Debankur Sanyal
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CHRONOLOGY OF EDUCATION

2018, Ph.D. in Soil Science, Dissertation title: Symbiotic Nitrogen Fixation in Dry Bean (*Phaseolus vulgaris* L.) Cultivars, Major Advisor: Dr. Amitava Chatterjee

2015, MS in Soil Science and Agricultural Chemistry, Thesis title: Potassium Dynamics in a Long-Term Fertilizer Experiment under Rice-Wheat Cropping System, Major Advisor: Dr. Babu Singh Brar

2013, BS in Agriculture (Honors), Specialization: Natural Resource Management, Crop Production, and Commercial Agriculture

CHRONOLOGY OF EMPLOYMENT

2024-present: Assistant Professor and Extension Specialist – Soil Health, Department of Environmental Science, University of Arizona

2022-2024: Assistant Specialist, Soil Health and Assistant Professor, Department of Environmental Science, University of Arizona

2020-2022: Postdoctoral Research Associate, South Dakota State University

2018-2020: Research Associate 1, South Dakota State University

HONORS AND AWARDS

2018, Certificate for outstanding achievement, Gamma Sigma Delta, NDSU chapter

2017, Dr. Charles E. Kellogg Scholarship Award, North Dakota State University

2016, Clarence and Cora Engberg Scholarship Award, North Dakota State University

2015, Dr. N.S. Randhawa Gold medal, Punjab Agricultural University

2015, Academic Scholar during MS, Punjab Agricultural University

2013-15, All India Junior Research Fellowship (merit), ICAR Govt. of India

2009-13, University Merit Scholarship, Govt. of West Bengal, India

SERVICE AND OUTREACH

Local/State Service and Outreach

2025, Co-organizer, Agricultural Water Treatment Workshop, Yuma, AZ (September 12, 2025).

2025, Peer-Reviewer, FY26 Arizona Institute for Resilience (AIR) Annual Resilience Theme Grant, The University of Arizona.

2025, Organizer, Breakout Session, *Soil Health Management in the Desert*. Southwest Ag Summit, Yuma, AZ, USA.

2024, Co-organizer with Randy Norton, Western SARE Grant Writing Workshop, Phoenix, AZ (September 12, 2024)

2024, Organizer, Breakout Session, *Soil Health*. Southwest Ag Summit, Yuma, AZ, USA.

2023 - present, State Co-coordinator, Western Sustainable Agricultural Research and Extension (SARE)

2023, Co-organizer with Elise Gornish, Soil Health Workshop (funded by Western SARE), Safford, AZ, USA

2023, Co-organizer, Breakout Session, *Soil Health in the Desert: Combating Water Crisis in the Southwest*. Southwest Ag Summit, Yuma, AZ, USA

2022 - present, Member, Arizona Agriculture Extension Association (AAEA)

National and International Service and Outreach

2025, Expert Panelist, *Siembra Directa en ambientes semiáridos*, XXXIII Aapresid Congress, August 5-7, 2025. Buenos Aires, Argentina.

2025, Expert Panelist, *A Panel Discussion on Sustainability of Groundwater and Irrigated Agriculture in the Southwestern U.S.: Lessons Learned from Extension/Engagement and Applied Research in California and Arizona*. UCOWR/NIWR Annual Water Resources Conference, Minneapolis/St. Paul. MN, USA.

2025, Leader (elected), American Society of Agronomy- Biochar Community

2024, Reviewer, Western Sustainable Agricultural Research and Education (SARE), United States Department of Agriculture (USDA), Research and Education Proposal Review Panel

2024, Reviewer, The US - Israel Binational Agricultural Research and Development (BARD) Fund

2024, Reviewer, United States Department of Agriculture (USDA) Specialty Crop Research Initiative (SCRI) proposal review panel

2024, Session Moderator, Biochar Uses in Agricultural Production Oral I (with Student Competition), ASA-CSSA-SSSA Annual Conference, San Antonio, TX (Nov 11, 2024)

2024, Session Moderator, Biochar Uses in Agricultural Production Poster I, ASA-CSSA-SSSA Annual Conference, San Antonio, TX (Nov 12, 2024)

2024, Session Moderator, Biochar Uses in Agricultural Production Oral II, ASA-CSSA-SSSA Annual Conference, San Antonio, TX (Nov 13, 2024)

2023-present, member, Cadmium Mitigation in Leafy Greens and Vegetables, led by Dr. De Ann Davis, Western Growers

2023-2024, Technical Editor, Frontiers in Agronomy - *Climate-Smart Agriculture: Enhancing Sustainable Crop Production in Arid and Semi-arid Environments through Conservation of Natural Resources*

2023-24, Peer Reviewer, United States Department of Agriculture, Specialty Crop Research Initiative Multistate Proposals

2023, Peer Reviewer, United States Department of Agriculture, NIFA ORG 2023 Research Proposals

2022-present, Associate Editor, Agronomy Journal

2023, Session Moderator, Impact of Cover Crops on Soil, Water and Conservation Management Oral, ASA-CSSA-SSSA Annual Conference, St. Louis, MO

2022-present, Member, Western Cover Crop Council-Southeast Region

2022-present, Co-organizer, Sustainable Regional Systems Research Networks (SRS RNs) Awards - National Science Foundation (NSF)

2022, Peer Reviewer, Water Resources Research Act general proposals 2022

Memberships in Professional Societies

2017-present, Member, American Society of Agronomy (ASA)

2017-present, Member, Crop Science Society of America (CSA)

2017-present, Member, Soil Science Society of America (SSSA)

Departmental Committees

2025- present, Faculty/Staff Professional Development Committee, Environmental Science

2025- present, Graduate Program Committee, Environmental Science

2025, Member, Maricopa Agricultural Center Director Search Committee, University of Arizona Cooperative Extension

2024 – present, Member of Advisory Committee, Arizona Institute of Resilience, University of Arizona

2024, Member, Soil Health Curriculum Committee, Environmental Science

2022-2025, Member, UA Vitae Peer Review Committee, Environmental Science

2022- present, Member, Graduate Student Committee, Environmental Science

2023, Member, Pinal County Extension Agent Search Committee, University of Arizona Cooperative Extension

2022- 2024, Reviewer, Water Irrigation Efficiency Grant Committee, University of Arizona

2022-2023, Member, Director of Maricopa Agricultural Center Search Committee

2022, Member, Integrated Post Management Extension Assistant Search Committee, University of Arizona Cooperative Extension

2022, Member, Postdoctoral Research Associate in Integrated Post Management Search Committee, University of Arizona Cooperative Extension

TEACHING, ADVISING, AND MENTORSHIP

Online Courses

Sanyal, D. Basics of Soil Health and Fertility Management for Urban Agriculture. Online Platform: *Teachable*; Course began: September 2024; Link: https://sara-hipperson-s-school.teachable.com/p/specialty-crop-nutrients

Advising and Mentorship

2025 – present, Gianna Leippert, PhD (Dissertation), Environmental Life Sciences, Arizona State University, Committee member

2025 – present, Pavan Thodeti, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025 – present, Kaelyn Mayo, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025 – present, Taylor Arp, PhD (Dissertation), Environmental Science, The University of Arizona, Major Advisor

