagement/>

**The UC Agricultural Sustainability Institute** has created the 'Solutions Center', a website developed as a clearinghouse for nutrient management information.

[http://ucanr.edu/sites/Nutrient\\_Management\\_Solutions/stateofscience/Nitrogen\\_management\\_in\\_California\\_agriculture/](http://ucanr.edu/sites/Nutrient_Management_Solutions/stateofscience/Nitrogen_management_in_California_agriculture/)

**Colorado WERA-103 report**

Colorado State University

Troy Bauder and Jim Ippolito

**Projects:**

- Nutrient Reductions in Irrigated Agricultural Watersheds: Intentional Planning, Implementation, and Maintenance; Arabi, M ; Bauder, T ; Hoag, D.
  - Objectives: 1. To understand how the effectiveness of agricultural practices for N and P control varies in combination with their landscape position, physical characteristics of the farm, proximity to perennial streams, irrigation ditches, and other factors; 2. To understand and characterize socioeconomic factors that influence (facilitate or impede) adoption of agricultural conservation practices; and 3. To develop a simple and practical model based on the Soil and Water Assessment Tool (SWAT) for representation of conservation practices at field, irrigation district, and watershed scales and then to identify simple and transparent approaches for incorporating watershed-scale benefits of BMPs into NRCS conservation planning field tools.
- Center for Comprehensive, Optimal and Effective Abatement of Nutrients Water Quality and Nutrient Management BMPs (CLEAN); Mazdak Arabi, Deanna Osmond, Troy Bauder;
  - Objectives: To understand how effectiveness of agricultural BMPs for N and P control varies with the selected practices, their landscape position, physical characteristics of the farm, proximity to perennial streams, irrigation ditches, and other factors; to understand and characterize socioeconomic factors that influence (facilitate or impede) adoption of agricultural BMPs; to develop a simple and practical model based on the SWAT model for representation of BMPs at field, irrigation district, and watershed scales and then identify simple and transparent approaches for incorporating watershed-scale benefits of conservation. [troy.bauder@colostate.edu](mailto:troy.bauder@colostate.edu)
- Improved Assessment of Nitrogen and Phosphorus Fate and Transport for Irrigated Agricultural Watersheds in Semiarid Regions; Mazdak Arabi, Ryan Bailey, and Timothy Gates

- Objectives: The overarching goal of the proposed project is to improve the modeling capacity to analyze the movement, transformation, and storage of N and P species in highly managed irrigated agricultural systems, particularly in areas susceptible to severe drought events. Contact: [Mazdak.Arabi@ColoState.Edu](mailto:Mazdak.Arabi@ColoState.Edu)
- Recovery of High Value Soil Amendment Products from Anaerobically Digested Cattle Manure; Sharvelle, S.
  - Objectives: Evaluate the potential to form high value soil amendment co-products from the MSAD system. Funds received from AES will be applied to evaluate the potential to form a cow peat product, assess the value of that product and also evaluate the potential to recycle nutrients from liquid leachate. Contact: [Sybil.Sharvelle@ColoState.Edu](mailto:Sybil.Sharvelle@ColoState.Edu)
- Plant Mediation of Nitrogen Mineralization via Shifts in Rhizosphere Carbon Allocation; Schipanski, M.
  - Objectives: Quantify the influence of cover crops on the carbon (C) allocation in succeeding cash crops, nitrogen (N) mineralization, and cash crop productivity. Contact: [Meagan.Schipanski@ColoState.Edu](mailto:Meagan.Schipanski@ColoState.Edu)
- Canola root trait effects on nitrogen acquisition and productivity; Schipanski, M.
  - Objectives: Identifying and integrating key belowground traits in canola that favor nitrogen acquisition from diverse sources to improve nitrogen use efficiency and soil health. Research includes greenhouse studies to evaluate root allocation, microbial activity, and nitrogen uptake of canola genotypes with different levels of organic matter and N-15 labeled fertilizer additions. Contact: [Meagan.Schipanski@ColoState.Edu](mailto:Meagan.Schipanski@ColoState.Edu)
- Precision Nutrient and Water Management across Spatial Variable Landscapes for Enhancing Nutrient and Water Use Efficiencies, Farm Profitability and Environment Sustainability; Khosla, R.; Reich, R. M.; Longchamps, L.
  - Objectives: 1. Quantify spatial and temporal variability in soils for delineating water management zones via precision irrigation systems to enhance and/or maintain grain production, while conserving soil and water and improving water-use-efficiency. 2. Quantify spatial and temporal variability in crop canopies, utilizing a suite of active sensor devices (i.e., reflectance, ultrasonic, fluorescence, moisture sensors, etc.) for in-season precision nutrient (nitrogen) management. 3. Make agronomic and economic comparisons in terms of grain production, water and nutrient use efficiencies, conventional practice of uniform application of water and nutrients. Contact: [raj.khosla@colostate.edu](mailto:raj.khosla@colostate.edu).
- Soil-based Use of Residuals, Wastewater and Reclaimed Water; Ippolito, J.A.; Borch, T.
  - Objectives: 1. Evaluate the short- and long-term chemistry and bioavailability of inorganic trace elements, organic micro-constituents and nutrients in residuals, reuse water and amended soil in order to assess the environmental and health risk-based effects of their application to uncontaminated soil. 2. Evaluate the agronomic and environmental benefits/advantages of land applying residual by-products and/or substituting such materials as fertilizers. 3. Evaluate residual land application benefits in terms of their potential to improve soil quality/soil health. Contact: [jim.ippolito@colostate.edu](mailto:jim.ippolito@colostate.edu)
- Yield and Water Quality as Affected by Conservation Tillage and Nutrient Management Under Furrow Irrigation; Troy Bauder, Erik Wardle and Neil Hansen
  - Objectives: 1) Compare cropping inputs, fertilization requirements, weed control, labor, and equipment costs between conventional, no-till and strip-tillage systems under furrow irrigation. 2)



Evaluate water quality (N, P, and sediment loads) in runoff between conservation systems. Contact: [troy.bauder@colostate.edu](mailto:troy.bauder@colostate.edu).

## Publications:

- A.L. Cowie, J. Novak, J.A. Ippolito, and N. Borchard. 2017. Biochar research activities and their relation to development and environmental quality. A meta-analysis. *Agron. Sustain. Dev.* 37:22.
- Barbarick, K.A., J.A. Ippolito, and J. McDaniel. 2017. Meta-analysis of biosolids effect in dryland wheat agroecosystems. *J. Environ. Qual.* 46:452-460.
- Barbarick, K.A., J.M. McDaniel, and J.A. Ippolito. 2017. Application of anaerobically digested biosolids effects soil phosphorus levels. *Colorado Ag. Exp. Sta. TR17-3.*
- Dungan, R., A. Leytem, J. Ippolito, and D. Tarkalson. 2017. Greenhouse gas emissions from an irrigated dairy forage rotation as influenced by fertilizer and manure applications. *Soil Sci. Soc. Am. J.* doi:10.2136/sssaj2016.08.0254.
- Ippolito, J.A., D.L. Bjerneberg, D.E. Stott, and D.L. Karlen. 2017. Soil quality improvement through conversion to sprinkler irrigation. *Soil Sci. Soc. Am. J.* 81:1505-1516.
- Ippolito, J.A., K.A. Barbarick, and K. Diaz. 2017. Biosolids application to no-till dryland rotations: 2016 results. *Colorado Ag. Exp. Sta. TR17-8.*
- Khosla, R. and L. Longchamps. Precision Maize cultivation. In. *Achieving sustainable cultivation of maize Vol 2: Cultivation techniques, pest and disease control.* D. Watson (ed) In press
- Kleinman, P.J.A., A. R. Buda, A. N. Sharpley and R. Khosla. Elements of Precision Manure Management. In *Precision Conservation.* J. Delgado (ed) doi:10.2134/agronmonogr59.2013.0023.
- Laird, D.A., J.M. Novak, H.P. Collins, J.A. Ippolito, D.L. Karlen, R.D. Lentz, K.R. Sistani, K. Spokas, and R.S. Van Pelt. 2017. Multi-year and multi-location soil quality and crop biomass yield responses to hardwood fast pyrolysis biochar. *Geoderma.* 289:46-53.
- Qiang Cao, Y. Miao, G Feng, X. Gao, B. Liua, Y. Liu, F. Lie, R. Khosla, D. J. Mulla, F. Zhang. 2017. Improving nitrogen use efficiency with minimal environmental risks using an active canopy sensor in a wheat-maize cropping system. *Field Crops Research* 214 (2017) 365–372
- Rosenzweig, S., M.E. Schipanski, J.P. Kaye. 2017. Rhizosphere priming and plant-mediated cover crop decomposition. *Plant and Soil* 417: 127-139.
- Seigfried, J, R. Khosla, and L. Longchamps. Infrared thermometry to quantify in-field soil moisture variability. *J. of Crop Improvement* Vol. 31 (1) 2017 Society of Agronomy Communications Outreach.
- Zohar, I., Litaor, M.I., J.A. Ippolito, and M. Massey. 2017. Innovative approach for agro-wastewater phosphorus removal using water treatment residuals. *Chemosphere.* 168:234-243.

## HAWAII WERA-103 report

University of Hawaii, Jonathan L. Deenik

Dr. Nicholas Comerford Dean (July 2017)

Dr. Jinzeng yang (Animal science) Interim Associate Dean and Director of Research

Dr. Ania Wieczorek (tropical Plant and Soil Soil sciences) Interim Associate Dean for Academic Affairs

Kelvin Sewake (Plant Pathology, extension agent) Interim Associate Dean for Extension

## **Research Update**

Center for Rural Agricultural Training and Entrepreneurship (CRATE) – Dr. K H. Wang, Assistant Researcher in the Department of Plant and Environmental Protection Sciences, leads an interdisciplinary team of researchers and extension agents in a training program designed to address sustainable agriculture for small-scale growers and gardeners in Hawaii.

(<https://cms.ctahr.hawaii.edu/wangkh/ResearchandExtension/CRATE.aspx>)

Sustainable and Organic Agriculture Program (SOAP) – Dr. Radovich leads a training program in organic agriculture designed to address small-scale organic farming in Hawaii. Across Hawaii, farmers and ranchers are experimenting with different ways of producing agricultural products, novel approaches which aspire to bring social, economic and environmental well-being to both farm families and to the rural communities in which they live. This type of agriculture simultaneously focuses on three equally important challenges: 1) To provide a more profitable farm income; 2) To promote environmental stewardship; and 3) To promote stable, prosperous farm families and communities. (<https://cms.ctahr.hawaii.edu/soap/Home.aspx>)

Web-based Agricultural/Ecological Decision Support System – Dr. Deenik continues to work with Dr. Miura (GIS and remote sensing professor in Department of Natural Resources and environmental Management). Current work is focused on adding crops to the HI-CROP Web Mapper, a GIS-based software to display crop suitability maps for the Hawaiian Islands in the current climate regime and climate 50-100 years in the future. (<http://gis.ctahr.hawaii.edu/CropSuitability>)

Breadfruit – Dr. Lincoln has embarked on an ambitious project to characterize environmental (climate, soil type) effects on breadfruit growth, yield, and fruit quality across its range of environments in Hawaii. The study combines greenhouse experiments, field trials, and citizen science approaches with numerous breadfruit growers across the state.

Macadamia – Dr. Cho conducts research on various aspects of macadamia and papaya production systems on Hawaii Island.

CropManage Hawaii – Drs Deenik and Bateni continue to collaborate with Dr. Cahn (UC Davis) to adapt the CropManage online irrigation scheduling decision support tool to Hawaii, Guam and American Samoa vegetable crop lands. Project activities include field measurements of canopy cover and root depth used to develop models for crop canopy growth (estimate of crop coefficients, Kc) and root growth.

Soil Health – Drs Crow and Deenik successfully secure funding for a NIFA project entitled “Putting the farmer in the Driver’s seat: integrative web tool for improved soil health and carbon assessment, monitoring and planning.” The project will empower farmers to improve soil health and promote carbon sequestration by synthesizing prior soil health and C sequestration data to derive principles that will form the basis for an individualized recommendation tool that meets the diverse needs of farmers, land owners, and managers in Hawaii.

The Hawaiian Soil Microbiome – This is a developing project where Dr. Nguyen aims to understand the composition of microbes (and beyond) that live in the diverse soils across the Hawaiian Islands in both managed and natural systems. The project (combined with other ongoing research activities) will contribute the underlying data for the concept of the Hawaiian Soil Microbiome. Starting with a collaboration with Dr. Deenik, we are looking at the soil microbial contributions to nitrogen mineralization across the diversity of Hawaiian soils.

## **Publications**

### Journal Publications

Gangaiah, C., A. Ahmad, N.V. Hue, K.H. Wang, and T.J.K. Radovich. 2017. Evaluating three invasive algal species as local sources of potassium for Pak Choi (*Brassica rapa Chinensis* group) growth. 2017. *HortScience* 52(3):436-440.

Leslie, A.W., K.H. Wang, S.L. Meyer, S. Marahatta, and C.R. Hooks. 2017. Influence of cover crops on arthropods, free-living nematodes, and yield in a succeeding no-till soybean crop. *Applied Soil Ecology* 117-118:21-31.

Marshall, K., C. Kosef, A.L. Roberts, A. Lindsey, A. Kagawa-Viviani, N.K. Lincoln, and P. Vitousek. 2017. Restoring people and productivity to Puanui: challenges and opportunities in the restoration of an intensive rain-fed Hawaiian field system. *Ecology and Society* 22(2):23

Yu, J., L. Deem, S.E. Crow, J.L. Deenik, and C.R. Penton. 2018. Biochar application influences microbial assemblage complexity and composition due to soil and bioenergy crop type interactions, soil biology and biochemistry 117:97-107.

### Extension Publications

Deenik, J.L. and L. Duponcheel. 2017. *Soils and Agriculture of Tinian*. Cooperative Extension Service Publication, CTAHR, SCM-34.

Love, K., R.E. Paull, A. Cho, and A. Kawabata. 2017 *Tropical fruit propagation guide*. University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources. Fruit, Nut, and Beverage Crops, March 2017, F\_N49.

Reppun, F., J.H.S. Silva, K. Wong, and J.L. Deenik. 2017. *A Soil Phosphorus Primer for Hawaiian Soils*. Cooperative Extension Service Publication, CTAHR, SCM-33, pp. 5.

