

Caio L. dos Santos

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EDUCATION

Ph.D., Crop Production and Physiology

2025

- Department of Agronomy, Iowa State University, Ames, Iowa, US
- Minor in Statistics
- Major advisor: Fernando Miguez
- Dissertation *Quantification and management of spatio-temporal variability in agricultural systems*

M.S., Crop, Soil, and Environmental Sciences

2020

- Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, Arkansas, US
- Major advisors: Larry Purcell and Trent Roberts
- Thesis: *Managing corn nitrogen fertility in Arkansas based on data from an unmanned aerial system*

B.S., Agronomy

2018

- College of Agriculture “Luiz de Queiroz”, University of Sao Paulo, Piracicaba, Sao Paulo, Brazil
- Major advisor: Jose Laercio Favarin
- Thesis: *Determination of the water potential threshold at which rice growth is impacted*

EXPERIENCE

Post-doc research associate

2026 - present

- Department of Agronomy, Iowa State University, Ames, Iowa, US
- Conducted research on methods for analyzing on-farm precision experiments, phenology modeling, and spatial analysis using crop models and remote sensing
- Developed infrastructure and analytical workflows enabling the use of precision agriculture data sets (yield monitor, satellite, weather) for agricultural experimentation
- Collaborated with agronomists, economists, soil scientists, and weed scientists on multi-institutional projects

Graduate research assistant

2020 - 2025

- Department of Agronomy, Iowa State University, Ames, Iowa, US
- Conducted research on methods for analyzing on-farm precision experiments, phenology modeling, and spatial analysis using crop models and remote sensing
- Developed infrastructure and analytical workflows enabling the use of precision agriculture data sets (yield monitor, satellite, weather) for agricultural experimentation
- Collaborated with agronomists, economists, soil scientists, and weed scientists on multi-institutional projects

Graduate research assistant

2018 - 2020

- Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, Arkansas, US
- Conducted research on tissue testing and remote sensing methods to assess maize nitrogen status
- Developed a decision support tool for predicting soybean phenology across the Midsouth
- Designed and conducted growth chamber experiments to investigate the effect of potassium fertilization on soybean stomatal conductance
- Assisted in various experiments assessing drought-resistant soybean wild genotypes, soybean response to sulfur fertilization, soybean stomata response to potassium fertilization, and rice and cotton nitrogen fertilization
- Analyzed drone images to assess maize nitrogen status and soybean canopy temperature

Undergraduate visiting scholar

2017

- Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, Arkansas, US
- Conducted research on soybean phenology and the interaction between maturity groups and planting dates in Arkansas
- Assisted with general research activities, such as grinding, field work, and experiment maintenance

Undergraduate research fellow

2016 - 2017

- Department of Crop Production, University of Sao Paulo, Piracicaba, Sao Paulo, Brazil
- Conducted research on rice biomass response to soil water potential

TEACHING AND INSTRUCTIONAL EXPERIENCE

Instructor of Data Science for Agricultural Professionals (AGRON 5130)

2026

- Iowa State University, Ames, Iowa, US
- This course covered quantitative methods for analyzing and interpreting agronomic experimental and observational data.
- Summary of topics covered:
 - Population and sample statistics
 - Experimental design, hypothesis testing, and treatment comparisons
 - Regression analysis
 - Spatial statistics

Precision on-farm experimentation workshop

2025

- Iowa State University, Ames, Iowa, US
- Workshop organized for the participants of the Horizon II grant to demonstrate the use of the pacu R package for analyzing yield monitor, satellite, and weather data in precision on-farm experiments
- Summary of topics covered:
 - Retrieving and analyzing satellite images
 - Processing as-applied treatment data
 - Processing yield monitor data
 - Analyzing yield response to treatments

Guest Lecturer in Soybean Production (CSES 3322)

2023 and 2025

- University of Arkansas, Fayetteville, Arkansas, US
- This was an undergraduate level class with approximately 30 students
- Taught a lecture on “Soybean development response to temperature and photoperiod”

Teaching assistant in Crop and Soil Modeling (AGRON 5250)

2022 - 2024

- Iowa State University, Ames, Iowa, US
- This was a graduate and undergraduate level class with approximately 15 students
- Provided office hours to help with weekly assignments
- Developed and taught lectures on:
 - Soybean development response to temperature and photoperiod
 - Process-based crop model parameter optimization

Teaching assistant in Crop Development, Production, and Management (AGRON 2800)