2025 – present, Dilshani Aswin, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025 – present, Kaitlin Fahlgren, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025, Elijah Mata, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025, Makayla Walizer, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025 – present, Emily Rockey, MS (Thesis), Environmental Science, The University of Arizona, Major Advisor

2025 – present, Sabrina Wilson, MS (Report), Hydrology and Atmospheric Science, The University of Arizona, Committee Member

2025, Katherine Jakubowski, Research Technician, Environmental Science, The University of Arizona, Supervisor

2025 – present, Charles Stackpole, MS (Thesis), Environmental Science, The University of Arizona, Major Advisor

2024 – 2025, Sanjoy Kumar, Postdoctoral Researcher, Environmental Science, The University of Arizona

2024 – present, Matt Halldorson, PhD (Dissertation), Environmental Science, The University of Arizona, Major Advisor

2023 – 2025, Taylor Arp, **MS (Thesis)**, Environmental Science, The University of Arizona, Major Advisor

2024 – present, Mercedes Martinez, MS (Thesis), Environmental Science, The University of Arizona, Major Advisor [*defending thesis on 04-09-2026*]

2024 – 2025, Todd Taylor, PhD (Dissertation), Environmental Science, The University of Arizona, Major Advisor (taken a break)

2024 – present, Mahdis Khorram, PhD (Dissertation) Student, Hydrosystems Engineering, Arizona State University

2024 – 2025, Dilshani Aswin, MS (Report) Student and Student Intern, Industrial Microbiology and Environmental Science, The University of Arizona, Major Advisor

2024 – 2025, Trevor Pettit, Research Professional, Environmental Science, The University of Arizona, Supervisor

2024 – 2025, Mercedes Martinez, Research Technician, Environmental Science, The University of Arizona, Supervisor

2023 – 2025, Jose Ornelas, MS (Report) Student, Environmental Science, The University of Arizona, Major Advisor

2023 – 2025, Erik Zamora, MS (Thesis) Student, Soil Science, Texas A&M University-Kingsville, Committee member

2023 – present, Flannery Lynn Bishop, MS (Report) Student, Environmental Science, The University of Arizona, Major Advisor

2023-2024, Mixly Garcia, Research Intern, Environmental Science, The University of Arizona

2023 – 2024, Joao Pedro, Research Intern, Environmental Science, The University of Arizona

2023, Xiaobo Hou, Ph.D. Graduate Student, Environmental Science, The University of Arizona, Committee Member

2022 – present, Chaz Stackpole, Research Technician, Environmental Science, The University of Arizona, Supervisor

2022 (summer), Ariel Heinrich, Research Intern, Environmental Science, The University of Arizona

2023, Member, Transitioning to The Workforce Mentoring Committee, American Society of Agronomy (ASA), Crop Science Society of America (CSA), Soil Science Society of America (SSSA)

PUBLICATIONS

Google Scholar: https://scholar.google.com/citations?user=bwcunzEAAAAJ&hl=en

Refereed Journal Articles

1. Roy, S.§, Soumen, S.§, Arp, J. T.§, Kaur, J., Bhowmick, R., Pettit, T., Choudhury, S., Das, T. K., Nayaka, S. C., Mandal, S. N., Mallikarjuna, M. G., & **Sanyal, D*.** (2026). From soil to sequences: Unraveling the impacts and molecular innovations in rhizomicrobiome analysis. *World Journal of Microbiology and Biotechnology*, *42*, 127. https://doi.org/10.1007/s11274-026-04865-6; [§ indicates shared first author]
2. Arp, J. T., **Sanyal, D.***, Kaur, J., Karki, D., & Bly, A. (2026). Exploring the nexus between regenerative agriculture and soil health: A special emphasis on semi-arid and arid agriculture. *Frontiers in Agronomy*, *8*, 1666008. https://doi.org/10.3389/fagro.2026.1666008
3. Khorram, M., **Sanyal, D.**, & Kumar, S. (2026). More than just spectra: The synergistic role of pH in advancing hyperspectral SOC prediction. *CATENA*, *263*, 109712. https://doi.org/10.1016/j.catena.2025.109712
4. Das, T. K., Kaur, J., Mukhopadhyay, R., Bezbaruah, A., & **Sanyal, D***. (2025). Engineered nanomaterials for removal, recovery, and reuse of phosphorus: From water to fertilizer pathways. *Advances in Colloid and Interface Science*, *346*, 103672. https://doi.org/10.1016/j.cis.2025.103672
5. Graham, C., **Sanyal, D.**, Brennan, J., & Olson, K. (2025). Short-term effects of livestock on northern, semi-arid US Great Plains spring wheat grain yield. *Agronomy Journal*, *117*, e70149. https://doi.org/10.1002/agj2.70149
6. Chang, H., Roe, B., Erkoc, M., Heyman, J., Foo, K., **Sanyal, D.**, Banerjee, D., Rushforth, R., & Srinivasan, J. (2025). Convergence research for sustainable regional systems. *iScience*, *28*(8), 113104. https://doi.org/10.1016/j.isci.2025.113104
7. Cheney, R., Seyfferth, A., Smith, R., McEntire, J., **Sanyal, D.**, & Davis, D. A. (2025). Factors affecting cadmium accumulation and mitigation: A literature review to inform spinach and carrots producers. *HortScience*, *60*(11), 1908–1917. https://doi.org/10.21273/HORTSCI18707-25
8. Loya, J., Subramanian, S., Kalil, A., Keene, C., **Sanyal, D.**, Eberly, J., & Graham, C. (2024). Assessing the use of native rhizobia to improve nitrogen fixation under abiotic stress. *Agrosystems, Geosciences & Environment*, *7*(4), e20573. https://doi.org/10.1002/agg2.20573
9. Bansal, S., **Sanyal, D.**, Graham, C., Gonzales, J., & Kumar, S. (2024). Impacts of stocking densities on soil biochemical and microbial properties in a mixed-grass prairie ecosystem at two landscape positions. *Frontiers in Sustainable Food Systems*, *8*, 1254973. https://doi.org/10.3389/fsufs.2024.1254973
10. Orr, E., Masson, R., **Sanyal, D.**, & Elshikha, D. E. (2023). Surviving these drying times: The role of a desert agricultural extension agent in helping farmers face drought. *Journal of the NACAA*, *16*(2), 1–10.
11. **Sanyal, D.***, Mukherjee, A., Rahhal, A., Wolthuizen, J., Karki, D., Clark, J. D., & Bly, A. (2023). Cover crops did not improve soil health but hydroclimatology may guide decisions preventing cash crop yield loss. *Frontiers in Soil Science*, *3*, 1111821. https://doi.org/10.3389/fsoil.2023.1111821