## IDAHO WERA-103 report

Olga Walsh, University of Idaho and David Tarkalson, USDA-ARS

### Ongoing Research:

- Optimizing Water and Nitrogen Use for Sustainable Wheat Production. Walsh O.S. and X. Liang, in collaboration with J.A. Torrion (MSU)
- Water and Soil Conservation and Effective Weed Management for Sustainable Dry Bean and Garden Bean Production. Walsh O.S., D. Morishita, and H. Neibling.
- Precision Sensing for Improved Wheat Production. Walsh O.S. and J. Marshall
- Potential of Silica Amendments for Improved Wheat Production. Walsh O.S. with MontanaGrow
- Evaluation of Micronutrients in Winter Wheat. Walsh O.S. with the Mosaic Company
- Alfalfa Fertility Trial. Walsh O.S. with the Mosaic Company
- Evaluation of NZoneMax in Corn, Beans, and Peas. Walsh O.S. with the AgXplore International
- Evaluation of Cover Crops for Improved Soil Health in Silage Corn Cropping System in Idaho. Walsh O.S. with the J.R. Simplot Company

Current projects lead by Dr. Tarkalson:

#### 1) Manure-amended soils

- Fate of N, C, and other nutrients in percolation waters of manured soils
- Influence of soil inorganic N availability on N mineralization in manured soils

#### 2) Biochar and/or Manure amended soils

- Long-term effects of biochar and other carbon amendments on soil properties, nutrient availability, leaching

#### 3) Deficient Irrigation Effects on soil N availability

#### 4) Long-term effects of PAM hydrogel soil amendments on nutrient availability and leaching losses

#### 5) Changes in groundwater quality and agriculture in 40 years on the Twin Falls Irrigation tract

### *Soil Fertility and Nutrient Cycling*

- Curl, C, M. Morra, J. Marshall, G. Shewmaker, and C.W. Rogers. Bromide uptake in crops following soil fumigation with methyl bromide for PCN eradication.
- Liang, X, A. Rashed, J. Marshall, C.W. Rogers. Barley yellow dwarf virus effects on wheat water and nitrogen use efficiency
- Neibling, H., C.W. Rogers, J. M. Marshall. Demonstration of water, power, and disease benefits of LESA center pivot irrigation.
- Rogers, C.W., J.M. Marshall, K. Schroeder. Evaluation of soil test methods for determining nitrogen fertilizer recommendations in barley producing soils.

- Rogers, C.W., X. Liang. All-malt barley: Nitrogen and cultivar management strategies for Idaho growers
- Rashed, A., J.M. Marshall, C.W. Rogers, X. Liang. A survey of central and eastern Idaho wireworm species and evaluating ecological and chemical approaches to maximize cereal production.

## **Publications:**

### Research

- Walsh O.S., S. Shafian, and R.J. Christiaens. 2018. Evaluation of Sensor-Based Nitrogen Rates and Sources in Wheat. *International Journal of Agronomy*. doi:10.1155/2018/5670479.
- Walsh O.S., S. Shafian, and R. J. Christiaens. 2017. Nitrogen Fertilizer Management in Dryland Wheat Cropping Systems. *Plants*. Special Issue. 7(1), 9.
- Samborski S. M., D. Gozdowski, O. S. Walsh, P. Kyveryga, and M. Stępień. 2017. Sensitivity of Sensor Based Nitrogen Rates to Selection of Within-Field Calibration Strips in Winter Wheat. *Crop and Pasture Science*. 68(2):101-114.
- Rashed, A., C.W. Rogers, M. Rashidi, and J. Marshall. 2017. Sugar beet wireworm damage to wheat and barley planted in different soil media and seeding depths, in a choice experiment setup. *Arthropod-Plant Interactions*. 11:147-154.
- Rogers, C.W., T.L. Roberts, and R.J. Norman. 2017. Evaluation of ammonia recovery from a laboratory static diffusion chamber system. *Comm. Soil Sci. Plant Anal*. 48:326-331.
- Rogers, C.W., G. Hu., R. Mikkelsen. 2017. Grain yield, quality, and nutrient concentrations of feed, food, and malt barley. *Comm. Soil Sci. Plant Anal*. 48:2678-2686.
- Lehrs, G.A., B. Brown, R.D. Lentz, J. Johnson-Maynard, and A.B. Leytem. 2017. Winter wheat yield, quality, and nitrogen recovery following compost- or manure-fertilized sugarbeet. *Comm. Soil Sci. Plant Anal*. 1:124-138.
- Laird, D.L., J.M. Novak, H.P. Collins, J.A. Ippolito, D.L. Karlen, R.D. Lentz, K. Sistani, K. Spokas, R.S. van Pelt. 2016. Multi-year and multi-location soil quality and crop biomass yield responses to hardwood fast pyrolysis biochar. *Geoderma* 289:46-53.

### Extension publications

- Walsh O.S., D. Tarkalson, A. Moore, G. Dean, D. Elison, J. Stark, O. Neher, and B. Brown. 2017. Southern Idaho Fertilizer Guide: Sugar Beets. Bulletin 915. University of Idaho.
- Walsh O.S., Kathleen M. Painter, Jordan R. McClintick-Chess, and Steven M. Blanscet. 2017. A Grower's Guide to Successful On-Farm Research. Bulletin 914. University of Idaho.
- Walsh, O.S., R. Mahler, and T. Tindall. 2017. Soil Sampling. Bulletin 913. University of Idaho.

- Neibling, H, C.W. Rogers, Z. Quereshi. 2017. Scheduling the final irrigation for wheat and barley. University of Idaho Extension. Moscow, ID. Bul. #912.
- Tarkalson, D.D., Bjorneberg, D.L., Camp, S., Dean, G., Elison, D., and Foote. 2017. Static Nitrogen Management. Amalgamated Sugar Company and USDA-ARS Sugar Guide December 2017.

#### Editor Reviewed Publications and Reports:

- Ondoua R. N. and O.S. Walsh. 2017. Varietal Differences in Nitrogen Use Efficiency among Spring Wheat Varieties in Montana. *Crops & Soils*. 50(5). pp.40-42.
- Ondoua R. N. and O.S. Walsh. 2017. Precision Agriculture, Advances, and Limitations: Lessons to the Stakeholders. *Crops & Soils*. 50(3). pp.40-47.
- Ondoua R. N., O.S. Walsh, and K. Desta. 2017. Grazing and Organic Amendments Enhance Growth and Development of Biennial Winter Canola. *Crops & Soils* 50(2). pp. 32-34.

#### Newsletters:

- Walsh O.S. Idaho Crops & Soils News. Quarterly Newsletter. January 2015 – current

#### Proceedings and Abstracts

- Walsh O.S., J. R. McClintick-Chess, and S.M. Blanscet. Rate and Application Time of Plant Available Silicon on Winter Wheat Yield and Quality. 2017. *Proc. of the 7<sup>th</sup> International Conference on Silicon in Agriculture*.
- Walsh O.S., S. Shafian, J.R. McClintick-Chess, and S. Blanscet. A Comparison of Machine Learning Techniques Applied to UAV Data for Nitrogen Content Estimation. 2017. *Proc. of the ASA International Annual meetings*.
- Walsh O.S., J. R. McClintick-Chess, and S.M. Blanscet. Rate and Application Time of Plant Available Silicon on Winter Wheat Yield and Quality. 2017. *Proc. of the ASA International Annual meetings*.
- Walsh O.S., D. Morishita, A. Woolf-Weibey, J. R. McClintick-Chess, and S.M. Blanscet. Irrigation Water Amount and Delivery Method Effect on Garden Bean Production under Conventional and Strip Tillage Systems. 2017. *Proc. of the ASA International Annual meetings*.
- Stanislaw Marek Samborski, Dariusz Gozdowski, Olga Walsh, Michał Stępień and Elżbieta Bodecka. Improving Optical Sensor Calibration for Winter Wheat Nitrogen Management in on-Farm Conditions. 2017. *Proc. of the ASA International Annual meetings*.
- Liang Xi, Walsh O.S., O'Brien K., and J. Torrion. Response of Spring Wheat to Varied Nitrogen and Water Applications. 2017. *Proc. of the ASA International Annual meetings*.

- Abi-Ghanem R., Bryla D., Walsh O.S., and L. Celi. Response of Spring Wheat to Varied Nitrogen and Water Applications. 2017. *Proc. of the ASA International Annual meetings.*
- Walsh O.S., D. Morishita, A. Woolf-Weibey, J. R. McClintick-Chess, and S.M. Blanscet. Irrigation Water Amount and Delivery Method Effect on Garden Bean Production under Conventional and Strip Tillage Systems. 2017. *Proc. of the Agrophysics Trends Conference.*
- Walsh O.S., Jessica A. Torrion, Xi Liang, Jordan R. McClintick, Steven M. Blanscet. Response of Spring Wheat to Varied Nitrogen and Water Applications. 2017. *Proc. of the Agrophysics Trends Conference.*
- Walsh O.S., J. Marshall, C. Jackson, J.R. McClintick-Chess, S.M. Blanscet, C. Thompson, and K. Swoboda. Precision sensing for improved wheat production. 2017. *Proc. of the Agrophysics Trends Conference.*
- Walsh O.S., D. Morishita, A. Woolf-Weibey, J. R. McClintick-Chess, and S.M. Blanscet. 2017. Irrigation Water Amount and Delivery Method Effect on Garden Bean Production under Conventional and Strip Tillage Systems. *Proc. of the Western Crop Science Society Conference.*
- Walsh O.S., J. R. McClintick-Chess, and S.M. Blanscet. 2017. Rate and Application Time of Plant Available Silicon on Winter Wheat Yield and Quality. *Proc. of the Western Crop Science Society Conference.*
- Walsh O.S., J. Marshall, J. McClintick-Chess, S. Blanscet, C. Jackson. 2017. Precision Sensing for Improved Wheat Production. *Proc. Western Nutrient Management Conference.*
- Walsh O.S., J. McClintick-Chess, S. Blanscet. 2017. Plant Available Silicon Application in Winter Wheat. *Proc. Western Nutrient Management Conference.*
- Walsh O.S., J. Torrion, X. Liang, J. McClintick, S. Blanscet. 2017. Response of Spring Wheat to Varied Nitrogen and Water Applications. *Proc. Western Nutrient Management Conference.*

#### Popular Press/Magazines:

- Rogers S.W., B. Dari, and O.S. Walsh. 2017. Managing Fertilizer Nitrogen Applications for Spring Barley and Wheat. Idaho Grain Magazine. Winter 2017. pp. 31-32.
- Ondoua R. N., O.S. Walsh, K. Desta, and S. Fransen. 2017. Grazing and Organic Amendments Enhance Growth and Development of Biennial Winter Canola. CSA News Magazine. pp. 116-121.
- Marshall J., K. Schroeder, and O.S. Walsh. 2017. 2016 Idaho Spring Wheat Variety Performance Tests and 2014-2016 Yield Summaries. Idaho Grain Magazine. Spring 2017. pp. 33-35.
- Marshall J., K. Schroeder, and O.S. Walsh. 2017. 2016 Idaho Spring Barley Variety Performance Tests and 2014-2016 Yield Summaries. Idaho Grain Magazine. Spring 2017. pp. 36-37.
- Marshall J., K. Schroeder, and O.S. Walsh. 2017. 2015-2016 Idaho Winter Wheat Variety Performance Tests and 2014-2016 Yield Summaries. Idaho Grain Magazine. Fall 2017. pp. 29-31.

- Schroeder, K., C.W. Rogers, C. Senefsky. 2017. Customizing nitrogen fertilizer and seeding rates in soft white winter wheat. (ASA-CSSA-SSSA Annual Meeting, Tampa Bay, FL).
- Rogers, C.W. and G. Loomis. 2017. Fertilizer nitrogen recovery of spring barley. (ASA-CSSA-SSSA Annual Meeting, Tampa Bay, FL).
- Curl, C., J. Marshall, M. Moll, M. Morra, J. Porter, C.W. Rogers, and G. Shewmaker. 2017. Assessment of inorganic bromide concentrations in crops following soil fumigation with methyl bromide. (International Society of Exposure Sciences Annual Meeting. Raleigh, NC).
- Rogers, C.W. 2017. All-malt barley: Sustainable nitrogen, cultivar, and water management strategies. (Brewers Association: Craft Brewers Conference. Washington, DC)
- Rogers, C.W. 2017. Evaluation of soil tests for potentially mineralizable soil nitrogen in Snake River Plain Soils in Idaho. (WERA-103, Reno, NV)

### **MINNESOTA WERA-103 report**

University of Minnesota

Fabián G. Fernández

### **Extension / Outreach Activities**

#### **Summary of primary Extension activities**

- Planned and organized two conferences “Nitrogen: Minnesota's Grand Challenge and Compelling Opportunity” and the “Nutrient Management Conference” two one-day events that provided 16 CEUs to more than 400 attendees.
- Participated as a member of the planning committee of two important Univ. of MN Extension programs: the Crops and Pest Management Short Course and the Field School for Ag Professionals.
- Presented research findings to approximately 1,945 attendees in 20 different events, including presentations in a webinar (no information on number of participants).
- I authored or co-authored 11 Minnesota Crop News posts (three with related video presentations; a new in which we are trying to reach our clientele) to discuss important issues that developed during the growing season.
- Participated in four podcasts (new way in which we are trying to reach our clientele).
- Provided teaching materials, reviewed and video-recorded presentations, and participated in one of the face-to-face meetings for the program “Nitrogen Smart” intended to provide foundational knowledge on nitrogen management to farmers.
- Published one article in the Crops and Soils Magazine of the American Society of Agronomy to extend the content of a peer-reviewed journal article to approximately 14,000 professional practitioners and Certified Crop Advisers (CCAs).



- I provided training to extension educators during some of the weekly Minnesota Crops Calls and on one-on-one conversations.
- Provided information on nutrient management for crop production to clientele through personal communications in more than 30 instances and in 18 articles or interviews with media outlets.
- Participated in three committees (Minnesota Department of Agriculture and Private Industry) as advisor on nitrogen related issues.
- Contributed content to the nutrient management website
- Total funds received in 2017 or prior supporting 2017 applied research: \$4,062,526 [1,317,514 to Fernández]

### **One showcase activity done in 2017**

Historically in Minnesota, anhydrous ammonia was the primary source of nitrogen used by farmers. In recent years, urea has become the primary nitrogen source due to market pressures, safety, and regulations. While urea can be an excellent source of nitrogen when applied close to planting time, this source is not as reliable for fall applications as anhydrous ammonia because it has greater potential for nitrification, and eventually, loss to the environment if soil conditions are right. Our current Best Management Practices (BMPs) for southcentral Minnesota do not include urea as an acceptable source for fall applications, but it is acceptable for southwestern, west-central, and northwestern Minnesota. The reason for this difference is that in southcentral Minnesota, due primarily to more precipitation in the spring, the potential for nitrogen loss is greater than in the other parts of the state. Several large coops that serve southcentral Minnesota have recently stop supplying anhydrous ammonia (an acceptable source for fall application), but continue to provide nitrogen for fall applications, now using urea. This is very concerning because of the potential for nitrogen loss and the fact that this switch in the supply comes at a time when regulations are being drafted (and scrutiny intensifying) for fall nitrogen applications. In addition, for the other regions of the state where fall urea is acceptable, I have been receiving reports that fall urea applications have not been as effective in the last several years. This is likely due to a consistent trend for wetter springs. Based on these needs, I developed a plan to understand and address this issue and I was successful in securing funds to establish a research project across the state evaluating urea and urea enhancers comparing timing of application and placement method. I have been deliberate in targeting extension-education efforts using the data collected (and being collected) to address the dos and don'ts of urea application. These efforts are rising awareness and providing research-based information to allow farmers and crop advisors make informed decisions. I have talked about the findings in winter meetings, field days, and blogs and podcasts. If warranted, once I have sufficient data from these studies, I will work with other nutrient management specialists to revise our current BMPs to reflect current findings.

