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EMPLOYMENT

2025	–	Present	Plant Scientist, Cropping Systems Research Laboratory, United States Department of Agriculture – Agricultural Research Service, Lubbock, TX
2021	–	2025	Postdoctoral Research Geneticist, Cropping Systems Research Laboratory, United States Department of Agriculture – Agricultural Research Service, Lubbock, TX
2019	–	2021	Postdoctoral Research Associate, School of Plant Sciences, University of Arizona, Tucson, AZ

EDUCATION

2018	Ph.D.	Texas A&M University, College Station, TX. Plant Breeding. Advisor – William L. Rooney, Regents Professor Dissertation Title: “Evaluation and Implementation of Proximal and Remote Sensing Techniques in a Sorghum Breeding Program”
2015	M.S.	Texas A&M University, College Station, TX. Plant Breeding. Advisor – William L. Rooney, Regents Professor Thesis Title: “Heritability and Quantitative Trait Loci for Popping Quality Characteristics in Sorghum Grain”
2012	B.S.	University of Central Oklahoma, Edmond, OK. Biology.

PUBLICATIONS

Peer-Reviewed Publications (Reverse Chronological Order)

23. **Pugh, N. A.**, Goebel, T. S., Escamilla, E., Young, A., & Lascano, R. J. (*In preparation*). Using satellite imagery and predictive modeling to estimate dryland wheat yield at a production field-scale.

22. **Pugh, N. A.**, Young, A., Nesbitt, M., & Hayes, C. (*In review*). Remote Sensing data and machine learning models estimate sorghum grain yield in a plant breeding program. *Plant Phenomics*.

21. Ojeda-Rivera, J. O., Barnes, A. C., Ainsworth, E. A., Angelovici, R., Basso, B., Brindisi, L. J., ... **Pugh, N. A**.… & Buckler, E. S. (2025). Designing a nitrogen-efficient cold-tolerant maize for modern agricultural systems. *The Plant Cell*, *37*(7), koaf139.

20. Goebel, T. S., Mahan, J. R., Payton, P., Young, A., **Pugh, N. A.**, Xin, Z., ... & Lascano, R. J. (2025). Quantifying Temporal Distortions of Artificial UAV Crop Canopy Temperature Measurements. *Advances in Remote Sensing*, *14*(2), 87-102.

19. **Pugh, N. A.**, Young, A., Emendack, Y., Sanchez, J., Xin, Z., & Hayes, C. (2025). High-throughput phenotyping of stay-green in a sorghum breeding program using unmanned aerial vehicles and machine learning. *The Plant Phenome Journal*, *8*(1), e70014.

18. **Pugh, N. A.**, Young, A., Ojha, M., Emendack, Y., Sanchez, J., Xin, Z., & Puppala, N. (2024). Yield prediction in a peanut breeding program using remote sensing data and machine learning algorithms. *Frontiers in Plant Science*, 15, 1339864

17. Hayes, C., Emendack, Y., Sanchez, J., Burke, J., **Pugh, N. A.**, & Xin, Z. (2023). Evaluation of diverse sorghum for leaf dhurrin content and post-anthesis (stay-green) drought tolerance. *Crops*, 3(3), 241-250

16. Xin, Z., Jiao, Y., Burow, G., Hayes, C., Chen, J., Burke, J., **Pugh, N. A.**, & Ware, D. (2023). Registration of 252 sequenced sorghum mutants as a community reverse genetic resource. *Journal of Plant Registrations*, 17(3), 599-604

15. **Pugh, N. A.**, Thorp, K. R., Gonzalez, E. M., Elshikha, D. E. M., & Pauli, D. (2021). Comparison of image georeferencing strategies for agricultural applications of small unoccupied aircraft systems. *The Plant Phenome Journal*, *4*(1), e20026.