12. Mukherjee, A., Roy, P., **Sanyal, D.**, Roy, T. N., & Wang, S. (2023). Does socio-economic dynamics influence crop yield variability? *Current Science*, *125*(8), 846–852. https://doi.org/10.18520/cs/v125/i8/846-852
13. Bielenberg, H., Clark, J., **Sanyal, D.**, Wolthuizen, J., Karki, D., Rahhal, A., & Bly, A. (2023). Cover crop composition in long-term no-till soils in semi-arid environments does not influence soil health measurements after one year. *Soil Science Society of America Journal*, *87*, 528–540. https://doi.org/10.1002/saj2.20523
14. Bielenberg, H., Clark, J., **Sanyal, D.**, Wolthuizen, J., Karki, D., Rahhal, A., & Bly, A. (2023). Precipitation and not cover crop composition influenced corn economic optimal N rate and yield. *Agronomy Journal*, *115*(1), 426–441. https://doi.org/10.1002/agj2.21265
15. **Sanyal, D.***, & Graham, C. (2022). Using the Haney soil test to predict nitrogen requirements in winter wheat (*Triticum aestivum* L.). *Nitrogen*, *3*(2), 376–386. https://doi.org/10.3390/nitrogen3020024
16. Graham, C., van Es, H., & **Sanyal, D**. (2022). Soil health changes from grassland to row crop conversion in the northern Great Plains. *Crops & Soils*, September–October 2022. https://doi.org/10.1002/crso.20219
17. **Sanyal, D.***, Wolthuizen, J., & Bly, A. (2021). Influence of nitrogen fertilization rate on soil respiration: A study using a rapid soil respiration assay. *Nitrogen*, *2*, 218–228. https://doi.org/10.3390/nitrogen2020014
18. **Sanyal, D.***, Rahhal, A., Wolthuizen, J., & Bly, A. (2021). Identifying diversity and activities of soil microbes using pigmentation patterns on buried cotton strips: A novel approach. *Communications in Soil Science and Plant Analysis*. https://doi.org/10.1080/00103624.2021.1908328
19. Graham, C., van Es, H., & **Sanyal, D.** (2021). Short-term soil health effects from the conversion of grassland to row crops by tillage in the northern Great Plains. *Geoderma Regional*, *26*, e00425. https://doi.org/10.1016/j.geodrs.2021.e00425
20. **Sanyal, D.***, Osorno, J. M., & Chatterjee, A. (2020). Influence of Rhizobium inoculation on dry bean yield and symbiotic nitrogen fixation potential. *Journal of Plant Nutrition*, *43*(6), 798–810. https://doi.org/10.1080/01904167.2020.1711946
21. **Sanyal, D.**, Solanki, S., Ameen, G., Brueggeman, R., & Chatterjee, A. (2020). Understanding the expression dynamics of symbiont rhizobial nifH and nitrogen assimilatory NR and GS genes in dry bean genotypes at various growth stages. *Legume Science*, e26. https://doi.org/10.1002/leg3.26
22. Saha, M., Bandyopadhyay, P. K., Sarkar, A., Nandi, R., Singh, K. C., & **Sanyal, D***. (2020). Understanding the impacts of sowing time and tillage in optimizing the micro-environment for rainfed lentil (*Lens culinaris* Medik) production in the lower Indo-Gangetic Plain. *Journal of Soil Science and Plant Nutrition*, *20*(4), 2536–2551. https://doi.org/10.1007/s42729-020-00319-6
23. **Sanyal, D.***, Brar, B. S., & Dheri, G. S. (2019). Organic and inorganic integrated fertilization improves non-exchangeable potassium release and potassium availability in soil. *Communications in Soil Science and Plant Analysis*, *50*(16), 2013–2022. https://doi.org/10.1080/00103624.2019.1648660

24. Chatterjee, A., **Sanyal, D.**, & Olson, D. (2019). Influence of stabilizer addition and application rate on nitrogen use efficiency of corn (*Zea mays* L.). *Crops and Soils*, *52*(4), 24–37. https://doi.org/10.2134/cs2019.52.0409
25. **Sanyal, D.***, Goos, R. J., & Chatterjee, A. (2018). Determining biological nitrogen fixation in dry beans using ureide and isotope-dilution techniques. *Communications in Soil Science and Plant Analysis*, *49*(16), 2042–2052. https://doi.org/10.1080/00103624.2018.1495727
26. O'Brien, P. L., Acharya, U., Alghamdi, R., Niaghi, A. R., **Sanyal, D.**, Wirtz, J., Daigh, A. L. M., & DeSutter, T. M. (2018). Hydromulch application to bare soil: Soil temperature dynamics and evaporative fluxes. *Agricultural and Environmental Letters*, *3*(1), 180014. https://doi.org/10.2134/ael2018.03.0014 (except for the corresponding/first author, all authors had equal contributions)

***** *indicates the corresponding author*

Manuscripts submitted/under revision

1. Kumar, S., Arp, J.T., Stackpole, C., Sanyal, D. Soil Health Interpretations Are Model- and Region-Dependent and do not Predict Crop Yield in Arid Irrigated Cotton Agroecosystems of Arizona. Submitted to *Soil and Tillage Research (STILL-D-26-01550)*
2. Rockey, E. C., Amorim, H. C. S., Mancini, M., Ashworth, A. J., Owens, P., Smith, S. E., Johnson, M. K., Arias, J., Thomas, H., Drescher, G., Winzeler, H. E., & **Sanyal, D**. Soil health assessment on Native American agricultural land in the semi-arid Southwest. *Vadose Zone Journal* (manuscript submitted for publication; 1st revision submitted)
3. Moffat, P., Boll, J., **Sanyal, D.**, Lombard, K., Rushforth, R., Meyer, T., Boylan, R., Slabaugh, R., Wang, Y., Efurd, K., Davenson, J., & Neibergs, S. Regenerative agriculture: Regional communities require deeper capacity to transform. *Journal of Agriculture, Food Systems, and Community Development* (manuscript submitted for publication).

Manuscripts under preparation

1. Kumar, K., **Sanyal, D.**, Dawar, P., Das, A., Koley, A., Bhowmik, R., Chakravarthy, T., Mukherjee, A., Barman, M., & Mandal, S. N. Flowering under stress: Unveiling environmental stressors under a changing climate.
2. Sanyal, D., Brar, B. S., Dheri, G. S., Sihi, D., & Dari, B. Temporal changes in potassium forms in a long-term fertilizer experiment under a rice-wheat cropping system.
3. Gomes, P., Gomes, R., Sanchez, P. A., & Sanyal, D. Integrating soil sensing and machine learning for precision agriculture: A multiscale approach to smarter fertilization. Submitted to *IEEE*.