### **Product Development**

*Author Contribution Legend:*

*† Principal author*

*‡ Secondary author*

*= Authors are equal in status*

+ Jointly authored with graduate students or post-doctoral fellows

Number preceding reference indicate placement in the continuum of the complete CV

### **Non-Refereed Articles in Scientific Society Popular Press**

- 7) †**Fernández**, F.G., R.T. Venterea, and K.P. Fabrizzi. 2017. Splitting nitrogen applications reduced nitrous oxide emissions. *Crops and Soils Magazine of the Am. Soc. Agron.* 50(2): 53.

### **Non-Refereed Extension Articles**

- 117) =Kaiser, D.E., P. Pagliari, and F.G. **Fernández**. 2017. 5 Best practices for late fall fertilizer management. In: *Minnesota Crop News*. Posted on 7 December 2017. <http://blog-crop-news.extension.umn.edu/2017/12/5-best-practices-for-late-fall.html>
- 116) †**Fernández**, F.G. 2017. VIDEO: Taking the basal stalk nitrate test. In: *Minnesota Crop News*. Posted on 27 October 2017. <http://blog-crop-news.extension.umn.edu/2017/10/video-taking-basal-stalk-nitrate-test.html>  
*Note: Includes video presentation.*
- 115) †**Fernández**, F.G. 2017. Everything you need to know before applying nitrogen this fall. In: *Minnesota Crop News*. Posted on 8 September 2017. <http://blog-crop-news.extension.umn.edu/2017/09/everything-you-need-to-know-before.html>
- 114) =**Fernández**, F.G., and P. Pagliari. 2017. What the research says about post-tassel nitrogen applications. In: *Minnesota Crop News*. Posted on 11 August 2017. <http://blog-crop-news.extension.umn.edu/2017/08/what-research-says-about-post-tassel.html>
- 113) =Kaiser, D.E., and F.G. **Fernández**. 2017. The PSNT from field to lab: How to ensure accurate results. In: *Minnesota Crop News*. Posted on 28 June 2017. <http://blog-crop-news.extension.umn.edu/2017/06/the-psnt-from-field-to-lab-how-to.html>  
*Note: Includes video presentation.*
- 112) =Klinger, G. F.G. **Fernández**, and D.E. Kaiser. 2017. The Supplemental Nitrogen Worksheet for Corn: a tool to help you with in-season nitrogen management decisions. In: *Minnesota Crop News*. Posted on 21 June 2017. <http://blog-crop-news.extension.umn.edu/2017/06/the-supplemental-nitrogen-worksheet-for.html>
- 111) †**Fernández**, F.G., and D.E. Kaiser. 2017. Tips for accurate pre-sidedress nitrate tests. In: *Minnesota Crop News*. Posted on 15 June 2017. <http://blog-crop-news.extension.umn.edu/2017/06/tips-for-accurate-pre-sidedress-nitrate.html>  
*Note: Includes video presentation.*
- 110) =Klinger, G. F.G. **Fernández**, and D.E. Kaiser. 2017. Wet spring weather and nitrogen loss: What has happened to my pre-plant nitrogen? In: *Minnesota Crop News*. Posted on 31 May 2017.

<http://blog-crop-news.extension.umn.edu/2017/06/wet-spring-weather-and-nitrogen-loss.html>

- 109) ‡Kaiser, D.E., and F.G. **Fernández**. 2017. Sulfur, potassium and boron: Scouting for common nutrient deficiencies in alfalfa. In: Minnesota Crop News. Posted on 31 May 2017. <http://blog-crop-news.extension.umn.edu/2017/05/sulfur-potassium-and-boron-scouting-for.html>
- 108) =Kaiser, D.E., and F.G. **Fernández**. 2017. 4 key nutrient deficiencies to scout for early in the season. In: Minnesota Crop News. Posted on 23 May 2017. <http://blog-crop-news.extension.umn.edu/2017/05/4-key-nutrient-deficiencies-to-scout.html>
- 107) †**Fernández**, F.G. 2017. Two conferences dedicated to soil fertility for crop production and environmental stewardship. In: Minnesota Crop News. Posted on 3 January 2017. <http://blog-crop-news.extension.umn.edu/2017/01/two-conferences-dedicated-to-soil.html>

### **Podcasts Episodes for University of Minnesota Extension Programs**

- 4) = **Fernández**, F.G., D.E. Kaiser, J. Vetsch, and B. Carlson. 2017. Urea and anhydrous ammonia for fall applications. University of Minnesota Extension Nutrient Management Podcast, St Paul, MN. 13 December 2017.
- 3) = Wilson, M., D.E. Kaiser, F.G. **Fernández**, and P. Pagliari. 2017. Manure nutrient management. University of Minnesota Extension Nutrient Management Podcast, St Paul, MN. 23 October 2017.
- 2) = **Fernández**, F.G., D.E. Kaiser, and J. Vetsch. 2017. Nitrogen management for fall. University of Minnesota Extension Nutrient Management Podcast, St Paul, MN. 21 September 2017.
- 1) =Kaiser, D.E., and F.G. **Fernández**. 2017. How to manage late nitrogen applications. University of Minnesota Extension Nutrient Management Podcast, St Paul, MN. 14 August 2017.

### **Extension Educator Training**

- 9) Participated in several weekly Minnesota Crop Calls during the growing season to discuss emerging issues and train educators on how to address them.

### **Program Delivery Events**

#### **Organized educational events and conferences**

- 6) Nitrogen: Minnesota's Grand Challenge and Compelling Opportunity 3<sup>rd</sup> Annual Conference. Mankato, MN. 16 February 2017. (207 attendees).

- 5) 9<sup>th</sup> Annual Minnesota Crop Nutrient Management Conference. St Cloud, MN. 7 February 2017. (Co-organizer with MAWRC: Warren Formo and Jerome Lensing). (175 attendees).

### **Invited Oral Extension Presentations**

#### ***International***

- 11) †**Fernández**, F.G. 2017. Understanding nitrogen enhancers and stabilizers. 2017 Agronomy Research Update. Saskatoon, Saskatchewan, Canada. 12 December 2017.

#### ***National/Regional***

- 20) †**Fernández**, F.G. 2017. Making nutrient placement in conservation tillage work for you. South Dakota Agronomy Conference, Sioux Falls, SD. 13 December 2017.
- 19) †**Fernández**, F.G. 2017. Where should I place P and K in no-till and strip-till systems? No-Till Farmer Webinar Series. 6 July 2017. Webinar.
- 18) †**Fernández**, F.G. 2017. The role of soil nitrogen testing in precision agriculture. Agvise Seminars, Granite Falls, MN; Watertown, SD; and Grand Forks, ND. 10-12 January 2017.

#### ***State/Local***

- 57) †**Fernández**, F.G. 2017. Minnesota nitrogen BMPs. Stern's Co. Soil and Water Conservation District Fall 2017 CCA Update, Paynesville, MN. 8 September 2017. (39 attendees).
- 56) †**Fernández**, F.G. 2017. Development of nitrogen guidelines for irrigated and non-irrigated corn. Central Lakes College Ag and Energy Center Field Day, Staples, MN. 25 August 2017. (25 attendees).
- 55) †**Fernández**, F.G., and N.R. Ricks. 2017. Impact of cover crops and living mulch on nitrogen loss. Rosholt Farm Agronomy Day, Westport, MN. 17 August 2017. (105 attendees).
- 54) †**Fernández**, F.G. 2017. Improved productivity with in-season nitrogen management. 9<sup>th</sup> Annual Minnesota Crop Nutrient Management Conference, St Cloud, MN. 7 February 2017. (75 attendees).
- 53) †**Fernández**, F.G. 2017. Improved nitrogen management with new guidelines for irrigated corn. 48th Annual Central Minnesota Irrigator's Clinic and Annual Meeting, Parkers Prairie, MN. 26 January 2017. (81 attendees).

- 52) †**Fernández**, F.G. 2017. Can soil nitrogen testing and canopy sensing improve yield and nitrogen deficiency predictions? Minnesota Ag EXPO, Mankato, MN. 25 January 2017. (75 attendees).

### **Oral Extension Presentations for University of Minnesota Programs**

- 34) †**Fernández**, F.G. 2017. Be a winner send grain, not nitrogen down the Mississippi. 67<sup>th</sup> Annual Institute for Agricultural Professionals Crops and Pest Management Short Course, Minneapolis, MN. 12-14 December 2017. (160 attendees).
- 33) †**Fernández**, F.G. 2017. Roundtable discussion, is it worth split-applying nitrogen? 13<sup>th</sup> Annual Conservation Tillage Conference, Willmar, MN. 5-6 December 2017. (60 attendees).
- 32) †**Fernández**, F.G. 2017. Smart nutrient management with conservation tillage. 13<sup>th</sup> Annual Conservation Tillage Conference, Willmar, MN. 5-6 December 2017. (75 attendees).
- 31) =Carlson, B., D.E. Kaiser, and F.G. **Fernández**. 2017. Fundamentals of nitrogen management. Nitrogen Smart Program, Jordan, MN. 11 September 2017. (5 attendees).
- 30) †+**Fernández**, F.G., J.D. Clark, and J.A. Spackman. 2017. How to manage urea and other forms of nitrogen effectively in south central Minnesota. 2017 Agronomy Field Tour at the Univ. of Minnesota Southern Research and Outreach Center, Waseca, MN. 20 June 2017. (59 attendees).
- 29) †**Fernández**, F.G. 2017. Splitting nitrogen applications: when are they worth your time?. 11<sup>th</sup> Annual Crops Day, Farmington, MN. 15 March 2017. (75 attendees).
- 28) †**Fernández**, F.G. 2017. In-season split nitrogen management and the role of soil testing. 3<sup>rd</sup> Annual Nitrogen: Minnesota's Grand Challenge & Compelling Opportunity Conference, Mankato, MN. 16 February 2017. (101 attendees).
- 27) †**Fernández**, F.G. 2017. Beyond academics: Real-life nitrogen management. Research Updates for Ag Professionals, Crookston, MN. 12 January 2017. (46 attendees).

### **Research Activities**

#### **Refereed Publications (Numbers indicate order in the total list)**

##### ***Published***

- 31) = +Kitchen, N.R., J.F. Shanahan, C.J. Ransom, C.J. Bandura, G.M. Bean, J.J. Camberato, P.R. Carter, J.D. Clark, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, Z. Qing, J.E. Sawyer, and M. Shafer. 2017. A public-industry partnership for enhancing corn nitrogen research and datasets: Project description, methodology, and outcomes. *Agron. J.* 109:2371-2388.

- 30) ‡Sutradhar, A., D.E. Kaiser, and F.G. **Fernández**. 2017. Does total N/S ratio predict N or S requirement for corn? *Soil Sci. Soc. Am. J.*81:564-577.
- 29) †**Fernández**, F.G., K.P. Fabrizzi, and S. Naeve. 2017. Corn and soybean's season-long *in-situ* nitrogen mineralization in drained and undrained soils. *Nutr. Cycl. Agroecosys.* 107: 33–47.

### ***In Review***

- 35) ‡ Bean, G.M., N.R. Kitchen, J.J. Camberato, R.B. Ferguson, F.G. Fernández, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, P.C. Scharf, J.S. Schepers, and J.F. Shanahan. n.d. Active-optical reflectance sensing corn algorithms evaluated for nitrogen fertilizer rate recommendations. *Agron. J.* (In review).
- 34) ‡ Bean, G.M., N.R. Kitchen, J.J. Camberato, R.B. Ferguson, F.G. Fernández, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, P.C. Scharf, J.S. Schepers, and J.F. Shanahan. n.d. Improving an active-optical reflectance sensor algorithm using soil and weather information. *Agron. J.* (In review).
- 33) ‡Yost, M., Veum K., Kitchen N.R., Sawyer J.E., Camberato J.J., Carter P.R., Ferguson R.B., **Fernández** F.G., Franzen D.W., Laboski C.A.M., Nafziger E.D. n.d. Evaluation of the soil health nutrient tool for corn nitrogen recommendations across eight Midwest states. *J. Soil Water Conserv.* (In review).
- 32) Yuan, M., F.G. Fernández, C.M. Pittelkow, K.D. Greer, and D. Schaefer. n.d. Tillage and fertilizer management effects on phosphorus runoff from minimal slope fields. *J. Environ. Qual.* (In review).

### ***In Preparation***

- 37) †+Coronel, E.G., F.G. **Fernández**, and C.A. Alesso. n.d. Corn residue management with nitrogen fertilizer. *Agron. J.* (In preparation).
- 36) †+Paiao, G.D., F.G. **Fernández**, D.E. Kaiser, and S. Weisberg. n.d. Canopy sensing technologies for corn nitrogen management in Minnesota. *Agron. J.* (In preparation).

### **Non-Refereed Publications**

- 15) ‡ Bean, G.M., N.R. Kitchen, J.J. Camberato, R.B. Ferguson, F.G. Fernández, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, P.C. Scharf, J.S. Schepers, and J.F. Shanahan. 2017. Active-optical reflectance sensing evaluated for red and red-edge waveband sensitivity. In: *Proc. of the North Central Extension-Industry Soil Fertility Conference*, Vol. 33. Des Moines, IA. 15-16 November 2017. International Plant Nutrition Institute, Peachtree Corners, GA. p. 121-126.

### **Abstracts**

- 75) †+Ricks, N.R., F.G. **Fernández**, and J.M. Baker. 2017. Can a winter rye cover crop mitigate nitrate leaching on irrigated corn coarse textured soils? ? In: *Proc. of the North Central*

Extension-Industry Soil Fertility Conference, Vol. 33. Des Moines, IA. 15-16 November 2017. International Plant Nutrition Institute, Peachtree Corners, GA. p. 99.