14. Deng, X., Thomasson, J. A., **Pugh, N. A.**, Chen, J., Rooney, W. L., Brewer, M. J., & Shi, Y. (2020). Estimating the severity of sugarcane aphids infestation on sorghum with machine vision. *International Journal of Precision Agricultural Aviation*, 3(2). DOI: 10.33440/j.ijpaa.20200302.89

13. Hodnett, G. L., Ohadi, S., **Pugh, N. A.**, Bagavathiannan, M. V., & Rooney, W. L. (2019). Sorghum bicolor x S. halapense interspecific hybridization is influenced by the frequency of 2n gametes in S. bicolor. *Scientific Reports*, DOI: https://doi.org/10.1038/s41598-019-53193-3

12. Nelson, A. D. L., Ponciano, G., McMahan, C., Ilut, D. C., **Pugh, N. A.**, El-shikha, D. E., Hunsaker, D. J., Pauli, D (2019). Transcriptomic and evolutionary analysis of the mechanisms by which P. argentatum, a rubber producing perennial, responds to drought. *BMC Plant Biology,* DOI: https://doi.org/10.1186/s12870-019-2106-2

11. **Pugh, N. A.**, Morgan, C. L. S., Horn, K., Pietsch, D., & Rooney, W. L. (2019). A statistical evaluation of replicated block designs and spatial variability in sorghum performance trials. *Journal of Crop Improvement*, DOI: https://doi.org/10.1080/15427528.2019.1627686

10. Malambo, L., Popescu, S. C., Horne, D.W., **Pugh, N. A.**, & Rooney, W. L. (2019). Automatic detection and characterization of individual sorghum panicles from terrestrial LiDAR data. ISPRS *Journal of Photogrammetry and Remote Sensing,* DOI: https://doi.org/10.1016/j.isprsjprs.2018.12.015

9. Patil, N. Y., **Pugh, N. A.**, Klein, R. R., Martinez, H. S., Martinez, R. S., Rodriguez-Herrera, R., Rooney, W. L., & Klein, P.E. (2019). Heritability and quantitative trait loci of composition and structural characteristics in sorghum grain. *Journal of Crop Improvement*, DOI:10.1080/15427528.2018.1536006

8. Han, X., Thomasson, A. J., Bagnall, G. C., **Pugh, N. A.**, Horne, D. W., Rooney, W. L., Jung, J., Chang, A., Malambo, L., Popescu, S. C., Gates, I. T., & Cope, D. A. (2018). Measurement and calibration of plant-height from fixed-wing UAV images. *Sensors*, DOI: https://doi.org/10.3390/s18124092

7. **Pugh, N. A.**, Han, X., Collins, S. D., Thomasson, J. A., Cope, D., Chang, A., Jung, J., Isakeit, T. S., Prom, L. K., Carvalho, G., Gates, I. T., Vree, A., Bagnall, G. C., & Rooney, W. L. (2018). Estimation of Plant Health in a Sorghum Field Infected with Anthracnose Using a Fixed-Wing Unmanned Aerial System. *Journal of Crop Improvement*, DOI: 10.1080/15427528.2018.1535462

6. **Pugh, N. A.**, Horne, D. W., Murray, S. C., Carvalho, G., Malambo, L., Jung, J., Chang, A., Maeda, M., Popescu, S., Chu, T., Starek, M. J., Brewer, M. J., Richardson, G., & Rooney, W. L. (2018). Temporal Estimates of crop growth in sorghum and maize breeding enabled by unmanned aerial systems. *The Plant Phenome*, DOI: 10.2135/tppj2017.08.0006

5. Malambo, L., Popescu, S. C., Murray, S. C., Putman, E., **Pugh, N. A.**, Horne, D. W., Richardson, G., Sheridan, R., Rooney, W. L., Avant, R., Vidrine, M., McCutchen, B., Baltensperger, D., & Bishop, M. (2018). Multitemporal field-based plant height estimation using 3D point clouds generated from small unmanned aerial systems high-resolution imagery. *International Journal of Applied Earth Observation and Geoinformation*, 64, 31-42. DOI:https://doi.org/10.1016/j.jag.2017.08.014

4. **Pugh, N. A**, Rodriguez-Herrera, R., Klein, R. R., Klein, P. E., & Rooney, W. L. (2017). Identification of Quantitative Trait Loci for Popping Traits and Kernel Characteristics in Sorghum Grain. *Crop Science,* 57(4), 1999-2006. DOI: 10.2135/cropsci2017.01.0029

3. **Pugh, N. A**, Awika, J. M., & Rooney, W. L. (2017). Heritability of popping characteristics in sorghum grain. *Crop Science*, 57(1), 71-77. DOI: 10.2135/cropsci2016.04.0250