Peer-reviewed Conference Proceedings

1. Rozario, P., P. A. Sanchez, **D. Sanyal,** D. Mitra, R. Gomes. 2026. *Integrating Soil Sensing and Machine Learning for Precision Agriculture: A Multiscale Approach to Smarter Fertility Management*. In 2026 IEEE International Conference on Electro/Information Technology. La Crosse, Wisconsin, USA.
2. Rozario, P., R. Gomes, P. Sanchez, **D. Sanyal**. 2026. MZ-GPT: *Bridging AI and Agriculture for Farmer-Friendly Sustainable Zone Management.* In IEEE International Geoscience and Remote Sensing Symposium, Washington, DC, USA.
3. Arp, J.T., **D. Sanyal**, T. Pettit, M. Martinez, and M. Walizer. 2025. *Sanitizers and Soil Health: Surveying Soil Health Response to Irrigation Sanitizers in Romaine Growing Systems in Arizona*. In CANVAS 2025.
4. Khorram, M., S. Kumar, **D. Sanyal**. 2025. *Advancing SOC Prediction Using Fractional Derivatives and Spectral Simulation: A Comparative Study of Hyperspectral and Simulated Multispectral Data*. In American Geophysical Union (AGU) 2025 meeting.
5. Zamora, E., S.D. Mudi, J.L.F. Malone, **D. Sanyal**, G. Schuster, J. McGinty, S. Chanda, and S.D. Nelson. 2025. *Soil Health and Sustainability Responses to Cover Crop Mixtures and Tillage Practices in a Long-Term Research Field*. In CANVAS 2025.
6. **Sanyal, D**., R. Norton, T. Pettit, J. Ornelas, and C. Stackpole. 2025. *Impact of Biofertilizers on Cotton Yield and Fiber Quality in Arizona*. In Beltwide Cotton Conference 2025
7. Moffatt, P., J. Boll, **D. Sanyal**, K. Lombard, and R. Rushforth. 2024. *A Systems Approach to Advancing Regenerative Agriculture in the Intermountain West*. In 2024 American Geophysical Union (AGU) Meeting.
8. **Sanyal**, **D.**, T. Arp, M. Martinez, T. Pettit, and C. Stackpole. 2024. *Enhancing Soil Health in the Desert: Roles of Soil Conditioners and Biofertilizers*. In 2024 ASA, CSSA, SSSA International Annual Meeting.
9. Arp, T., **D. Sanyal**, T. Pettit, M. Martinez, C. Stackpole. 2024. *Alternative Cover Crop Management in the Desert: A Report from Arizona*. In 2024 ASA, CSSA, SSSA International Annual Meeting.
10. Zamora, E., S. D. Mudi, J. L. F. Malone, **D. Sanyal**, G. Schuster, J. McGinty, ... 2024. *Effect of Cover Crop Mixtures and Tillage Practices on Soil Health and Agricultural Sustainability in a Long Term Research Field*. In 2024 ASA, CSSA, SSSA International Annual Meeting.
11. **Sanyal, D.**, and C. Stackpole. 2023. *Evaluating Potential Cover Crops in the Desert Southwest*. In 2023 ASA, CSSA, SSSA International Annual Meeting.
12. Elshikha, D.E.M., S. Attalah, P.M. Waller, D.J. Hunsaker, K.R. Thorp, C. Williams, M. Katterman, **D. Sanyal**, G. Wang, D. Dierig, and D.T. Ray. 2023. *Guayule Germination and Growth under Subsurface Gravity Drip and Furrow Irrigation in Arizona*. In 2023 ASABE Annual International Meeting (p. 1). American Society of Agricultural and Biological Engineers.
13. **Sanyal, D.**, P. Andrade-Sanchez, and J. T. Heun. 2022. *Evaluating an in-Situ, Low-Cost, Soil CO_2 Sensor as a Soil Health Assessment Tool in the Desert Southwest.* In 2022 ASA, CSSA, SSSA International Annual Meeting.
14. **Sanyal, D.**, A. G. Bly, A. Rahhal, H. Bielenberg, J. Wolthuizen, J. Clark, and D. Karki. 2022. *Cover Crop Composition Impacts Soil Health and Nutrient Cycling*. In 2022 ASA, CSSA, SSSA International Annual Meeting.

15. Bly, A. G., **D. Sanyal**, D. Karki, A. Rahhal. 2022. *Corn Yield and Soil Nutrient Response to Cover Crops and Water Availability in South Dakota from 2018 to 2021*. In 2022 ASA, CSSA, SSSA International Annual Meeting.
16. **D. Sanyal**, A. Rahhal, H Bielenberg, A. G. Bly, D. Karki, and J. Wolthuizen, J. Clark. 2020. *Understanding How Cover Crops Influence Soil Health and Nutrient Cycling.* In 2020 ASA, CSSA, SSSA International Annual Meeting.
17. Clark, J., H Bielenberg, A. G. Bly, **D. Sanyal**, D. Karki, and J. Wolthuizen. *Cover Crop Composition Influences Nitrogen Fertilizer Needs of Corn*. In 2021 ASA, CSSA, SSSA International Annual Meeting.
18. Rahhal, A., **D. Sanyal**, J. Clark, A. G. Bly, and H. Bielenberg. 2020. *Cover Crops Relation with Soil Health and Nutrient Availability to Cash Crops*. In 2020 ASA, CSSA, SSSA International Annual Meeting.
19. Bielenberg, H., **D. Sanyal**, J. Clark, A. G. Bly, A. Rahhal, and J. Wolthuizen. 2020. *Can Cover Crops Help to Improve Soil Health While Having a Positive Effect on Corn Yield?* In 2020 ASA, CSSA, SSSA International Annual Meeting.
20. **Sanyal, D.**, J. Wolthuizen, D. Karki, A.G. Bly. 2019. *Cover crops influence soil health, nutrient cycling, and yield in South Dakota*. In 2019 ASA, CSSA, SSSA International Annual Meeting.
21. Bly, A. G., **D. Sanyal**, D. Karki, and J. Wolthuizen. *Cover Crop Influences Nutrient Cycling, Soil Moisture, Soil Health, and Corn Yield in South Dakota.* In 2019 ASA, CSSA, SSSA International Annual Meeting.
22. Sekaran, U., K. L. Sagar, N. P. Butail, L. G. Denardin, J. Singh, N. Singh, **D. Sanyal**, … 2019. *Responses of Soil Hydrological, Physical, and Biological Properties to Short and Long-Term No-till Systems.* In 2019 ASA, CSSA, SSSA International Annual Meeting.
23. **Sanyal, D.**, S. Solanki, G. Ameen, R. Brueggeman, and A. Chatterjee. 2017. *Understanding the Expression Dynamics of Rhizobial nifH and Dry Bean NR and GS Genes*. In 2017 ASA, CSSA, SSSA International Annual Meeting.
24. **Sanyal, D.**, R. J. Goos, J. M. Osorno, and A. Chatterjee. 2017. *Biological Nitrogen Fixation in Dry Bean Cultivars Inoculated with Rhizobia.* In 2017 ASA, CSSA, SSSA International Annual Meeting.