- 74) †+Clark, J., F.G. **Fernández**, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and J. Shanahan. 2017. Do split-nitrogen applications in the Midwest affect corn nitrogen uptake and grain yield? In: Proc. of the North Central Extension-Industry Soil Fertility Conference, Vol. 33. Des Moines, IA. 15-16 November 2017. International Plant Nutrition Institute, Peachtree Corners, GA. p. 145-146.
- 73) ‡ Bean, G.M., N.R. Kitchen, J.J. Camberato, P.R. Carter, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, C.J. Ransom, J.E. Sawyer, P.C. Scharf, and J. Shanahan. 2017. Regional corn nitrogen recommendation models for predicting EONR are improved using hydrologic classification. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 72) ‡Ransom, C., N.R. Kitchen, G.M. Bean, J.J. Camberato, P.R. Carter, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and J. Shanahan. 2017. Fusing corn nitrogen recommendation tools for an improved canopy reflectance sensor performance. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 71) †+Clark, J.D., F.G. **Fernández**, J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and J. Shanahan. 2017. Why the different responses between single and split nitrogen applications? In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 70) ‡Camberato, J.J., M. Shafer, P.R. Carter, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, R.L. Nielsen, J. Shanahan, and J.E. Sawyer. 2017. Soil and environmental factors affecting internal nitrogen efficiency of maize. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 69) †+ Ricks, N.R., F.G. **Fernández**, and J. Baker. 2017. Rye cover crop impact on nitrate leaching on Minnesota coarse-textured soils. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 68) †**Fernández**, F.G., K.P. Fabrizzi, and S. Naeve. 2017. Corn and soybean grain yield with differential soil drainage in Minnesota. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 67) =**Fernández**, F.G., K.P. Fabrizzi, R.T. Venterea, and S. Naeve. 2017. Nitrous oxide emissions in soybean fields with differential drainage in poorly drained soils in Minnesota. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.

- 66) †+Spackman, J.A., F.G. **Fernández**, J.A. Coulter, and D.E. Kaiser. 2017. Tracking soil nitrogen fertility across Minnesota In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 65) †+Clark, J.D., F.G. **Fernández**, and K.S. Veum. 2017. Incorporating soil and weather measurements to improve nitrogen management in the Midwest. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.
- 64) ‡Shanahan, J., N.R. Kitchen, C. Ransom, C. Bandura, G.M. Bean, J.J. Camberato, P.R. Carter, J. Clark, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, C.A.M. Laboski,, E.D. Nafziger, J.E. Sawyer, and M. Schaefer. 2017. Overview of a public-industry partnership for enhancing corn nitrogen research and datasets. In: Annual Meetings Abstracts [CD-ROM]. ASA, CSSA, and SSSA, Madison, WI.

### **Invited Lectures**

†**Fernández**, F.G. 2017. Fertilizer placement for improved productivity and environmental quality. 4R Summit. Minneapolis, MN. 12-13 June 2017.

### **Other Research Activities**

#### ***Non-Refereed Articles in Scientific Society Popular Press***

- 6) †**Fernández**, F.G., R.T. Venterea, and K.P. Fabrizzi. 2017. Splitting nitrogen applications reduced nitrous oxide emissions. *CSA News* 62(2):15.

#### ***Contributed Presentations at Professional Meetings, Conferences, etc.***

- 32) †**Fernández**, F.G. 2017. Nitrogen and water quality research to meet current and future needs. Research Project Progress Report, Minnesota Agricultural Fertilizer Research and Education Council. Waseca, MN. 9 August 2017.
- 31) †**Fernández**, F.G. 2017. In-season fertilization: Can we enhance nitrogen availability through placement techniques. Proposal Session, Minnesota Agricultural Fertilizer Research and Education Council. Eagan, MN. 6 January 2017.

### **Instructional Activities**

#### **Guest lectures**

ESPM2021: Environmental Problem Solving (1 lecture)

Agro4605: Strategies for Agricultural Production and Management (1 lecture)

### **Advising**

#### **Graduate Advisees**

##### ***Current***

Clark, Jason D. Ph.D. Project title: Performance and refinement of nitrogen fertilization tools. May 2014-Present.



Ricks, Natalie R. M.S. Project title: Nitrogen, cover crops and living mulches and their role in corn production and water quality. January 2016-Present.

Spackman, Jared A. M.S. Project title: Nitrogen mineralization under various timings of nitrogen application. May 2014- December 2016 (Expected Graduation). Note: this student will start a Ph. D. degree under my supervision in 2018.

### ***Graduated***

Paiao, Gabriel D. M.S. Project title: Can Active Canopy Sensing Technologies and Soil Nitrogen Content Help Us Improve Corn-Nitrogen Management in Minnesota? May 2014- January 2017. Note: this student will start a Ph. D. degree under my supervision in January 2018.

### **Research Associates and Fellows**

Dr. Fabrizzi, Karina. 2014-Present. (75% FTE)

### **Undergraduate Researchers**

Menegaz, Sonia. Student working as a Junior Laboratory Technician in various projects to obtain research experience. 2017-2018.

Ratgen, Luke. Nitrate in tile-drain water relative to time and source of nitrogen application. 2014-2017.

### ***Employment and training***

I have provided employment and learning opportunities to approximately 10 undergraduate students in my research group during 2017.

### **Examining Committee Assignments**

#### ***Current***

Bohman, Brian. Doctoral preliminary oral exam committee member.

Nigon, Tyler. Doctoral preliminary oral exam committee member.

#### ***Completed***

Arana, Eduardo Daniel (This student graduated from Universidad Nacional de Mar del Plata, Buenos Aires Province, Argentina. I served as external committee member).

### **Service / Outreach**

#### **Research Journal Reviews**

Associate Editor of Division S-4 of the Soil Science Society of America Journal (SSSAJ) and member of the SSSAJ Editorial Board (S302). Appointment January 2015-December 2017. Re-appointed for another 3-yr term (2018-2020).

## **MONTANA WERA-103 report**

Montana State University

Clain Jones

### **ONGOING RESEARCH**

- Nitrate Leaching – **Dr. Stephanie Ewing, Dr. Clain Jones, Dr. Perry Miller and Adam Sigler** attained funding from the Montana Fertilizer Check Off to continue portions of their USDA grant to study effects of best management practices on nitrate leaching in the Judith Basin. Treatments include fallow, pea, and barley. Nitrate leaching rates have been measured at both field scale and watershed scale, on very shallow (<43 cm) and moderately shallow (53-105 cm) soils.
- Cropping Systems – **Drs. Miller and Jones** continue to investigate the effect of previous crop (legumes, brassicas, small grains) and crop rotation on N requirements and availability.
- Deep P application - **Dr. Maryse Bourgault** began investigating the effects of deep P application on winter wheat. There are concerns that nutrient application in no-till systems has led to nutrient stratification with a high concentration at the surface for nutrients that are less mobile, such as phosphorus. Nutrient availability might become limiting when the surface dries out. As such, application of phosphorus deeper in the soil profile might help prevent P deficiency in semi-arid environments.
- Cover crop cocktails – **Dr. Miller, Dr. Jones, and Dr. Zabinski** are continuing to evaluate the effects of mixed cover crops on soil quality and nutrient availability, using herbicide termination. They have found that 6 species grew significantly more biomass than two species mixtures, but 8 species grew no more than 6 or 1 species. **Dr. Darrin Boss and Dr. Bourgault** are also studying mixed cover crops but using mowing or grazing as additional termination strategies. All researchers are specifically investigating the effect of plant functional groups on subsequent yield and soil quality.
- Fertilizer management strategies for enhanced N recovery by crops- **Dr. Engel** is evaluating N placement and fertilizer N source effects on fertilizer N recovery (FNR) by wheat. Research in Montana has shown that FNR by no-till wheat is often greater for nitrate sources of fertilizer N compared to ammonium-based N fertilizer sources, including urea. The response is believed to be due, in part, to microbial immobilization preference for ammonium vs. nitrate. This research seeks to explore whether fertilizer N sources and application timings can be manipulated to provide for the highest recovery fertilizer N by dryland crops in Montana. Fertilizer trials, some ongoing and some completed, have utilized 15N enriched fertilizer sources to trace fertilizer N fate and cycling.
- Micro-nutrients – **Peggy Lamb**, working with The Mosaic Company, is evaluating the effects of micro-nutrient application on spring wheat quality and production. **Drs. Yesuf Mohammed and Chengci Chen** have been studying micronutrient effects on pea yield and micronutrient content. **Dr. Kent McVay** has been investigating micronutrient effects on small grains.

- Cultivar specific response to Zn foliar application. **Dr. Hikmet Budak et al.** are studying spring wheat varietal differences to Zn fertilization on yield, plant height, test weight, kernel weight and grain Zn content, at three locations.
- Soil acidification – **Drs. Engel, Jones and Carr** are investigating the extent of, and mitigation practices for, soil acidification in the Highwood Bench area in Chouteau County that are likely a result of nitrification from ammonium fertilizers. Soil pH levels (upper 7.5 cm) as low as 3.8 have been measured in dryland fields managed under a wheat-based cropping system. On-farm field scale strip trials with four sugar-beet lime application rates are being conducted at three locations in Chouteau County with soil pH < 5. The goal will be to evaluate the efficacy of sugar beet lime to remediate acid affected soils. Field trials are also being conducted at two farms to identify among four crop species (spring wheat, barley, pea and canola) with cultivar susceptible and tolerant selections to low pH and Al toxicity.
- Variety specific-response to N x water levels. **Drs. Torrion, Bob Stougaard, and Luther Talbert** conducted N response study of four soft white (SWSW) and four hard red spring wheat (HRSW) over irrigated and dryland environments.
- Optimization of water and N requirement for cultivar with Gpc-B1 gene (high protein). **Dr. Torrion** investigated yield and protein performance of Egan under four water regimes: rainfed, 50 percent evapotranspiration (50ET), 75ET, and 100ET, and four N treatments: 40, 150, 200, and 250 lbs/acre total N.
- Boron x water regime interaction study. **Drs. Torrion and Emily Meccage** further evaluated impacts of boron with the availability of moisture.
- Relationship between fertility management and malt barley quality – **Jamie Sherman, Pat Carr, and Kent McVay** attained funding from the Montana Fertilizer Advisory Committee to determine the impact of nitrogen and sulfur on the malt quality of three sister lines with the low protein gene and a parent line without the low protein gene tested at four nitrogen and two sulfur levels at the Central Ag. Research Center (CARC; dryland) near Moccasin, the Southern Ag. Research Center (SARC; irrigated) near Huntley, and the Post Farm (dryland) just outside Bozeman.
- Sugarbeets. **Dr. Chen** continues to work on no-till sugarbeet nitrogen and irrigation requirements.

## PUBLICATIONS

### JOURNAL PUBLICATIONS

- Engel R., C. Jones, C.M. Romero, R. Wallander. 2017. Late fall, winter and spring broadcast applications of urea to no-till winter wheat I. Ammonia loss and mitigation by NBPT. Soil Science Society of America Journal 81:322-330. doi:10.2136/sssaj2016.10.0332.
- Huang, J., R. Keshavarz Afshar, and C. Chen. 2017. Efficacy of starter nitrogen fertilizer and Rhizobia inoculants in dry pea production. Soil Science and Plant Nutrition. 63:248-253.  
<http://dx.doi.org/10.1080/00380768.2017.1315834>
- John, A.A., C.A. Jones, S.A. Ewing, W.A. Sigler, A. Bekkerman, and P.R. Miller. 2017. Fallow replacement and nitrogen management for reducing nitrate leaching in a semiarid region. Nutrient Cycling in Agroecosystems. 108:279-296. doi: 10.1007/s10705-017-9855-9.

- Mohammed, Y.A., and C. Chen. 2017. Nutrient requirements of camelina (*Camelina sativa* L. Crantz) for biodiesel feedstock in central Montana. *Agron. J.* 109:309-316. doi:10.2134/agronj2016.03.0163
- Romero, C. M., R. E. Engel, J. D'Andrilli, C. Chen, C. Zabinski, P. R. Miller, R. Wallander. 2017. Bulk optical characterization of dissolved organic matter from semiarid wheat-based cropping systems. *Geoderma* 306: 40-49. <http://dx.doi.org/10.1016/j.geoderma.2017.06.029>
- Romero C.M., R.E. Engel, C. Chen, R. Wallander, C. A. Jones. 2017. Late fall, winter and spring broadcast applications of urea to no-till winter wheat II. Fertilizer N recovery, yield and protein as affected by NBPT. *Soil Science Society of America Journal* 81:331-340. doi:10.2136/sssaj2016.10.0333.
- Sapkota. A., E.C. Meccage, R.N Stougaard, J.P. Tanner, D.M. Peterson, and J.A. Torrion. Boron fertilization of alfalfa in Montana. *Crop, Forage, and Turfgrass Management J.* (Accepted with minor revision)
- Torrion, J.A. X. Laing, O. Walsh, B. Bicego, and A. Sapkota. Achieving yield and grain protein stability on wheat with *Gpc-B1* gene. Submitted to *Crop Sci. J.* (In Review)

#### EXTENSION PUBLICATIONS

- Afshar, R.K. and C. Chen. 2017. Biofortification of durum and spring wheat with zinc to improve yield and nutritional quality. *Fertilizer eFacts* No. 74. MSU Extension, Bozeman, MT. 2 p.
- Chen, C. J. Huang and R. K. Afshar. Starter N fertilizer and rhizobia inoculant effects on dry pea. *Fertilizer eFacts* No. 73. MSU Extension. Bozeman, MT. 3 p.
- Jones, C., and K. Olson-Rutz. 2017. Crop and Fertilizer Management Practices to Minimize Nitrate Leaching. MT201103AG. MSU Extension. Revision. 4 p.
- McCauley, A., C. Jones, and K. Olson-Rutz. 2017. Soil pH and Organic Matter. *Nutrient Management Module 8.* 4449-8. MSU Extension. Montana State Univ. Bozeman. Revision. 12 p.
- McVay, K., M. Burrows, C. Jones, F. Menalled, and K. Wanner. 2017. MT Wheat Production Guide. EB0197. MSU Extension. Revision. 32 p.
- McVay, K., M. Burrows, C. Jones, K. Wanner, and F. Menalled. 2017. MT Barley Production Guide. EB0186. MSU Extension. Revision. 24 p.
- Miller, P., J. Holmes, R. Engel, A. Bekkerman, C. Jones and S. Ewing. 2017. Long-term profitability of pea-wheat systems, managed at high and low N fertility. *Montana Fertilizer eFacts* No. 72. MSU Extension, Bozeman MT. 3 p.
- Pariera Dinkins, C., C. Jones, and K. Olson-Rutz. 2017. Home Garden Soil Testing & Fertilizer Guidelines. MT200505AG. MSU Extension. Revision. 8 p.
- Sapkota, A., J.A. Torrion, E. Meccage, B. Stougaard, D. Peterson, and J. Tanner. Boron maintenance fertilization in alfalfa. *Montana fertilizer eFacts.* No. 75. November, 2017. MT State Ext and MT Ag Expr Station.

- Pariera Dinkins, C., C. Jones, and K. Olson-Rutz. 2017. Soil Sampling Strategies. MT200803AG. MSU Extension. Revision. 4 p.