2. Shi, Y., Thomasson, J. A., Murray, S. C., **Pugh, N. A.**, Rooney, W. L., Shafian, S., Rajan, N., Rouze, G., Morgan, C. L. S., Neely, H. L., Rana, A., Bagavathiannan, M. V., Henrickson, J., Bowden, E., Valasek, J., Olsenholler, J., Bishop, M. P., Sheridan, R., Putman, E. B., Popescu, S., Burks, T., Cope, D., Ibrahim, A., McCutchen, B. F., Baltensperger, D. D., Avant, R. V., Vidrine, M., & Yang, C. (2016). Unmanned aerial vehicles for high- throughput phenotyping and agronomic research. *PloS one*, 11(7), e0159781. DOI: https://doi.org/10.1371/journal.pone.0159781

1. Brennan Jr, R. E., Caire, W., **Pugh, N. A**, Chapman, S., Robbins, A. H., & Akiyoshi, D. E. (2015). Examination of bats in western Oklahoma for antibodies against Pseudogymnoascus destructans, the causative agent of White-Nose Syndrome. *The Southwestern Naturalist*, 60(2-3), 145-150. DOI: https://doi.org/10.1894/SWNAT-D-14- 00030.1

Conference Proceedings (Reverse Chronological Order)

2. Han, X., Thomasson, J. A., Bagnall, C., **Pugh, N. A.**, Horne, D. W., Rooney, W. L., Malambo, L., Chang, A., Jung, J., & Cope, D. A. (2018). Calibrated plant height estimates with structure from motion from fixed-wing UAV images. In *Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping III* (Vol. 10664, p. 106640D). International Society for Optics and Photonics. DOI: https://doi.org/10.1117/12.2305746

1. Shi, Y., Murray, S. C., Rooney, W. L., Valasek, J., Olsenholler, J., **Pugh, N. A.**, Henrickson, J., Bowden, E., Zhang, D., & Thomasson, J. A. (2016). Corn and sorghum phenotyping using a fixed-wing UAV-based remote sensing system. In *Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping* (Vol. 9866, p. 98660E). International Society for Optics and Photonics. DOI: https://doi.org/10.1117/12.2228737

PROFESSIONAL ACTIVITIES AND PRESENTATIONS

Platform Presentations

2022 ASA, CSSA, SSSA International Annual Meeting in Baltimore, MD (*Invited Speaker*); "Optimal Georeferencing of Aerial Photogrammetry Projects"

2022 Sorghum Improvement Conference of North America *(Invited Speaker*); "Optimal Georeferencing of Aerial Photogrammetry Projects"

2020 Arizona Postdoctoral Research Conference in AZ (*Remote*); "Optimal Georeferencing of Aerial Photogrammetry Projects"

2020 Phenome Conference held at University of Arizona in Tucson, AZ: "Georeferencing of Aerial Photogrammetry via Ground Control Point Optimization and Real-time Kinematic Positioning in Agricultural Fields at Breeding and Production Scale"

2018 Invited Presentation at the 'Sorghum in the 21st Century' Conference in Cape Town, WC, South Africa; "Validation and Implementation of Unmanned Aerial Systems in a Sorghum Breeding Program"

2018 Invited Poster Presentation at the Washington State University Plant Science Symposium in Pullman, WA; "Temporal Estimates of Crop Growth in Sorghum and Maize Breeding Enabled by Unmanned Aerial Systems"

2018 Seminar Presentation at Texas A&M University in College Station, TX; "Temporal Estimates of Crop Growth in Sorghum and Maize Breeding Enabled by Unmanned Aerial Systems"

2018 Student Speaker Award – Oral Flash Presentation at the Texas A&M Plant Breeding Symposium in College Station, TX; "Temporal Estimates of Crop Growth in Sorghum and Maize Breeding Enabled by Unmanned Aerial Systems"

2018 Webinar Presentation for the Plant Phenome Journal Webinar Series; "Temporal Estimates of Crop Growth in Sorghum and Maize Breeding Enabled by Unmanned Aerial Systems"

2017 ASA, CSSA, SSSA International Annual Meeting in Tampa, FL; "Estimation of Biomass Yield and Plant Height in Bioenergy Sorghum Using Unmanned Aerial Systems"