Peer-Reviewed Extension Publications

1. Arp, J. T., **Sanyal, D.***, Rock, C., & Brassil, N. (2026). *Investigating soil health changes after irrigation sanitizer application in desert southwest production systems: A guide to soil health* (AZ 2181). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/investigating-soil-health-changes-after-irrigation-sanitizer-application-desert
2. Elshikha, D., Attalah, S., Norton, R., Williams, C., Thorp, K., **Sanyal, D.**, Singh, B., Alshraah, S., & Elsadek, E. A. (2026). *Silage corn yield, water productivity, and quality under different irrigation scenarios in Arizona* (AZ 2187). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/silage-corn-yield-water-productivity-and-quality-under-different-irrigation-scenarios

3. Arp, J. T., Francis, B., McLane, E., Lombard, K., & **Sanyal, D.*** (2025). *A soil health survey of agricultural lands in the southern intermountain west* (AZ 2163). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/soil-health-survey-agricultural-lands-southern-intermountain-west
4. Halldorson, M., & **Sanyal, D***. (2025). *Understanding nutrient dynamics in desert soil* (AZ 2160). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/understanding-nutrient-dynamics-desert-soil
5. Martinez, M., & **Sanyal, D***. (2025). *Building super soil: The contribution of soil organic matter, soil organic carbon, and soil organic nitrogen* (AZ 2151). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/building-super-soil-contribution-soil-organic-matter-soil-organic-carbon-and-soil
6. Bishop, F., & **Sanyal, D***. (2025). *Effective soil sampling for sustainable crop production* (AZ 2147). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/effective-soil-sampling-sustainable-crop-production
7. Martinez, M., & **Sanyal, D***. (2025). *Key to soil resiliency: Understanding soil aggregate stability* (AZ 2146). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/key-soil-resiliency-understanding-soil-aggregate-stability
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12. **Sanyal, D.***, Stackpole, C., & Pettit, T. (2025). *Guayule: Introducing a potential crop for sustainable soil management in the desert* (AZ 2119). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/guayule-introducing-potential-crop-sustainable-soil-management-desert

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14. Elshikha, D.*, Attalah, S., Waller, P., Hunsaker, D., **Sanyal, D.**, Sanchez, C., Norton, R., Alshraah, S., Singh, B., Thorp, K., Williams, C., Mostafa, A., Orr, E., & Elsadek, E. A. (2025). *Optimizing broccoli (Brassica oleracea var. italica) yield and water productivity in Arizona* (AZ 2123). University of Arizona Cooperative Extension. https://extension.arizona.edu/publication/optimizing-broccoli-brassica-oleracea-var-italica-yield-and-water-productivity-arizona
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19. Gornish, E.*, Rein, B., Blankinship, J., Johnstone, P., & **Sanyal, D**. (2024). *Soil health perspectives of Arizona rangeland stakeholders* (AZ2077-2024). University of Arizona Cooperative Extension. https://extension.arizona.edu/pubs/soil-health-perspectives-arizona-rangeland-stakeholders
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22. **Sanyal, D.***, Stackpole, C., & Megdal, S. B. (2023). *Evaluating forage cover crop mixes for the desert southwest* (AZ2062-2023). University of Arizona Cooperative

Extension. https://extension.arizona.edu/pubs/evaluating-forage-cover-crop-mixes-desert-southwest

23. **Sanyal, D.***, Stackpole, C., & Masson, R. (2023). *Yuma soil health survey 2022: A discussion on POX-C, PMN, and soil protein* (AZ2059-2023). University of Arizona Cooperative Extension. https://extension.arizona.edu/pubs/yuma-soil-health-survey-2022-discussion-pox-c-pmn-soil-protein
24. **Sanyal, D.**, Wolthuizen, J., & Bly, A*. (2020). *"How's life in the soil?" Ask (count) the earthworms*. South Dakota State University Extension. https://extension.sdstate.edu/hows-life-soil-ask-count-earthworms
25. **Sanyal, D.**, Wolthuizen, J., & Bly, A*. (2020). *Cotton strip soil test: Rapid assessment of soil microbial activity and diversity in the field*. South Dakota State University Extension. https://extension.sdstate.edu/cotton-strip-soil-test-rapid-assessment-soil-microbial-activity-and-diversity-field

***** *indicates the corresponding author*

Book Chapters

1. Raghunandan, K., Dutta, S., Thribhuvan, R., Bhowmick, R., Chourasia, N. K., Meena, J. K., Das, A., Kumaraswamy, H. H., **Sanyal, D**., & Mandal, S. N. (2025). Breeding minor pulses for climate resilience in the era of genomics: Opportunities and prospects. In *Breeding climate resilient and future ready pulse crops* (pp. 351–372). Springer Nature Singapore. https://doi.org/10.1007/978-981-96-0483-8_12
2. Solanki, S., Ameen, G., **Sanyal, D.**, Chittem, K., Jain, S., Lall, S., Kumar, A., Brueggeman, L., & Brueggeman, R. (2020). Friends and foes: Phyto-microbial interactions in molecular perspective. In *Phyto-microbiome in stress regulation* (pp. 81–98). Springer Singapore. https://doi.org/10.1007/978-981-15-2576-6_5
3. Dheri, G. S., Brar, B. S., & **Sanyal, D** (2016). Salt-affected soils: Nitrous oxide emissions. In R. Lal (Ed.), *Encyclopedia of soil science* (3rd ed., pp. 1969–1971). Taylor & Francis. https://doi.org/10.1081/e-ess3
4. Dheri, G. S., Brar, B. S., & **Sanyal, D** (2016). Brick making: Soil degradation. In R. Lal (Ed.), *Encyclopedia of soil science* (3rd ed., pp. 255–257). Taylor & Francis. https://doi.org/10.1081/e-ess3

Popular Publications

1. Wolthuizen, J., & **Sanyal, D***. (2021). Agriculture triggered drought is causing desertification. *Modern Concepts & Developments in Agronomy*, *8*(5), 859–860. https://doi.org/10.31031/MCDA.2021.08.000699
2. **Sanyal, D.***, & Wolthuizen, J. (2021). Regenerative agriculture: Beyond sustainability. *International Journal of Agriculture Research and Environmental Sciences*, *2*(1), 17–18. https://doi.org/10.51626/ijares.2021.02.00007

Patents

Heun, J. T., Andrade-Sanchez, P., and D. Sanyal. "Low-cost electronic monitoring system of high temporal resolution in-situ soil respiration". Invention Disclosure UA23-221 filed on April 27, 2023. Provisional patent application in progress.

Web-Based Tools

Cover Crop Selector. https://covercrop-selector.org/ [Expert from the state of Arizona as a member of Western Cover Crop Council, https://covercrop-selector.org/about]

Media Coverage

Dungan, R. September 22, 2023. "This desert plant can be used to make rubber and grows with little water", *91.5 KJZZ Phoenix*. https://www.kjzz.org/2023-09-22/content-1858257-desert-plant-can-be-used-make-rubber-and-grows-little-water

Kerr, J. September 3, 2023. "On the farm or in the lab, Debankur Sanyal is a soil doctor", *The University of Arizona Environmental Science News*. https://environmentalscience.cales.arizona.edu/news/2023/09/farm-or-lab-debankur-sanyal-soil-doctor

Latzman, P. August 25, 2023. "Amid cutbacks, heat, and drought, Arizona farmers get help from the University of Arizona", *91.5 KJZZ Phoenix*. https://kjzz.org/content/1855771/amid-cutbacks-heat-and-drought-arizona-farmers-get-help-university-arizona

Allen, L. July 19, 2023. "Arizona's water challenges: What can be done?", *Western Farm Press*. https://www.farmprogress.com/farm-policy/arizona-s-water-challenges-what-can-be-done-

Migoya, C. January 27, 2023. "Central Arizona farms rely on groundwater. How research aims to help farmers adapt, protect aquifers", *Arizona Republic*. https://www.azcentral.com/story/news/local/arizona-environment/2023/01/27/research-project-to-develop-better-tools-for-pinal-agriculture/69841975007/