**PROCEEDINGS, PRESENTATIONS, AND ABSTRACTS (\* - presenter)**

- Afshar, R.K.\* , C. Chen, B. Stevens, and W. Iversen. 2017. Sugarbeet yield and quality response to irrigation management. ASA-CSSA-SSSA 2017 International Annual Meeting, Oct. 22-25, Tampa, FL.
- Bicego, B\* . A. Wipf, S. Powell, and J.A. Torrion. Evaluation of spring wheat senescence using multispectral data. ASA-CSSA-SSSA International Meetings. Oct. 22-25, 2017. Tampa, FL.
- Boss, D\*, Dafoe, J. M., Hybner, R., Lamb, P., Hensleigh, P. and Bourgault, M. 2017. Evaluations of Alternative Economic Endpoints of Cover Crops in Northern Montana Replacing Fallow in a Crop-Fallow Rotation. American Society of Agronomy. Tampa FL. Oct. 22-25, 2017
- Chen, C.\* , R.K. Afshar, B. Stevens, and W. Iversen. 2017. Response of sugarbeet to nitrogen rate while shifting from conventional tillage to conservation tillage. ASA-CSSA-SSSA 2017 International Annual Meeting, Oct. 22-25, Tampa, FL.
- Jones, C.\* , P. Miller, T. Rick, W.A. Sigler, and S. Ewing. 2017. Nitrate leaching potential in a semi-arid region affected more by crop rotation than nitrogen fertilizer rate. American Society of Agronomy Annual Conference Abstracts. Tampa, FL. Oct 25, 2017.
- Kluth, D.\* , C. Jones, and T. Rick. 2017. Effects of gravel depth and available phosphorus on nitrogen fixation in pea. Undergraduate Scholars Program celebration. April 21, 2017. Bozeman, Montana.
- McVay, K.\* , Boss, D., Lamb, P., Khan, Q. A., Chen, C., Carr, P., Torrion, J., Miller, Z., Fordyce, S., Dafoe, J. M., Hybner, R. 2017. Evaluation of multiple species for use as cover crops in dryland production in Montana. American Society of Agronomy. Tampa, FL. Oct. 22-25, 2017.
- Miller, P\* , C. Jones, and A. Bekkerman. 2017. Net revenue of pea cover crop-wheat compared to fallow-, pea grain-, and wheat-wheat systems across time and space. American Society of Agronomy Annual Conference Abstracts. Tampa, FL. Oct 25, 2017.
- Mohammed, Y.A\* and C. Chen. 2017. Micro-nutrient fertilization of dry pea: Effects on grain yield. ASA-CSSA-SSSA International Annual Meetings, Oct. 22-25, 2017, Tampa, FL.
- Sapkota A\*., **J.A. Torrion**, R.N Stougaard, B.V.A. Bicego, E. Glunk. Effects of Irrigation and Boron Fertilization on Yield and Forage Quality of Alfalfa. ASA-CSSA-SSSA International Meetings. Oct. 22-25, 2017. Tampa, FL.

**New Mexico WERA-103 report**

New Mexico State University

Robert Flynn

Dr. Rolston St. Hilaire is department head of Plant and Environmental Sciences and became interim department head of Extension Plant Sciences

Former Extension Plant Sciences Department head, Dr. Natalie Goldberg, accepted a new position as interim Director of the Agricultural Experiment Station.

Dr. Rolando Flores is the new dean of ACES (Agriculture, Consumer, and Environmental Sciences). Dr. Flores is most recently from the University of Nebraska.

**Research:** Notable agronomic, horticulture, and water funded research includes:

- Diversifying the Water Portfolio for Agriculture in the Rio Grande Basin (Sam Fernald, PI) in conjunction with Texas A&M University.
- Sustainable Bio-economy for Arid Regions (SBAR). John Idowu lead PI for NMSU and Katy Brewer, College of Engineering. Lead institution is University of AZ.
- Coordinating Nontraditional Sustainable Water Use in Variable Climates (CONSERVE): A Center of Excellence for Safe and Sustainable Water Reuse in Agriculture. Barbara Chamberlin, Media Production. Dr. Barbara Chamberlin
- Strategies to Improve Soil and Water Conservation in Forage Corn Production System in New Mexico: Increasing Forage Cutting Height and Reducing Row Spacing. Funded through USDA/NRCS.
- Interactive Effects of Soils and Browsing on Sagebrush: Implications for Restoration Success. Colby Brungard, Plant and Environmental Sciences Dept.
- Tools and Techniques for Biological Soils Crust Survey. Biological soil crust and soil relationships to support reclamation and restoration efforts in the Uinta Basin, Utah, Colby Brungard and Nicole Pietrasiak. Funding through BLM
- Digital Soil Mapping for Improving Hydrological Modeling. Colby Brungard, Water Resources Institute.
- Sustainable Use of Biomass Resources in a Semi-Arid Landscape: Connecting Chem. Eng, Soil Science, and Extension. Catherine Brewer (Chemical and Materials Engineering), April Ulery (Plant and Environmental Sciences), John Idowu (Ext. Plant Sciences). Creating a multidisciplinary graduate fellowship program connecting chemical engineering and soil science. This program will prepare fellows to address the challenges of producing food, fiber, and fuel from biomass while improving soil quality in water-limited regions. USDA-NIFA.
- Monitoring of Potential Heavy Metals on Farmlands Adjacent to the Animas and San Juan Rivers. Kevin Lombard. Farmington Ag Science Center. USDA-NRCS
- Sustainable Bioeconomy for Arid Regions. John Idowu, PI. Project run by Univ. of AZ.
- Quantifying Ecosystem Effects of Termite Mounds Using Moderate and High Resolution Satellite Imagery. NASA. PI Niall, Hanan. Supporting Pastoralist Communities in West Africa through Remote Sensing of Rangeland Forage Production, Vegetation Structure, Forage Production and Long-Term Trend Analysis. NASA
- Strategies to Improve Soil and Water Conservation in Forage Corn Production System in New Mexico: Increasing Forage Cutting Height and Reducing Row Spacing. Sultan Begna. ASC Clovis USDA NRCS.
- A Novel Platform for Algal Biomass Production Using Cellulosic Mixotrophy. Francisco Holguin. ASU.
- Application of an Area-Based Quality Index (ABQI) to Assess and Manage Biological Soil Crusts in the Mojave and Sonoran Deserts. Nicole Pietrasiak. BLM.
- Cover Crops in the Southwest: Obtaining Ecosystem Services while Minimizing Water Use USDA/NIFA EPPWS. Erik Lehnhoff, Soum Sonogo, Idowu, Schutte, Pietrasiak.
- Effects of Conservation Practices on Ecosystem Health in the Rio Puerco Watershed. USDA/NRCS. Ganguli, Amy Animal and Range Sciences. CoPI Pietrasiak.
- Developing Alternative Water Sources for Bioenergy Crops Production on Marginal Lands. Dr. Girisha Ganjunte, Texas A&M Agrilife Research Center, Texas A&M University System, Collaborators include

Dr. Genhua Niu, Texas Agrilife Research, El Paso Center, Texas A&M University System, Dr. Samuel Zapata, Texas Agrilife Extension, Weslaco Center, Texas A&M University System, Dr. Juan Enciso, Texas Agrilife Research, Weslaco Center, Texas A&M University System, Dr. April Ulery and Robert Flynn, Plant and Environmental Sciences Dept, NMSU, Dr. Yanqi Wu, Department of Plant and Soil Sciences, Oklahoma State University.

### **Internal Grant**

Dr. April Ulery is one of the eight recipients of the 2017 IMPACT Mini-Grants. Co-PIs are Kevin Lombard, Gaby Phillips, and Alyce Mathews. The proposal was titled 'Edible Safety of Produce in Farmington, NM'.

### **Research Publications**

Begna S., S. Angadi, M. Stamm, and A. Mesbah. 2017. Winter canola: a potential dual-purpose crop for the United States southern Great Plains. *Agronomy Journal* 109:2508-2520. (Cover Article for the AJ).  
Shalygin, S., Shalygina, R., Johansen, J.R., Pietrasiak, N., Berrendero, E., Bohunická, M., Mareš, J. & Sheil, C.A. 2017. *Cyanomargarita* gen nov. (Nostocales, Cyanobacteria): Convergent evolution resulting in a cryptic genus. *Journal of Phycology*, 53: 762-777. (Cover Article for Journal of Phycology)

### **Extension Guides**

Managing Organic Matter in Farm and Garden Soils. Robert Flynn and John Idowu.

Test your garden Soil (Revision and Translated to Spanish). Robert Flynn

### **Presentations**

- Sifat Sultana, O. J. Idowu, Murali Darapuneni, T. Wedegaertner T. 2018. Reduced tillage effects on cotton growth and yield in New Mexico. Beltwide Cotton Conference.
- Impacts of Crop Management Systems on Arid Land Soil Quality. 2017. Mohammed Nasir Omer, Omololu J. Idowu, April L. Ulery, Dawn VanLeeuwen, Steven J. Guldan, Nicole Pietrasiak, Mark A. Marsalis. ASA-CSSA-SSSA National Meetings.
- Organic Carbon and Nutrients Dynamics in Saline Soils Under Switchgrass Irrigated with Treated Municipal Wastewater. 2017. Girisha Keshavamurthy Ganjegunte, Soil and Crop Sciences, Texas Agrilife Research, El Paso, TX, April L. Ulery, Plant and Environmental Sciences, New Mexico State University, Las Cruces, NM, Genhua Niu, El Paso, Texas A&M AgriLife Research, El Paso, TX and Yanqi Wu, Oklahoma State University, Stillwater, OK. ASA-CSSA-SSSA National Meetings. ASA-CSSA-SSSA National Meetings.
- Impacts of Crop Management Systems on Arid Land Soil Quality. 2017. Mohammed Nasir Omer, NMSU, Omololu J. Idowu, April L. Ulery, Dawn VanLeeuwen, Steven J. Guldan, Nicole Pietrasiak, and Mark A. Marsalis. ASA-CSSA-SSSA National Meetings.
- Metal Concentration in Agricultural Fields Downstream from the Gold King Mine Spill. 2017. Gaurav Jha<sup>1</sup>, April L. Ulery, Kevin A Lombard, David C. Weindorf, Samuel Fullen, and Brandon Francis. ASA-CSSA-SSSA National Meetings.
- Visualizing Soil Properties: A Multimedia Approach to Training Students and Practitioners. 2017. Robert P. Flynn, NMSU; James Walworth, The University of Arizona, Joan Davenport, Washington State University - IAREC, April L. Ulery, NMSU Jeanne Gleason, Media Productions, NMSU and Troy A. Bauder, ASA-CSSA-SSSA National Meetings

- Soil Quality Indicators across Major Agricultural Land Resources Area in New Mexico. 2017. Mohammed Nasir Omer, Omololu J. Idowu, April L. Ulery, Dawn Van Leeuwen, Steven J. Guldan, New Mexico State University, Alcalde, NM. ASA-CSSA-SSSA National Meetings
- Interactive Computer Tools to Clarify the Role of Nitrogen in Agriculture and the Environment. 2017. April L. Ulery, Laura White, Barbara Chamberlin, and Jeanne Gleason, NMSU. ASA-CSSA-SSSA National Meetings
- Metal Concentration in Agricultural Fields Downstream from the Gold King Mine Spill. 2017. Gaurav Jha (Student Competition), April L. Ulery, Kevin A Lombard, David C. Weindorf (TTU), Samuel Fullen, and Brandon Francis. ASA-CSSA-SSSA National Meetings
- Quantifying Water Required to Cool Artificial Turf. 2017. Ahmed Kanaan (student competition) Mechanical & Aerospace Engineering, NMU, El Paso, TX, Matteo Serena, NMSU, NM, Elena Sevostianova, NMSU, Igor Sevostianov, and Bernd Leinauer. ASA-CSSA-SSSA National Meetings
- Soil C and N Cycling Under Reduced-Tillage and Cover Crops in the Southern High Plains Agroecosystems. 2017. Rajan Ghimire, Binod Ghimire, Vesh B. Thapa, and Abdel O. Mesbah. NMSU. ASA-CSSA-SSSA National Meetings
- Potential Soil Carbon Mineralization and Mineralization Kinetics Under Diverse Cover Crop 2017. Binod Ghimire, Rajan Ghimire, Abdel O. Mesbah, Dawn VanLeeuwen, Residues. ASA-CSSA-SSSA National Meetings
- Soil Responses of Cover Crops in a Winter Wheat-Summer Fallow System. 2017. Binod Ghimire, Rajan Ghimire, and Abdel O. Mesbah. ASA-CSSA-SSSA National Meetings. ASA-CSSA-SSSA National Meetings
- Circular Buffer Strips of Perennial Grasses: Preliminary Assessment. 2017. Sangu Angadi, Sultan Begna, Prasanna H. Gowda, USDA-ARS Grazinglands Research Laboratory, El Reno, OK, Omololu J. Idowu, Rajan Ghimire, Charles P West, Plant and Soil Science, Texas Tech University, Lubbock, TX, Gary W. Marek, USDA-ARS Conservation and Production Research Laboratory, Bushland, TX and John Stout, ARS, USDA, Lubbock, TX. ASA-CSSA-SSSA National Meetings. ASA-CSSA-SSSA National Meetings
- Soil Biochemical Responses of Cover Crops in a Winter Wheat-Summer Fallow System. 2017. Student Competition. Binod Ghimire, Rajan Ghimire, and Abdel O. Mesbah. Student Competition. ASA-CSSA-SSSA National Meetings. ASA-CSSA-SSSA National Meetings
- Water Use and Yield Potential of Winter and Summer Alternate/Cover Crops. 2017. Murali Darapuneni, Ashley Cunningham, and Leonard M. Lauriault. ASA-CSSA-SSSA National Meetings
- Manure Application in Strip Tillage: Effects on Grain Sorghum Yield, Water Use Efficiency, and Nutrient Uptake Under Dryland Cropping Systems. 2017. Murali Darapuneni, Ashley Cunningham, and Leonard M. Lauriault. ASA-CSSA-SSSA National Meetings
- Water Use and Yield Potential of Winter and Summer Alternate/Cover Crops. 2017. Murali Darapuneni, Ashley Cunningham, and Leonard M. Lauriault. ASA-CSSA-SSSA National Meetings.

#### **Awards**

- Bernd Leinauer, Turfgrass Specialist, was appointed Wageningen University's Endowed Chair, and ASA Fellow.
- The Association for Communication Excellence awarded their Gold Award and the Outstanding Professional Skill award to Dr. Ulery and Dr. Gleason for their "Chemistry in Agriculture" project.



## Upcoming Events

The 2018 SWCS Annual Meeting is to be hosted by New Mexico with John Idowu, Robert Flynn, Sangu Angadi, and Mick O'Neil (retired) on the organizing committee.