2017 Invited Presentation at the University of Minnesota Plant Sciences Symposium; "Estimation of Plant Height in Sorghum Using Unmanned Aerial Systems"

2016 Keynote Presentation at the Texas A&M University Plant Breeding Symposium, College Station, TX; "Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain"

2014 Presentation at the Sorghum Improvement Conference of North America in Corpus Christi, TX; "Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain"

2014 Seminar Presentation at Texas A&M University in College Station, TX; "Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain"

Poster Presentations

2024 Sorghum Improvement Conference of North America in Oklahoma City, OK; "Assessment of growth and yield potential of a dominant multi-tillering sorghum mutant"

2020 Phenome Conference held at University of Arizona in Tucson, AZ; "Georeferencing of aerial photogrammetry via ground control point optimization and real-time kinematic positioning in agricultural fields at breeding and production scale"

2018 Texas A&M Plant Breeding Symposium in College Station, TX; "Temporal Estimates of Crop Growth in Sorghum and Maize Breeding Enabled by Unmanned Aerial Systems"

2017 Texas Plant Protection Conference in College Station, TX; "Estimation of Disease Presence and Severity in Sorghum Using Unmanned Aerial Systems"

2017 Texas A&M Plant Breeding Symposium in College Station, TX; "Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain"

2015 Tri-society Meeting in Minneapolis, MN; “Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain”

2015 Texas A&M Plant Breeding Symposium in College Station, TX; “Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain”

2014 Texas A&M Horticulture Symposium in College Station, TX; “Heritability and Quantitative Trait Loci for Popping Characteristics in Sorghum Grain”

AFFILIATIONS/ASSOCIATIONS/MEMBERSHIPS

North American Plant Phenotyping Network	Member (2024 – Present)
Crop Science Society of America	Member (2013 – Present)
American Society of Agronomy	Member (2013 – Present)
Soil and Crop Sciences Dept. Climate Committee	Student Member (2017)

GRANTS, HONORS, AND AWARDS

2024 Performance Award – USDA-ARS

2023 Performance Award – USDA-ARS

2022 Invited Speaker – ASA, CSSA, & SSSA International Annual Meeting in Baltimore, MD

2022 Invited Speaker – Sorghum Improvement Conference of North America in Dallas, TX

2019 Yuma Center of Excellence for Desert Agriculture (YCEDA) Seed Funding Program Grant for $10,000 USD

2018 Special Achievement Award for Graduate Student Research in Plant Breeding – Texas A&M Dept. of Soil and Crop Sciences

2018 USDA/NIFA Participant Support and Travel Scholarship to Cape Town, WC, South Africa

2018 Student Travel Award – Washington State University Plant Science Symposium

2018 Oral Presentation Award – Texas A&M Plant Breeding Symposium

2017 Invited Speaker – University of Minnesota Plant Sciences Symposia

2016 Keynote Oral Presentation – Texas A&M University Plant Breeding Symposium

2014 Student Oral Presentations (3rd Place) – Sorghum Improvement Conference of North America

2011 Research Experience for Undergraduates – Texas A&M University Dept. of Biochemistry

2011 Student Research, Creative, and Scholarly Activities (RCSA) Grant

MEDIA AND OUTREACH

Crop Science Society of America; “Popping potential of sorghum” by Danielle St. Louis (https://www.crops.org/science-news/popping-potential-sorghum)

Agrilife Today, Texas A&M University; “Popped Sorghum Making its Way onto Snack Scene” by Kay Ledbetter (http://today.tamu.edu/2016/03/07/popped-sorghum-making-its-way-onto-snack-scene/)

PROFESSIONAL REFERENCES

Zhanguo Xin	Research Molecular Biologist Plant Stress and Germplasm Development USDA-ARS	email: zhanguo.xin@ars.usda.gov phone: (806) 749-5560 ext. 5223
William L. Rooney	Regents Professor Department of Soil and Crop Sciences Texas A&M University	email: wlr@tamu.edu phone: (979) 845-2151
Naveen Puppala	Professor College of Ag, Consumer, and Enviro Sciences New Mexico State University	email: npuppala@nmsu.edu phone: (575) 693-9094
Nithya Rajan	Professor Department of Soil and Crop Sciences Texas A&M University	email: nrajan@tamu.edu phone: (979) 321-5936