Other

CONFERENCES AND SCHOLARLY PRESENTATIONS

Invited Presentations at Regional, National, and International Scientific Conferences

Advanced Practices for Modern Date Palm Farming to Enhance Sustainable Productivity and Guarantee High Quality, Muscat, Oman, "Soil Health Management in Arid Environments" (November 18, 2024)

Southwest Agroforestry Action Network (SWAAN) 5th Annual Conference, Tucson, AZ, "Regenerative Agroforestry Practices for Soil Health and Conservation" (April 24, 2024)

Building Partnerships for Agricultural Sustainability Summit, Sustainable Agricultural Research and Education (SARE), Phoenix, AZ "Partnerships to Select Potential Cover Crops for Arizona" (Dec 12, 2023)

Natural Resource Conservation Service Annual Meeting, Sedona, AZ, "Opportunities to Climate-Smart Soil Health Management in Arizona" (Aug 23, 2023)

SYAHI Carbon Climate Collaborative Network (CCCN) Talk series, Virtual, "Soil Health Management for Commercial Agriculture" (Apr 30, 2023)

Water and Agriculture: Chile-Arizona Experience Webinar, Virtual, "Managing Carbon in the Desert: Introducing Healthy Desert Soils Initiative" (Nov 29, 2022)

International Conference on Contribution of Agriculture for Challenges and Opportunity of Food Security till 2030, Virtual, "Healthy Soils for Healthy Foods: A Climate-Smart Approach" (Oct 16, 2022)

International Pepper Conference, Pearce, AZ, "Chile Pepper Production in the Southwest USA-Soil Health Approach" (September 27, 2022)

Invited Seminars

2025

Two (2) New Technology Conferences, Tempe, AZ, "Revisiting Soil Health Technologies from Desert Perspectives" (May 21 and September 4, 2025)

Irrigation Workshop, Maricopa, AZ, "Understanding changes in soil health under different irrigation systems" (August 17, 2025)

Four (4) Cotton Tent talks, Marana, Eloy, Florence, Maricopa, AZ, "Managing Healthy Soils for Sustainable Cotton" (May 27, July 16, August 05, September 9)

Cotton Production Workshop, Thatcher, AZ, "Biofertilizer Impacts on Arizona Cotton Production" (February 26, 2025)

2024

Arizona Viticulture Symposium, Tucson, AZ, "Soil Health Management for AZ Vineyards" (December 6, 2024)

Field Day at the Little Lighthouse Farm, Phoenix, AZ, "Choosing cover crops for Urban Farms" (November 8, 2024)

Arizona State University Hydrosystems Seminar, "Building Healthy Soils in Water-Limited Arizona" (September 11, 2024)

Guest Lecture for SLMG 350, North Carolina A&T, "Soil Health Management in Arid Irrigated Croplands of Arizona" (September 4, 2024)

Soil to table Summit, Phoenix, AZ, "Basics of Soil Health Management" (September 4, 2024)

New Technologies Conference, Tempe, AZ, "Cover Crops: A Sustainable Tool for the Desert" (June 25, 2024) **presented by Trevor Pettit*

Urban Farming Education Conference, Tempe, AZ, "From Microbes to Ecosystems: Techniques for Monitoring and Managing Soil Health" (Jun 10, 2024) **presented by Trevor Pettit, also hosted a Soil Health Booth sharing our program details*

Alfalfa and Forage Workshop, Maricopa, AZ "Cover Crops as Alternative Forage", (May 7, 2024) **presented by Taylor Arp*

The University of Arizona/ National Resources Conservation Service Project Workshop, Tempe, AZ, "Impacts of Cover Cropping on Soil Health Properties" (May 2, 2024)

Beginner Farmer Rancher Development Program 2024, Workshop #2, "Understanding Your Soil", (April 30, 2024)

Environment Professionals in Arizona Conference, "Is Deficit Irrigation to Conserve Water Sustainable for Commercial Agriculture in the Desert?" (April 27, 2024) **presented by Taylor Arp*

Southeastern Arizona Farm and Ranch Trade Show, Wilcox, AZ, "Intro to Soil Health" (Feb 14, 2024)

AZ COWS Workshop, V bar V Ranch, Rimrock, AZ, "Pasture Cover Crops for Soil Health Improvements in the Desert" (Feb 2, 2024)

Cotton Production Workshop, Safford, AZ "Soil Health Considerations for Optimum Nutrient and Pest Management in Cotton" (Feb 1, 2024)

Desert Ag Research Symposium, Yuma, AZ, "Healthy Desert Soil Initiative: Updates from a Soil Health Research and Extension Program" (Jan 9, 2024)

2023

Southeast Pinal County Master Gardeners, Virtual, "Nutrient Deficiencies in Plants and How to Improve Soils" (Dec 13, 2023)

Arizona Winter Viticulture Symposium, Tucson, AZ, "Vineyard Soil Health and Fertility" (Dec 5, 2023)

Farming Under Extreme Weather Conditions: Building Soil Health and Cultivating Financial Resiliency, Florence, AZ, "Building Soil Health through Amendments and Cover Crops" (Nov 29, 2023)

DASHI Grower Workshop, YCEDA, Yuma, AZ, "Diagnosing Soil Health in the Desert" (Nov 9, 2023)

Maricopa County Cooperative Extension, Tempe, AZ, "Soil Health Management in an Urban Farm" (Oct 18, 2023)

Livestock Workshop, UACE, Parker, AZ, "Evaluating Alternative Forage Crops for Healthy Soils in the Desert" (Sep 15, 2023)

AZ COWS Workshop, Rimrock, AZ, "Soil Health 101: Principles and Management" (Sep 1, 2023)

Alfalfa and Forage Tent Talk, Buckeye, AZ, "Considerations for alternative forage in the desert" (Aug 28, 2023)

New Technologies Conference, Maricopa, AZ, "Diagnosing Soil Health: Modern Tools and Techniques" (May 3, 2023)

Alfalfa and Forage Workshop, Maricopa, AZ, "Soil Health Diagnosis & Improvements For Forage Crop Management" (Apr 19, 2023)

2023 Farm, Home, and Ranch Day, Thatcher, AZ, "Soil Health Considerations for the Desert Southwest" (Mar 8, 2023)

Southwest Ag Summit, Yuma, AZ, "The Nexus of Soil Health and Soil Fertility" (Feb 23, 2022)

Urban Ag Hour, Tempe, AZ, "Healthy Soils for Urban Farms" (Feb 22, 2023)

Southeastern Arizona Farm and Ranch Trade Show, Wilcox, AZ, "Soil Health Management in the Desert Southwest" (Feb 8, 2023)

2022

Spaces of Opportunity, Phoenix, AZ, "Understanding Soil Test Results" (Dec 17, 2022)

University of Arizona Cooperative Extension, Snowflake, AZ, "Cover Crop Considerations for High-elevation Agriculture" (Dec 8, 2022)

University of Arizona Cooperative Extension, Phoenix, AZ, "Healthy Soils for Urban Farms " (October 27, 2022)