## OREGON WERA-103 report

Oregon State University

The Department of Crop and Soil Science at Oregon State University is happy to welcome Amber Moore as a partner in nutrient management:

The focus of Dr. Moore's position is applied research and development of nutrient and lime recommendations that improve nutrient use efficiency by large-acreage crops grown in Oregon. The crops of primary focus are grass grown for seed, cereals, and potatoes, with a secondary focus on other seed crops, peppermint, forages, vegetables, berries, Christmas trees, etc. Her research program is focused on soil fertility research efforts that are statistically sound and address current soil fertility needs in Oregon large acreage field crops. Research interests include fertilizer response, nitrogen mineralization, acidification caused by nitrogen fertilizers, lime response, plant nutrient uptake, and soil nutrient dynamics,

### ONGOING RESEARCH

#### Berry Crops

Bernadine Strik continues to research nutrient management in blueberry, particularly in organic production systems. An on-going project is focused on the impact of soil and plant nutrient status on yield as affected by long-term fertilization with high-potassium containing fertilizer sources (fish emulsion and yard-debris compost). Strik and colleagues have found that various sources of fertilizer were effective when fertilizing 10 blueberry cultivars in an organic system, but pre-plant amendment with a farm compost (high in Ca) increased soil pH so much so that some cultivars had reduced yield. A Ph.D. student working with Strik (Fernandez-Salvador) is studying the impact of organic mulch type (weed mat, sawdust), cultivar (Duke, Liberty) and fertilizer source (fish, feather meal) on nutrient content and allocation in mature organic blueberry. Strik and colleagues are now assessing the impact of green or black weed mat with or without sawdust underneath on blueberry plant growth and nutrient uptake as compared to sawdust mulch alone. A M.S. graduate student (Kingston) working with Scagel, Bryla and Strik studied the impact of media components and potassium source and rate on the growth of blueberry in containers; substrate production of blueberry is an emerging trend in many production areas worldwide. Many publications are available on Strik's horticulture department web site.

Dr. David Bryla (USDA-ARS, Horticultural Crops Research Unit, Corvallis, OR) continues to conduct research on nutrient management of berry crops in both organic and conventional systems. His recent work with humic acids has shown that applying these products increase early shoot growth and root development during establishment of highbush blueberry, but there is no evidence to date to support they have any effect on nutrient uptake or production once the plants are mature. His work with K fertilizers in blueberry revealed that fertigation with SOP or KTS resulted in lower pH and higher concentrations of K, Ca, Mg, and S in soil solution than either no K or granular SOP. Additional measurements are underway to study the dynamics of K movement with depth following each fertilizer application and to examine whether there is any impact on K uptake in the leaves and fruit the following year. Links to his previous publications are available online at

<https://www.ars.usda.gov/pacific-west-area/corvallis-or/horticultural-crops-research/people/david-bryla/>.

## **Agronomic Crops**

Central Oregon, Tracy Wilson and collaborators:

**Carrot N Project:** Study to validate current nitrogen recommendations in hybrid carrot seed production. In addition, this study will track nutrient uptake and partitioning in the plant between the roots, shoots, and seed throughout the growing season. This data will be used to update the Oregon State University Nutrient Management Guide for Carrot Seed.

**Nitrogen Cycling in Cover Crops:** Cover crops in irrigated high desert systems are a greater mystery than in rain-fed systems from the Mid-West. Ultimately, the nitrogen required to grow brassica and grass cover crops will be cycled back the soil, but when and how much remains uncertain. This study seeks to answer these questions for central Oregon growers.

**Balancing Yield and Quality in Orchardgrass Hay Production:** Nitrogen is a limiting factor in forage production and is applied after each cutting. Although increasing N rates may increase yield, they may also increase the risk of lodging and nitrate accumulation. Forage producers must balance forage yield with forage quality. This study will evaluate impacts on yield and forage quality of orchardgrass against a range of N rates.

## **Publications**

### **Research**

- Buckland, K., J. Reeve, E. Cheech, S. Durham. 2017. Managing Soil Fertility and Health for Quinoa Production and Weed Control in Organic Systems. *Soil and Tillage Research*.
- Del Moro, S.K., D.M. Sullivan, and D. A. Horneck. 2017. Ammonia Volatilization from Broadcast Urea and Alternative Dry Nitrogen Fertilizers. *Soil Sci. Soc. Am. J.* DOI 10.2136/sssaj2017.06.0181.
- Downing, T.W. and J. Seymour. 2017. Using weekly pasture growth and production measurements to make management decisions on an organic dairy in Oregon. *Journal of the NACAA*. 7:1.
- Ghimire, R., S. Machado, P. Bistra. 2017. Soil pH, soil organic matter, and Crop Yield in Wheat-Fallow Systems. *Agronomy Journal*. 109:2. <https://dl.sciencesocieties.org/publications/aj/pdfs/109/2/706>
- M.T.A. Chowdrey, C.M. Deacon, G. Jones, et al. 2017. Arsenic in Bangladeshi soils related to physiographic region, paddy management, and micro-and macro-elemental status. *Science of the Total Environment*. 590: 406–415. 10.1016/j.scitotenv.2016.11.191 .
- Machado, S. 2017. Soil organic carbon pools as early indicators for soil organic matter stock changes under different tillage practices in inland Pacific Northwest. *Frontiers*. Doi: 10.3389/fevo.2017.00096
- Pett-Ridge, J.C. 2017. Nutrient feedbacks to soil heterotrophic nitrogen fixation in forests. *Biogeochemistry*. 134: 41-55. 10.1007/s10533-017-0341-x 0168-2563
- Qin, R., C. Noulas and J.M. Herrera. 2017. Morphology and distribution of wheat and maize roots as affected by tillage systems and soil physical parameters in temperate climates: an overview. *Archives of Agronomy and Soil Science*.
- Shock, C.C. 2017. Potato Performance as Influenced by the Proportion of Wetted Soil Volume and Nitrogen under Drip Irrigation with Plastic Mulch. *Agricultural Water Management*. 179: 260-270.
- Strik, B.C. 2017. The effects of long-term management on patterns of carbon storage in a northern highbush blueberry production system. *Science of the Total Environment*. 579: 1084-1093.

- Strik, B.C. and A.J. Vance. 2017. Seasonal variation in mineral nutrient concentration of primocane and florican leaves in trailing blackberry cultivars produced in an organic system. HortScience. 52: 836-843.
- Strik, B.C., Vance, A., Bryla, D.R. and Sullivan, D.M., 2017. Organic Production Systems in Northern Highbush Blueberry: I. Impact of Planting Method, Cultivar, Fertilizer, and Mulch on Yield and Fruit Quality from Planting through Maturity. HortScience, 52: 1201-1213.
- Vance, A.J. and B.C. Strik. 2017. Seasonal changes in leaf nutrient concentrations of male and female hardy kiwifruit grown in Oregon. European Journal Horticultural Science.
- Yeo R., J., J. Weiland, D. Sullivan, and D. Bryla. 2017. Nonchemical, Cultural Management Strategies to Suppress Phytophthora Root Rot in Northern Highbush Blueberry. HortScience 52: 725-731.

### **Book Chapter**

Strik, B.C. 2017. Plant Nutrient Management. *In* Blackberries and their hybrids by H. Hall, R. Funt (eds). CABI Press. Wallingford, Oxfordshire, UK.

### **Extension publications**

- Brewer, L.J., D.M. Sullivan, P. Diol, S. Angima. 2017. Como evaluar y reducir el peligro del plomo en los huertos y jardines. EC 1616-S. Oregon State University Extension Service, Corvallis, OR. [https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1616-s\\_0.pdf](https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec1616-s_0.pdf)
- Harrison, J.J.H., Bary, A.I. and Sullivan, D.M., 2017. The field book for dairy manure applicators. WSU Extension. Pub 506 (revised). <http://hdl.handle.net/2376/12193>. Shock, C. and S.J. Filley, S.J. 2017. Pasture Management Guidelines: Creating and Maintaining Healthy Pastures. OSU Land Stewards Resource Management Guidelines. Oregon State University Extension Service, Corvallis, OR.
- Sullivan, D.M., R.E. Peachey, A. Heinrich, L.J. Brewer. 2017. Nutrient Management for Sustainable Vegetable Cropping Systems in Western Oregon. EM 9165. Oregon State University Extension Service, Corvallis, OR. [https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9165\\_0.pdf](https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9165_0.pdf)

### **Agricultural Experiment Station & Commodity Commission Reports**

- Buckland, K. 2017. Whole Farm Management to Reduce Onion Thrips Pressure. Hermiston Farm Fair. Hermiston, OR.
- Dixon, E. and B.C. Strik. 2017. Review of published literature on strawberry nutrient management through 2017. Literature review prepared for the Oregon Strawberry Commission. Oregon Strawberry Commission, Salem, OR. 28pages.
- Duggan, S.J. 2017. Increasing Pasture Profitability. Oregon Cattlemen's Association. Salem, Oregon. 17:28-30. <http://orcattle.com/oregon-beef-producer-publication/>
- Dung, J.K. and D.L. Walenta. 2017. An Update on Green Manure Trials for Verticillium Wilt Management. Oregon Mint Update. Salem, OR.
- Slater, B. and T. Wilson. 2017. Miamian Ohio State Soil. Soil Science Society of America, Madison, WI. <http://www.soils4teachers.org/state-soils>

### **Proceedings/Webinars/Abstracts/Other publications**

- Andrews, N., L.B. Coop, A.L. Heinrich, J. Myers, R.E. Peachey, H. Stoven, D.M. Sullivan. 2017. Two online decision tools: Organic nutrient management and crop scheduling in Oregon.

- Filley, S., G. Wang, J. Hall, G. Pereilli, M. Bohle. 2017. Selenium and fertilizer application schemes in hay fields. European Grassland Federation, Zurich, Switzerland.
- Ruijun, Q., G. Suduan, G. Hanson. 2017. Biochar Type and Factors Affecting N Transformation, Ammonia Volatilization, and Nitrous Oxide Emissions. 2017 International Annual Meeting Abstracts. ASA, CSSA, SSSA. <https://scisoc.confex.com/crops/2017am/webprogram>
- Sullivan D.M., R.C. Costello, and S.B. Andrews. 2017. A simple titration method to determine elemental sulfur required for compost acidification. International Symposium on Growing Media, Soilless Cultivation, and Compost Utilization in Horticulture, Portland, OR. [https://www.researchgate.net/publication/321474594\\_A\\_simple\\_titration\\_method\\_to\\_determine\\_elemental\\_sulfur\\_required\\_for\\_compost\\_acidification](https://www.researchgate.net/publication/321474594_A_simple_titration_method_to_determine_elemental_sulfur_required_for_compost_acidification)
- Sullivan, D.M. and A. Moore. 2017. Estimating in-situ N mineralization rate with a buried bag method. Soil Science Society of America Annual Meeting, Tampa FL. [https://www.researchgate.net/publication/320475715\\_Estimating\\_in-situ\\_N\\_mineralization\\_rate\\_with\\_a\\_buried\\_bag\\_method](https://www.researchgate.net/publication/320475715_Estimating_in-situ_N_mineralization_rate_with_a_buried_bag_method)
- Sullivan, D.M. and N. Andrews. 2017. Predicting plant-available nitrogen provided by organic fertilizers and cover crops using an online calculator. Agriculture for Life, Life for Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest. [https://www.researchgate.net/publication/320505867\\_PREDICTING\\_PLANT-AVAILABLE\\_NITROGEN\\_PROVIDED\\_BY\\_ORGANIC\\_FERTILIZERS\\_AND\\_COVER\\_CROPS\\_USING\\_AN\\_ONLINE\\_CALCULATOR](https://www.researchgate.net/publication/320505867_PREDICTING_PLANT-AVAILABLE_NITROGEN_PROVIDED_BY_ORGANIC_FERTILIZERS_AND_COVER_CROPS_USING_AN_ONLINE_CALCULATOR).

### **UTAH WERA-103 report**

Grant Cardon (USU) and Bryan Hopkins (BYU) and noted colleagues

### Utah State University Report

*Nitrogen fertilizer credit to rotational crops following alfalfa – Bailey Shaffer, Grant Cardon, Earl Creech and Paul Grossl:*

Two years of silage corn following alfalfa is a common crop rotation in Utah and southern Idaho in part, to take advantage of residual nitrogen fixed by bacteria that work in symbiosis with the roots of alfalfa. The Utah Fertilizer Guide published in 1989, recommends a credit to a rotational crop following alfalfa of 112 kg ha<sup>-1</sup>. On-farm experiments were conducted to test whether this credit is valid and to what extent residual nitrogen from a previous alfalfa crop benefits corn silage yield and quality in the first and second year following alfalfa. Four different rates of nitrogen were applied (0, 56, 112, and 224 kg of nitrogen per hectare), and each rate had four replications. The data from 27 site-years of first-year corn showed that yield increased from 22.1 to 23.1 Mg ha<sup>-1</sup> as the nitrogen application increased from 0 to 224 kg N ha<sup>-1</sup>, but was not significantly different across treatments. The economic optimum nitrogen rate was lower than the currently accepted recommended rate on all 27 first year sites. Nine site-years of second-year corn showed that yield also increased (from 19.8 to 21.8 Mg ha<sup>-1</sup>) as application rate went from 0 to 224 kg N ha<sup>-1</sup>. Eight of the nine sites had an Economically Optimum N Rate of 0 kg N ha<sup>-1</sup>. Based on this research, Nitrogen credits to fertilizer inputs for corn silage following alfalfa will be adjusted much lower than the current credit, potentially saving Utah growers an estimated \$10 million, annually. Research in 2018 will now shift to small grain (winter wheat and spring barley) rotations following alfalfa.

*AVAIL® Treated Phosphorus Rate Effects as a function of Erosion Severity on Dryland Winter Wheat in a Calcareous Soil – Ryan Hodges, Grant Cardon, Earl Creech, Paul Grossl and Matt Yost*

Soluble phosphorus is fixed rapidly after application as a fertilizer on calcareous soils. A fertilizer additive known as AVAIL® is purported to keep applied phosphorus more available to plants by binding soil cations, thereby reducing the opportunity for fixation reactions. In a soil high in base cations, this could prove useful, but is fairly unstudied for dryland wheat production on calcareous soils. Applying reduced rates of phosphate fertilizers with AVAIL® have resulted in greater yields for potato, compared to the full-recommended rate without AVAIL®. The objective of this study is to evaluate the effect of low-rate fertilizer treatments with AVAIL® on dryland small grain yield on calcareous, eroded hillslopes. Two experiments have been, or are being conducted to determine the effects of AVAIL® on yield and grain quality for (1) spring broadcast application of mono-ammonium phosphate (11-52-0) fertilizer (performed in 2017), and (2) fall band application of mono-ammonium phosphate at planting (in progress in 2018). Fertilizer treatments are the recommended rate or one-half the recommended rate for dryland small grain, with or without AVAIL® (four treatments) replicated four times in a randomized block design (blocked on erosional severity). Dryland wheat production areas in Utah are often highly eroded, exposing highly calcareous, low organic matter content subsoil at the surface. This experiment is being conducted on a catena of erosional severity. The erosional severity blocks (non-eroded, slightly eroded, highly eroded, and depositional slope segments) were subjectively determined based on catena position and hill peak position. Segmenting the hillslope allows us to investigate correlations between calcium carbonate content, organic matter content and yield across the fertilizer treatments. Results from the 2017 study (broadcast applied fertilizer) indicate that there is no statistically significant yield advantage of any fertilizer treatment at any level of erosional severity, indicating that a reduced rate of application (half the recommended rate) with Avail is competitive with the full recommended rate of fertilizer without Avail across all erosional segments. This may end up being economically advantageous to the grower, but the economic evaluation in this study has not been completed. In 2018, banded application of the fertilizer is being evaluated with the same treatments.

*Preliminary screening of the effect of biochar properties and soil incorporation rate on lettuce growth to guide research and educate the public through extension -- Britney Hunter, Grant E. Cardon, Shawn Olsen, Diane G. Alston and Daren McAvoy:*

Extension is often the first source of public information for emerging soil amendments such as biochar. However, the highly variable properties of biochar materials and their effects on plant growth and soil nutrient supply make it difficult to objectively study the effect of this soil amendment and provide guidance to users of locally sourced biochar materials. Therefore, preliminary screening studies are needed to identify potentially beneficial ranges of biochar properties and their effects on soils and plants that can then be rigorously tested in field research. The role of extension in conducting such screening studies is invaluable to providing both guidance to researchers in developing sound study methods, and in educating the public on biochar and the myriad of uncertainties surrounding its use; thereby establishing the need for rigorous research on its properties. In 2014, a simple, yet informative screening trial was performed to identify optimal biochar pyrolysis production temperature, conditioning (that is, degree of crushing) and soil application rate for future field experiments. Lettuce (*Lactuca sativa*, var. Parris Island Cos) chosen for its short growth period and rapid biomass development, was grown in 9-L pots filled with silt loam field soil amended with biochar and/or fertilizer (or none) made from Utah-sourced cherry wood. The pots were uniformly drip irrigated once daily to keep them near field capacity throughout the study period, thereby eliminating any influence of differential soil-plant-water relations. Three biochar products created from the same cherry wood source, but resulting from three different pyrolysis temperatures (375, 475 and 575°C) and either powder ground (P) or masticated (M) were applied to soil at three application rates (1, 2 and 3% by weight). Variation in plant dry weight at harvest within and among treatments was high. Lettuce growth with the addition of biochar was decreased as compared to control treatments in all cases, except for biochar produced at the lowest temperature, 375°C. Results indicate that masticated biochar produced at 375°C and applied to soil at the rate of 2% by mass offers the best combination of beneficial response and ease of handling for future field evaluations. This

case study demonstrates the value of Extension demonstration and preliminary screening trials to inform both future research and public outreach education.

### *Dirt Diggers Digest – Monthly Soil Educational Blog – Grant Cardon*

A monthly blog, entitled USU Dirt Diggers Digest was launched in 2017. The emphasis of the blog is on common questions directed to USU Extension on soil management, fertility, salinity and other issues. The blog posts address a single question with a short informative essay followed by links to additional reading and resources. The blog has been picked up by a number of topical newsletters, and reaches thousands of readers each month as a result. The link to the archive site is:

<https://extension.usu.edu/dirtiggersdigest/>

USU Publications:

#### ***Refereed Journal Articles***

Hunter, B., Cardon, G., Olsen, S. H., Alston, D. G., & McAvoy, D. (2017, January). Preliminary screening of the effect of biochar properties and soil incorporation rate on lettuce growth to guide research and educate the public through extension. *Journal of Agricultural Extension and Rural Development*, 9(1), 1-4.

#### ***Periodicals***

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Cardon, G. (2017). Is it a Plant Food or Nutrient?, In Grant Cardon (Ed.), (vol. November 2017). Logan UT: USU Soils Extension -- Dirt Diggers Digest. [extension.usu.edu/dirtiggersdigest/](https://extension.usu.edu/dirtiggersdigest/)

Cardon, G. (2017). Organic Matter Soil Amendments, In Grant Cardon (Ed.), (vol. October 2017). Logan UT: USU Soils Extension -- Dirt Diggers Digest. [extension.usu.edu/dirtiggersdigest/](https://extension.usu.edu/dirtiggersdigest/)

Gale, J. A., Shaffer, B., Cardon, G., Creech, J. E. (2017). Reducing Nitrogen Fertilizer Inputs for 1st and 2nd Year Corn Following Alfalfa in Utah. (pp. 12,). Albuquerque, NM: Western Association of County Agriculture Agents. <http://aces.nmsu.edu/nacaa/>

Cardon, G. (2017). Is it Alkali or Alkaline?, In Grant Cardon (Ed.), (vol. September 2017). Logan UT: USU Soils Extension -- Dirt Diggers Digest. [extension.usu.edu/dirtiggersdigest/](https://extension.usu.edu/dirtiggersdigest/)

#### ***Refereed Extension Publications***

Caron, M. S., Cardon, G., Beddes, T., Kopp, K. (2017). Preparing soil for turfgrass establishment-Northern Utah. USU Cooperative Extension. [https://digitalcommons.usu.edu/extension\\_curall/1806/](https://digitalcommons.usu.edu/extension_curall/1806/)

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Buckland, K., Creech, J. E., Reeve, J., Cardon, G., Pace, M. (2017). Quinoa for Utah. Utah State University Extension.

Thomsen, E., Reeve, J., Alston, D. G., Cardon, G. (2017). Simple soil tests for onsite evaluation of soil health in orchards. (2017-02pr ed., vol. Horticulture/Soils, pp. 1-5). Logan, UT: Utah State University Extension. [http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2814&context=extension\\_curall](http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2814&context=extension_curall)

Hodges, R., Clawson, R., Cardon, G. (2017). Soil Series: Elevation and Agricultural Soil Test Survey of the Godfrey Dryland Experimental Farm, Clarkston, Utah. (vol. AG/Soils/2017-01pr). Logan, UT: Utah State University Extension.

#### **Brigham Young University Report**

The BYU report for 2017 is a compendium of citations for papers and presentations made by Bryan Hopkins, his students and colleagues.

## In Review:

- Carroll, A., K. DeJonge, B.G. Hopkins, and N.C. Hansen. 201x. Water stress indices of maize with controlled deficit irrigation and variable nitrogen supply. *Field Crops Res.*
- Jones, C.D., J.M. Stettler, V.D. Jolley, B.G. Hopkins, S.L. Jensen, D. Turner, and M.R. Stevens. 201x. Comparisons of cultivation methods for *Lupinus sericeus*, *L. argenteus*, *L. prunophilus* and *L. arbustus*. *Native Plants Journal*. (submitted in August of 2017)
- Hopkins, B.G., J.C. Stark, D.T. Westermann, and K.A. Kelling. 201x. Nutrient Management. In Jeff Stark (ed.) *Potato Production Systems*.

## Accepted:

- LeMonte, J.J., V.D. Jolley, T.M. Story, and B.G. Hopkins. 201x. Assessing atmospheric nitrogen losses with photoacoustic infrared spectroscopy: Polymer coated urea. *Plos One*

## Refereed Journal Publications - In Press:

- Hopkins, B.G., K.J. Fernelius, N.C. Hansen, and D.L. Eggett. 2018. AVAIL phosphorus fertilizer enhancer: Meta-analysis of 503 field evaluations. *Agron. J.* 110: 389-398
- Carroll, D.A., II., N.C. Hansen, B.G. Hopkins, and K.C. DeJonge. 2017. Leaf temperature of maize and crop water stress index with variable irrigation and nitrogen supply. *Irrig. Sci.* 35(6): 549-560. DOI: 10.1007/s00271-017-0558-4
- Fernelius, K.J., M.D. Madsen, B.G. Hopkins, S. Bansal, V.J. Anderson, D.L. Eggett, and B.A. Roundy. 2017. Post-fire interactions between soil water repellency, soil fertility and plant growth in soil collected from a burned Piñon-Juniper woodland. *J. Arid Env.* 144: 98-109. DOI:org/10.1016/j.jaridenv.2017.04.005.
- Katseanes, C.K., M.A. Chappell, B.G. Hopkins, B.D. Durham, C.L. Price, B.E. Porter, and L.F. Miller. 2017. Multivariate soil fertility relationships for predicting the environmental persistence of 2,4,6-trinitrotoluene (TNT) and 1,3,5-trinitro-1,3,5-tricyclohexane (RDX) among taxonomically distinct soils. *J. Environ. Manage.* 203: 383-390. DOI: <https://doi.org/10.1016/j.jenvman.2017.08.005>
- Summerhays, J.S., V.D. Jolley, M.W. Hill, and B.G. Hopkins. 2017. Enhanced phosphorus fertilizers (Carbond P® and AVAIL®) supplied to maize in hydroponics. *J. Plant Nutr.* 40: 2889-2897. DOI:10.1080/01904167.2017.1384007. Available at: <http://www.tandfonline.com/doi/full/10.1080/01904167.2017.1384007>

## Conference Proceedings:

- Campbell C., A. Campbell, N. Hansen, B.G. Hopkins, S. Evans, E. Campbell, and D. Cobos. 2017. Comparing in situ soil water characteristic curves to those generated in the lab. *Second Pan-American Conf. on Unsaturated Soils*; 12-15 Nov. 2017; Dallas, Texas. Reston, VA; ASCE Publishing.
- Bartholomew S., T. J. Hopkins, and B.G. Hopkins. 2017. Polymer coated urea: Meeting plant needs while mitigating environmental impacts – research summary. In *Proc. of the Western Nutrient Management Conf.*; 2-3 March 2017; Reno, NV. 12:181-190. Available at: [http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/\\$FILE/17WNMC%20Bartholomew%20pg181.pdf](http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/$FILE/17WNMC%20Bartholomew%20pg181.pdf)
- Hopkins, B.G., and J.D. Svedin. 2017. Soil fertility and plant nutrition 101. *49th Annual Idaho Potato Conf. and 38th Ag Expo*; 18 - 19 January 2017; Pocatello, ID. Pocatello, ID: University of Idaho Extension Program.
- Hopkins, B.G., J.D. Svedin and R.C. Christensen. 2017. On farm fertilizer management: Case studies. *49th Annual Idaho Potato Conf. and 38th Ag Expo*; 18 - 19 January 2017; Pocatello, ID. Pocatello, ID: University of Idaho Extension Program.
- Hopkins, B.G., and N.C. Hansen. 2017. Nitrogen and water interactions: Crop production systems case studies. In *Proc. of the Western Nutrient Management Conf.*; 2-3 March 2017; Reno, NV. 12:22-27. WERA-103; USDA-NIFA; Peachtree Corners, GA: International Plant Nutrient Institute. Available at: [http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/\\$FILE/17WNMC%20Hopkins%20pg22.pdf](http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/$FILE/17WNMC%20Hopkins%20pg22.pdf)



- Russell K.A., A.P. Hopkins, N.C. Hansen, and B.G. Hopkins. 2017. Nitrogen and irrigation water interactions in drought stressed Kentucky bluegrass. *In Proc. of the Western Nutrient Management Conf.*; 2-3 March 2017; Reno, NV. 12:172-180. Available at:  
[http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/\\$FILE/17WNMC%20Hopkins%20pg172.pdf](http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/$FILE/17WNMC%20Hopkins%20pg172.pdf)
- Shipp E., T.J. Hopkins, and B.G. Hopkins. 2017. Improving phosphorus use efficiency: Right rate, timing, and placement and enhanced efficiency fertilizer sources: Research summary. *In Proc. of the Western Nutrient Management Conf.*; 2-3 March 2017; Reno, NV. 12:164-171. Available at:  
[http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/\\$FILE/17WNMC%20Shipp%20pg164.pdf](http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/$FILE/17WNMC%20Shipp%20pg164.pdf)
- Svedin J.D., N.C. Hansen, R. Kerry, R.C. Christensen, and B.G. Hopkins. 2017. Creating prescription variable rate irrigation and fertilization zones: Water and nutrient management interactions. *In Proc. of the Western Nutrient Management Conf.*; 2-3 March 2017; Reno, NV. 12:156-163. Available at:  
[http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/\\$FILE/17WNMC%20Svedin%20pg156.pdf](http://www.ipni.net/ipniweb/conference/wnmc.nsf/e0f085ed5f091b1b85257900057902e/ccbc3bfdb684ebee852580e400519374/$FILE/17WNMC%20Svedin%20pg156.pdf)

#### Professional Meetings with Abstracts:

- Campbell, C.S., B.G. Hopkins, and N.C. Hansen. 2017. Soil water and plant canopy sensor technologies to optimize water and nutrient use. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 Oct 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA. 361-5. Available at:  
<https://scisoc.confex.com/scisoc/2017am/webprogram/Paper109041.html>
- Hopkins, A. P., N.C. Hansen, B.G. Hopkins, and K. Russell. 2017 Nitrogen and irrigation interactions in water-stressed turfgrass species. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 Oct 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA. Poster No. 301.
- Nelson, S.V., W. Petersen, J.D. Svedin, M. Madsen, V. J. Anderson, N.C. Hansen, B.G. Hopkins. 2017. Polyacrylamide for increasing soil moisture and seeding success. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 October 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA. Poster No. 910.
- Porter, W. H., J. D. Svedin, T.J. Hopkins, and B.G. Hopkins. 2017. Polymer coated urea research summary: Meeting plant requirements while mitigating environmental impacts. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 October 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA.
- Svedin, J. D., R. Kerry, N.C. Hansen, and B.G. Hopkins. 2017. Developing irrigation zones from a field scale crop water productivity map. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 October 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA.
- Thurgood, G.W., and B.G. Hopkins. 2017. Potato yield response to select phosphorus and potassium sources. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 October 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA. 107523; Poster No. 215.
- Valencia, M. C., J.D. Svedin, T.J. Hopkins, and B.G. Hopkins. 2017. Rate, Timing, Placement and Enhanced Fertilizer Sources for Improving Phosphorus Use Efficiency. In Abstracts, ASA•CSSA•SSSA International Annu. Meet.; 22-25 October 2017; Tampa, FL. Madison, WI: ASA-CSA-SSSA. 106055; poster No. 211.
- Hopkins, B.G.. 2017. Mode of action, effectiveness, and value of enhanced efficiency macro- and micronutrient fertilizer products. *4R Nutrient Stewardship Summit*; 12-13 June 2017; Minneapolis, MN. Washington, DC: The Fertilizer Institute.
- Svedin, J., R. Kerry, N. Hansen, and B.G. Hopkins. 2017. Using a field scale crop water productivity layer to develop variable rate irrigation zones. *11th European Conf. on Precision Agriculture*; 16-20 July 2017; Edinburgh, UK.