Yuma Center of Excellence for Desert Agriculture, Yuma, AZ, "Introducing the Healthy Desert Soils Initiative" (November 16, 2022)

Yuma Fresh Vegetable Association, Yuma, AZ, "Soil Health Needs, Assessment & Management in Arid & Semi-Arid Environments of Arizona" (February 24, 2022)

Arizona Association of Conservation Districts, Phoenix, AZ, "Soil Health and Conservation: A Comprehensive Approach" (August 4, 2022)

University of Arizona Cooperative Extension, Yuma, AZ, "Soil Health: The Role of Soil Amendments" (July 26, 2022)

University of Arizona Cooperative Extension, Benson, AZ, "Building Soil Health with Cover Crops" (May 6, 2022)

University of Arizona Cooperative Extension, Elfrida, AZ, "Soil Health Research & Extension Program For Arizona: An Outlook" (April 27, 2022)

University of Arizona Cooperative Extension, Maricopa, AZ, "Soil Health Program for Alfalfa and Forage Crops in Arizona" (April 21, 2022)

University of Arizona Cooperative Extension, Mesa, AZ, "Soil Health Research Based Extension Program for Arizona: An Outlook" (April 6, 2022)

Center for Food Safety and Applied Nutrition, Office of Food Safety, U.S. Food and Drug Administration, Virtual, "Soil Health Needs & Management" (January 27, 2022)

University of Arizona Cooperative Extension, Goodyear, AZ, "Soil Health Improvements in Arid and Semi-Arid Environments of Arizona" (January 20, 2022)

Contributed Talks to Professional Conferences (Non-Invited)

University of Arizona Cooperative Extension Annual Conference, Tucson, AZ, "Selecting Cover Crop Mixes for Desert Southwest" (August 2, 2023)

University of Arizona Cooperative Extension Annual Conference, Tucson, AZ, "Forage Water Utilization and Regulatory Restrictions Survey in Arizona's Dairy Sector" (August 2, 2023)

UCOWR/NIWR Annual Water Resources Conference, Fort Collins, CO, "Selecting Cover Crop mixes for Water-limited Environments of Southwestern US" (Jun 14, 2023)

North Central Extension Industry Soil Fertility Conference, Des Moines, IA, "Cover crops influence soil health, nutrient cycling, and yield in South Dakota" (Nov 6, 2019)

ND, SD, and MN NCSS Technical Planning Workshop, Fargo, ND, "Cover crops influence soil health, nutrient cycling, and yield in SD" (April 9, 2019)

Soil Health Conference, ISU, Ames, IA, "Cover crops influence soil health and nutrient cycling in South Dakota" (Feb 4, 2019)

American Society of Agronomy-Crop Science Society of America-Soil Science Society of America Annual Meetings, Tampa, FL, "Understanding the Expression Dynamics of Rhizobial *nifH* and Dry Bean *NR* and *GS* Genes" (Oct 24, 2017)

SNRS Symposium, NDSU, Fargo, ND, "Understanding the Expression Dynamics of Rhizobial *nifH* and Dry Bean NR and GS Genes" (Dec 4, 2017)

SNRS Symposium, NDSU, Fargo, ND, "Nitrogen fixation potentials of four dry bean market classes" (2016)

AWARDED GRANTS AND CONTRACTS

Federal Grants Awarded

2025-2030 "WERA103: Nutrient Management and Water Quality", United States Department of Agriculture Hatch – Multistate Project, PI.

2024-2028 "AFRI: Climate-Smart Cotton: Developing Precision Regenerative Practices and Market Opportunities for Addressing Climate Change in the Cotton Belt", Texas A&M University// $224,998 total – 4% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2024-2026 "NSF Convergence Accelerator J Track Phase 2: AquaSteady - Balancing Soil Moisture, A Seaweed-Based Hydrogel for Sustainable Agriculture", Pratt Institute //$600,000 total – 4.4% paid effort, co-PI (PI: John Chorover, PI, University of Arizona)

2023-2025 “Building a Climate Smart Domestic Rubber Industry and a Solution for Growers to a Water Crisis”, USDA NRCS Partnerships for Climate-smart Commodities // ~$35,000,000 total – 22% paid effort, Co-PI (PI: Kim Ogden, University of Arizona)

2023-2025 “Climate-SMART (Specific Management for Arizona Resilience and Transformation) through Ag BMPs-Expands Markets for Climate-Smart Specialty Crops, Organic Crops, Grains and Livestock in Arizona and Tribal Areas and Supports Rancher Implementation and Monitoring of Climate-Smart Practices”, Arizona Association of Conservation Districts // $105,964 – 5% paid effort, PI

2021-2026 “SRS RN: Transforming Rural-Urban Systems: Trajectories for Sustainability in the Intermountain West”, University of New Mexico// $1,250,000 total – 2% paid effort, Senior Personnel (PI: Kelly Potter, University of Arizona)

2022-2026 “Trees for the future: Coordinated use of genetic tools to develop geographic and climate adapted pecan”, New Mexico State University//$336,507 total, 1% paid effort, co-PI (PI: Randy Norton, University of Arizona, PI)

2022-2027 “Sustaining Groundwater and Irrigated Agriculture in the Southwestern United States under a Changing Climate”, University of California-Davis//$414,140 total, 4% paid effort, senior personnel (Sharon Megdal, University of Arizona, co-PI; Isaya Kisekka, University of California-Davis, PI)

2022-2025 “Quantifying Ecosystem Services in Turfgrass Systems”, USDA Agricultural Research Service NACA// $44,867 ($0 Indirect Cost) – no paid effort, PI

2021-2025 “Assessing Soil and Plant Health Response to Composted and Solarized Grape Pomace with Manure in Semi-arid Soil”, United States Department of Agriculture// $575,000 – Senior Personnel (PI: Judith Brown, University of Arizona)

2021–2026 “W1196: Implementing and Correlating Soil Health Management and Assessment in Western States”, United States Department of Agriculture Hatch – Multistate Project, PI (National Co-lead with Rebecca Lybrand).

Other Grants Awarded (State, Industry, Private Foundation)

2026 “Evaluating Biofertilizers to Improve Soil Health and Cotton Production in the Desert”, Cotton Incorporated-Arizona Cotton Growers Association// $13,824 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2026 “Can Biofertilizers Improve Durum Wheat Grain Yield and Quality in the Desert?”, Arizona Grain Research and Promotion Council// $13,908 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2026 “Exploring Cover Cropping Techniques for Regenerative Irrigated Cotton Production in Arizona: A Systems Approach”, Cotton Incorporated// $30,726 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2025-2027, “Studying Different Sanitizer Chemistries for Soil Health in Romaine Production”, Arizona Dept. of Agriculture (AZDA)// $95,987 total ($0 Indirect cost)– 1% paid effort, PI (Channah Rock, University of Arizona, co-PI)

2025 “Exploring Cover Cropping Techniques for Regenerative Irrigated Cotton Production in Arizona: A Systems Approach”, Cotton Incorporated// $27,766 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2025 “Evaluating Biofertilizers to Improve Soil Health and Cotton Production in the Desert”, Cotton Incorporated-Arizona Cotton Growers Association// $12,000 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2024-2026 “The Effect of Warm Season Cover Crops in Arizona Vineyard Systems”, Arizona Dept. of Agriculture (AZDA)// $98,536 total ($0 Indirect cost)– 1% paid effort, co-PI (PI Matt Halldorson, University of Arizona, co-PIs)

2024 “Evaluating Biofertilizers to Improve Soil Health and Cotton Production in the Desert”, Cotton Incorporated-Arizona Cotton Growers Association// $19,100 total ($0 Indirect Cost) – 0% paid effort, PI (Randy Norton, University of Arizona, co-PI)

2024–2025 “Gift Funding towards Soil Health Research and Extension Program”, California Growers Shippers Association// $30,000.