#### Trade Journals/Popular Press (All Invited):

- Hopkins A.P., B.G. Hopkins, N.C. Hansen, and T.J. Hopkins. 2017. Interacting Water & Nitrogen. *Turf Trends* 3(3): 10-17.



Hopkins, B.G., A.P. Hopkins, and N.C. Hansen. 2017. Water-wise turf is good even without drought. *SportsTurf*. Plymouth, MN: Sports Turf Managers Association via Green Media Online. 3:32-34

#### Webcasts and Digital Education (Invited):

Hopkins, B.G. 2017. Advanced soil science for the Sports Turfgrass Professional. Sports Turf Managers Association Pre-Conference Webinar; 29 Nov 2017. Available at:

<http://www.meetingburner.com/b/kristen2/watch?c=317RVN&h=f>

Hopkins, B.G. 2017. Enhanced efficiency fertilizers. *Federated Co-operatives Limited*; 7 November 2017; Saskatoon, SK S7K 0H2, Canada

Hopkins, B.G. 2017. ESN research on potatoes review— Dr. Bryan Hopkins, Ph.D. Brigham Young University. *Agrium ESN Field Day*; 20 July 2017; Aberdeen, ID. Available at: <https://youtu.be/myWFOtHcwGg>

Hopkins, B.G. 2017. Dr. Bryan Hopkins, Ph.D. Brigham Young University discusses the merits of ESN. *Agrium ESN Field Day*; 20 July 2017; Aberdeen, ID. Available at: [https://youtu.be/Za1E\\_2gOZB8](https://youtu.be/Za1E_2gOZB8)

Hopkins, B.G., N. Hansen, and K. Kopp. 2017. Don't let water restriction strike you out. *Sports Turf Managers Association*. 19-22 12 Jan 2017.

#### Presentations at Professional Meetings

Hopkins, B.G. 2017. Potato rotations and soil fertility/plant nutrition. *Montana Seed Potato Seminar*; 15-16, November 2017; Missoula, MT. Bozeman, MT: Montana State University.

Hopkins, B.G., and J.D. Svedin. 2017. Palomar coated urea in potato. *Agrium ESN Field Day*; 20 July 2017; Aberdeen, ID

Hopkins, B.G. 2017. Research update. *BYU-Idaho AG Field Day Experience*; 7 July 2017; Rexburg, ID.

Hopkins, B.G. 2017. Nutrient sources: How to choose them to meet plant nutrient need in traditional, organic, or mixed management settings? *5<sup>th</sup> Annual Urban and Small Farms Conf.*; 22 Feb 2017; Salt Lake City, UT.

Hopkins, B.G. 2017. Are sports field managers at risk legally? Water, Soil, Plant, and Pest BMPs for Success. *Sports Turf Managers Association Annu. Meet.*; 24-27 Jan. 2017; Orlando, FL. (Invited)

Kopp, K. and B.G. Hopkins. 2017. Let it breathe. Optimizing turfgrass water use. *Sports Turf Managers Association Annu. Meet.*; 24-27 Jan. 2017; Orlando, FL. Lawrence, KS: Sports Turf Managers Association. (Invited)

Nelson, S.V., M.C. Valencia, H. Black, J.D. Svedin, M. Madsen, V.J. Andersen, N.C. Hansen, and B.G. Hopkins. 2017. Polyacrylamide (PAM) as a potential soil micro reservoir. *BYU PWS Graduate Student Conclave*; 16 Nov 2017; Provo, UT

Svedin, J.D., R. Kerry, N.C. Hansen, and B.G. Hopkins. 2017. Informing irrigation management from spatial variation in 'Crop per Drop'. *BYU PWS Graduate Student Conclave*; 16 Nov 2017; Provo, UT.

#### Newspaper Articles, Radio/TV Interviews:

Mintz, M. 2017. Every drop; more crop per drop with variable rate irrigation. *The Furrow*. Olathe, KS: John Deer. 122(8): 4-5.

Crossingham, R. 4 August 2017. ESN smart nitrogen helps farmers minimize N loss in potatoes. *Farm & Ranch Guide - Producer Progress Reports*. Bismarck, ND. 38(7):10A-11A.

Henriksen, M. 2017. Making the most of your campus landscape. *Athletics Admin*. Westlake, OH: NACDA. pages 34-38

#### WASHINGTON WERA-103 report

Washington State University

#### Ongoing Research:

- **(Davenport and Granastein) Monitoring uptake of legume N by apple trees using N isotopic discrimination.** Funded by Washington State University's BIOAg Initiative. Comparing <sup>15</sup>N labeled N from urea and legumes with non labeled legume for N uptake into apple trees after spring (May) and fall (August) applied materials.

- **(Davenport and T. Sullivan) Microbial and Photo Siderophores for Alleviating Concord Chlorosis.** Funded by Washington State Concord Grape Research Council. Study of soil microbiome in chlorotic and nonchlorotic Concord grape. Also evaluating the impact of grass cover crops on chlorosis and Fe bioavailability.
- **(Davenport and L. Devetter) Blueberry Tissue Nutrient Standards for Eastern Washington.** Funded by Washington State Blueberry Commission. Leaf tissue sampling throughout the growing season on early, mid, and later season cultivars to determine what nutrient standard ranges should be as well as to evaluate optimal sampling time.
- **(Davenport) Compost Applications on Golf Course Fairways.** Funded by Joint Base Lewis McChord and the NW Turf Association. Ph. D. student Nathan Stacey is evaluating compost as an alternative to N fertilizers for golf course fairways.
- **(Davenport) Assessing Salinity and Sodicty in Irrigated Winegrape Vineyards in Eastern Washington.** Funded by Washington Wine Advisory Committee. Survey of waters and soils from vineyards irrigated with surface or groundwater sources of irrigation to determine if either saline or sodic conditions are developing due to impaired water sources.

#### **Students Completing Degrees:**

Nate Stacey, Ph.D., Dec 2017. COMPOSTED BIOSOLIDS AS A NUTRIENT SUBSTITUTE FOR GOLF COURSE FAIRWAYS

#### **Publications:**

##### **Research**

Stout, J.E. and J. R. Davenport. 2017. Evaluation of deficit irrigation strategies for *Vitis labruscana* 'Concord' in central Washington. *Acta Hort.* 1150: 435-442 DOI: 10.17660/ActaHortic.2017.1150.60

Stout, J. E., R. T. Peters, and J. R. Davenport. 2017. Deficit Irrigation in *Vitis labruscana* Bailey 'Concord' in Central Washington. *HortScience* 52: 450-456. doi: 10.21273/HORTSCI11450-16

Granatstein, D., J. R. Davenport, and E. Kirby. 2017. Growing legumes in orchard alleys as an internal nitrogen source. *HortScience* 52: 1283 - 1287. doi: 10.21273/HORTSCI12121-17

##### **Extension**

#### **Published Abstracts, Presentations:**

Davenport, J. R., C. A. Jones, and L. W. DeVetter. Effect of Canopy and Leaf Sampling Position on Blueberry Leaf Nutrient Concentration. Poster Presentation. American Society for Horticultural Sci, Kona, HI, Sept 2017

Ramphisa, P.D., T. Winkler and J.R. Davenport. 2017. Bean response to conventional versus alternative phosphorus fertilizer. SSSA Division: Soil Fertility and Plant Nutrition. International Annual Meeting, Tampa, FL Nov 2017

## **WYOMING WERA-103 report**

University of Wyoming, Jay Norton, Associate Professor and Soil Fertility Specialist, Department of Ecosystem Science & Mgmt; Urszula Norton, Associate Professor of Agroecology, Department of Plant Sciences

### **Research Publications**

Okeyo J, J Norton, S Koala, B Waswa, J Kihara, A Bationo. 2016. Impact of reduced tillage and crop residue management on soil properties and crop yields in a long-term trial in western Kenya. *Soil Research* 54: 719-129. 2016.

Aboukila EF, IN Nassar, M Rashad, M Hafez, JB Norton. 2016. Reclamation of calcareous soil and improvement of squash growth using brewers' spent grain and compost. *Journal of the Saudi Society of Agricultural Sciences* 2016.

Lamb JN, KM Moore, J Norton, EC Omondi, R Laker-Ojok, DN Sikuku, DS Ashilenje, J Odera. 2016. A social networks approach for strengthening participation in technology innovation: lessons learnt from the Mount Elgon region of Kenya and Uganda. *International Journal of Agricultural Sustainability* 14 (1), 65-81 2016.

Hurisso TT, U Norton, JB Norton, J Odhiambo, SJ Del Grosso, GW Hergert, DJ Lyon. 2016. Dryland soil greenhouse gases and yield-scaled emissions in no-till and organic winter wheat–fallow systems. *Soil Science Society of America Journal* 80 (1), 178-192. 2016.

Ghimire R, U Norton, P Bista, AK Obour, JB Norton. 2017. Soil organic matter, greenhouse gases and net global warming potential of irrigated conventional, reduced-tillage and organic cropping systems. *Nutrient Cycling in Agroecosystems* 107: 49–62. 2016.

Ghimire R, U Norton, P Bista, AK Obour, JB Norton. 2017. Soil organic matter, greenhouse gases and net global warming potential of irrigated conventional, reduced-tillage and organic cropping systems. *Nutrient Cycling in Agroecosystems* 107: 49–62. 2016.

Norton, U., J. Odhiambo, J. Norton. Conservation agriculture practices in smallholder farming of western Kenya: nutrient cycling and greenhouse gas fluxes. In review by co-authors. For submission to *Nutrient Cycling in Agroecosystems*. 2017.

### **Extension Publications, Proceedings, and Other Publications**

Rooney EC, M Badu, J Norton, U Norton, E Creech. 2016. Compost carryover and cover crop effects on soil quality and profitability in dryland wheat. *Proceedings of the Great Plains Soil Fertility Conference*, March 1-2, 2016, Denver. 2016.

Rooney EC, JB Norton. 2016. Cover Crops and Compost Carryover Effects on Phosphorus Cycling in Calcareous Soils. Abstracts, Meeting of the American Society of Agronomy. November 7, 2016, Phoenix. 2016.

Norton, JB, and OK Ng'etich. 2017. N and P rates for sugarbeet under sprinkler irrigation and conservation tillage. *UW Ag Exp. Station Field Days Bulletin*.

### **Workshops and Meetings hosted**

3<sup>rd</sup> annual High Plains Organic Farming Conference, February 22-23, 2016, Cheyenne (105 participants).

4<sup>th</sup> annual High Plains Organic Farming Conference, February 21-22, 2017, Cheyenne (115 participants).

### **Presentations**

Rooney EC, JB Norton. 2016. Cover Crops and Compost Carryover Effects on Phosphorus Cycling in Calcareous Soils. American Society of Agronomy, November 7, 2016, Phoenix.

Rooney EC, M Badu, J Norton, U Norton, E Creech. 2016. Compost carryover and cover crop effects on soil quality and profitability in dryland wheat. Great Plains Soil Fertility Conference, March 1-2, 2016, Denver.

Urszula Norton; Judith Odhiambo; Jay Norton. 2016. Conservation Agriculture Practices in Smallholder Farming of Western Kenya: Nutrient Cycling and Greenhouse Gas Fluxes. Tropentag Conference on Tropical Agriculture, September 21, 2016, Vienna, Austria.

Norton JB, U Norton, D Ashilenje. 2016. Conservation Agriculture in the Mt Elgon Highlands of Kenya and Uganda: Successes and Limitations. Tropentag Conference on Tropical Agriculture, September 21, 2016, Vienna.

Urszula Norton; Prakriti Bista; Rajan Ghimire; Jay Norton. 2016. Greenhouse gas fluxes and global warming potential in three winter wheat systems during drought in eastern Wyoming, USA. International Conference on Agrophysics in Lublin, Poland, 28th September, 2016.

Urszula Norton; Ada Harris; Susan Schmidt; Jay Norton. 2016. Terrestrial carbon and nitrogen eight years after large scale beetle-caused forest mortality. International Conference on Agrophysics, Lublin, Poland; September 28th, 2016.

Norton JB. 2016. Wyoming soils and their reconstruction following extraction of energy resources. November 7, 2016, Wroclaw University of Environmental and Life Sciences, Institute of Soil Science and Environmental Protection, Wroclaw, Poland.

Norton JB. 2016. Soil Health and Gardening Basics in Wyoming. Wyoming Gardening Conference, April 2, 2016, Riverton.

Norton JB. 2016. Soil health and fertility for home gardens. Laramie Local Foods Conference, April 30, 2016, Laramie.

Norton JB, OK Ngetich, J Vardiman. 2016. Conservation tillage, soil quality, and N and P fertilizer requirements under sprinkler irrigated sugar beet-bean-barley rotations. Mini Field Day, June 21, 2016, Powell Research & Extension Center.

Norton JB. 2016. Soil Fertility Options in Organic Dryland Crop Production. 3rd Annual High Plains Organic Farming Conference, February 23-24, 2016, Cheyenne.

### **Current Grant-Funded Projects**

2014-18: Compost carryover and cover crop effects on soil quality, profitability, and cultivar selection in organic dryland wheat. USDA-OREI in collaboration with Utah State, \$1,555,000 total; \$305,000 UW subaward.

2014-16: Soil Organic Matter, Water Use, and Crop Response to N and P in Sugarbeet-Bean-Barley Rotations under Conservation Tillage, Cover Crops, and Limited Irrigation. UW Ag Exp. Station Competitive Grant Program, \$75,000.

2014-16: Soil Health, Water Use, and Fertilizer Recommendations for Sugarbeet-Dry Bean- Barley Rotations under Conservation Tillage and Limited Irrigation, Wyoming Dept of Agriculture Ag Producer Priority Grant Program, and UW AES, \$40,000.

2015-2016: Mechanisms linking ecosystem N processing and hydrological transport following bark beetle-caused forest mortality: Urszula Norton and Jay Norton, UW EPSCOR, \$33,200

2015-2017: Riparian Wetland Soil Quality as Affected by Grazing Exclusion: Sweetwater Wetland Study. USDI-BLM, \$6000.

2016-2017: Harnessing the Sun to Produce Fertilizer On-farm: Jay Norton and Jessica Davis, Wyoming Specialty Crop Grant, \$24,500.

2017-2018: Sustainable Production Practices for Edible Dry Beans: Jay Norton, Jim Heitholt, Urszula Norton, others, Wyoming Specialty Crop Grant, \$24,500.

2017-2018: Edible dry beans as part of improved crop rotations in Wyoming: Jay Norton, Jim Heitholt, Wyoming Bean Commission, \$5000.

2015-2018 Best Cover Crop and Tillage Management Strategies for Dryland Winter Wheat Cropping Systems in Central High Plains. Urszula Norton and Jay Norton. Wyoming Department of Agriculture, \$20,000.