2023-2025, “Do Water Sanitizers Change Soil Biology in Romaine Lettuce Fields?”, Arizona Dept. of Agriculture (AZDA)// $99,883 total ($0 Indirect cost)– 1% paid effort, PI (Channah Rock and Albert Barberan, University of Arizona, co-PIs)

2022-2025, “Soil Health Following Water Sanitization in Romaine Lettuce Production System”, Arizona Dept. of Agriculture (AZDA)// $90,708 total ($0 Indirect cost)– 1% paid effort, PI (Channah Rock, University of Arizona, co-PI)

2022-2025, “Investigating Nitrogen Fertilizer Rates for Sustainable Arizona Pecan Production” Arizona Department of Agriculture// $51,639 total, PI (Randy Norton, University of Arizona, co-PI)

2023 “CPS Flood Rapid Response”, Center for Produce Safety// $149,028 total, co-PI (Channah Rock, University of Arizona, PI)

2023 “Assessing Water Use Efficiency on Dairy and Crop Farms in AZ”, The Walton Family Foundation - Dairy Management, Inc.// $59,500 total – 1% paid effort, co-PI (Duarte Diaz, University of Arizona; George Frisvold, University of Arizona; Elbert Norton, University of Arizona, co-PIs)

2022-23 “Evaluating Winter Small Grain Crops for Water Productivity and Soil Health Dynamics Under Deficit Irrigation Regime in Desert Agricultural Systems of Arizona” Arizona Grain Research and Promotion Council// $19,900 total ($0 Indirect Cost) – 0% paid effort, PI (Kelly Thorp and Prasad Bandaru, USDA ARS, co-PIs)

2022-23, “Healthy Desert Soils Initiative: Building the First Comprehensive Soil Health Assessment Framework for Arizona”, iViP - USDA NIFA Hatch, $86,610 total ($0 Indirect Cost) - 0% paid effort, PI (Channah Rock, University of Arizona; Charles Sanchez, University of Arizona, co-PIs)

2022-23 “Comprehensive Soil Health Survey and Assessment in Yuma”, Yuma Center of Excellence for Desert Agriculture (YCEDA)// $10,000 total ($0 Indirect cost) – 0% paid effort, PI (Robert Masson, Cooperative Extension, co-PI)

2022-23 “Dynamics of Soil Microbial Respiration of Rotations with Durum as Winter Crop in Arizona: Role of Durum Production in Maintaining Soil Health” Arizona Grain Research and Promotion Council// $20,354 total ($0 Indirect Cost) – 0% paid effort, co-PI (Pedro Andrade, University of Arizona, PI)

2022 “Evaluating Soil Health Status in The Irrigated Cotton Production Systems of Arizona”, Cotton Incorporated-Arizona Cotton Growers Association// $18,870 total ($0 Indirect Cost) – 0% paid effort, PI (Joseph Blankinsmith, Jeff Silvertooth, co-PIs)

Before Current Position

2021-2023 “Evaluating Selected Soil Health Indices for Predicting Nitrogen Fertilizer Requirement for Winter Wheat in Western South Dakota”, South Dakota Nutrient Research and Education Council// $37,879 total ($0 Indirect Cost) – 10% paid effort, co-PI (Christopher Graham, South Dakota State University, PI)

Submitted Grants (Not Awarded)

2027-2028 “Can cover crops strengthen Integrated Insect Pest Management in irrigated desert cotton systems?”, United States Department of Agriculture// $299,886 total – 6% paid effort, PI [Peter Ellsworth, University of Arizona, co-PI, pending*]

2026-2029 “DSFAS PARTNERSHIPS: Mapping Soil Microbial Community and Functions at Regional Scales across the United States using AI-ML”, United States Department of Agriculture// $799,982 total – 4.16% paid effort, PI [Kushwaha, Priyanka; University of Arizona, co-PIs, pending*]

2026-2030 “Soil to Cash: Farm Economic Evaluations of Using Biochar and Cover Crops in Arid and Semi-arid Environments”, United States Department of Agriculture// $649,993 total – 3% paid effort, PI [Russ Tronstad, Jose Quintero, Avik Mukherjee, Ayman Mostafa; University of Arizona, co-PIs, pending*]

2026-2030 “Assessing soil health outcomes following cover cropping and biochar application in arid and semi-arid cotton cropping systems”, United States Department of Agriculture// $750,000 total – 3.29% paid effort, PI [Duke Pauli, Alonso Favela, Randy Norton, Avik Mukherjee; University of Arizona, co-PIs, pending*]

2026-2029 “PARTNERSHIP: Precision Detection and Management of Cadmium Uptake in Leafy Greens Using Hyperspectral Imaging”, Arizona State University/United States Department of Agriculture// $161,857 total – 1% paid effort, PI [Lead PI: Saurav Kumar, Arizona State University, pending*]

2026-2029 “PARTNERSHIP: Field-based mitigation strategies for lowering cadmium levels in spinach”, Arizona State University/United States Department of Agriculture// $179,882 total – 8% paid effort, PI [Lead PI: Angelia Seyfferth, Arizona State University, pending*]

VOLUNTEER SERVICES

Scientific Journal Peer Review Committee

**Topics covered in peer reviews indicated in parenthesis*

Agriculture [*Crop production*]

Agronomy [*Nitrogen dynamics, Soil amendments*]

Agronomy for Sustainable Development

Agronomy Journal (ASA) [*Soil Health, Soil Fertility, Plant Nutrition*]

Agronomy for Sustainable Development [*Fertilizer use*]

Agrosystems, Geosciences, and Environment [*Soil Health, Soil Fertility, Plant Nutrition*]

Applied Science [*Soil amendment*]

American Society of Agricultural and Biological Engineers (ASABE) Journal [*Soil hydrology*]

Communications in Soil Science and Plant Analysis [*Micronutrient dynamics*]

European Journal of Agronomy [*Crop nitrogen management*]

European Journal of Soil Science [*Micronutrient chemistry*]

Field Crops Research [*Soil amendments, Biofertilizers*]

Journal of Environmental Biology [*Abiotic stress*]

Journal of Environmental Studies and Sciences [*Crop protection*]

Journal of Soil and Sediment [*Soil health*]

Land Degradation and Development [*Soil fertility*]

PLoS ONE [*Soil health, Soil amendments, Ecosystem services*]

Sensors [*Soil biology*]

Soil Advances [*Carbon dynamics*]

Sustainability [*Crop management, Soil biology, Soil remediation*]

Water [*Soil hydrology*]