2023

- Iowa State University, Ames, Iowa, US
- This was an undergraduate level class with approximately 70 students
- Taught a lecture on “Brazilian agriculture”
- Provided office hours to help with weekly assignments
- Graded weekly assignments

Teaching assistant in Soil Fertility (CSES 5114)

2020

- University of Arkansas, Fayetteville, Arkansas, US
- This was a graduate level class with approximately 30 students
- Provided office hours to help with weekly assignments
- Developed and taught lectures on:
 - History of soil fertility and crop growth

- Plant essential nutrients
- Nutrient mobility, solubility, and deficiency
- Soil pH, salts, and lime requirement
- Soil sampling methods
- Plant and soil analysis
- Soil test extraction methods
- Fertilizer correlation and calibration

MENTORING EXPERIENCE

Rafael Santos Balsanobre

2025

- Undergraduate Agronomy Student
- Department of Crop Production, University of Sao Paulo, Piracicaba, Sao Paulo, Brazil
- Mentored Rafael during the execution of his honors project titled “Growth and development of tropical wheat cultivars sown in the main and second cropping seasons in Brazil”
- Taught concepts of crop physiology and data analysis, helped Rafael understand the scientific method and formulate a scientific question, and will help Rafael write his first scientific publication

PUBLICATIONS

PEER-REVIEWED

1. Pinto, J.G.C., Balboa, G., Mueller, N., Slater, G., Frels, K., **dos Santos**, C.L., Miguez, F.E., Lollato, R., & Puntel, L.A. (2025). Evaluation of APSIM Next Generation for simulating winter wheat growth, yield response to nitrogen, and nitrogen dynamics. *Frontiers in Agronomy*, 7.
2. Pessotto, M.V., Roberts, T.L., **dos Santos**, C.L., Hoegenauer, K., Bertucci, M., Ross, J., & Savin, M. (2025). Use of growing degree days to predict aboveground biomass and total nitrogen accumulation of winter cover crops. *Agrosystems, Geosciences & Environment*, 8, 4.
3. **dos Santos**, C.L. & Miguez, F.E. (2025). Comparative study of yield monitor data processing methods for on-farm agronomic trials. *Agronomy Journal*, 117, 5.
4. Carvalho-Moore, P., Norsworthy, J. K., Porri, A., **dos Santos**, C.L., Barber, T., Sudhakar, S., Meiners, I., & Lerchl, J. (2025). Distribution of glufosinate resistance and glutamine synthetase copy number variation among Palmer amaranth (*Amaranthus palmeri*) accessions in northeast Arkansas. *Weed Science*, 73, e62.
5. **dos Santos**, C.L., & Miguez, F.E. (2024). PACU: Precision Agriculture Computational Utilities. *SoftwareX*, 28, 101971.
6. Pessotto, M. V., Roberts, T.L., Bertucci, M., **dos Santos**, C., Ross, J., & Savin, M. (2023). Determining cardinal temperatures for eight cover crop species. *Agrosystems, Geosciences & Environment*, 6, e20393.
7. **dos Santos**, C.L., Miguez, F.E., King, K.A., Ruiz, A., Sciarresi, C., Baum, M.E., Danalatos, G. J.N., Stellman, M., Wiley, E., Pico, L.O., Thies, A., Puntel, L. A., Topp, C.N., Trifunovic, S., Eudy, D., Mensah, C., Edwards, J.W., Schnable, P.S., Lamkey, K.R., Vyn, T.J. , & Archontoulis, S.V. (2023). Accelerated leaf appearance and flowering in maize after four decades of commercial breeding. *Crop Science*, 1–13.
8. Ruiz, A., Trifunovic, S., Eudy, D.M., Sciarresi, S. C., Baum, M., Danalatos, G.J.N., Elli, E.F., Kalogeropoulos,G., King, K., **dos Santos**, C.L., Thies, A., Pico, L.O., Castellano, M.J., Schnable, P.K., Topp, C., Graham, M., Lamkey, K.R., Vyn, T.J., & Archontoulis, S.V. (2023). Harvest Index has increased over the last 50 years of maize breeding. *Field Crops Research*, 300, 10900.
9. **dos Santos**, C.L.; Abendroth, L.J.; Coulter, J.A.; Nafziger, E.D.; Suyker, A.; Yu, J.; Schnable, P.S.; Archontoulis, S.V. (2022). Maize leaf appearance rates: a synthesis from the United States corn belt. *Frontiers in Plant Science*, 13.

10. **dos Santos**, C.L., T.L. Roberts, & L.C. Purcell. (2021). Leaf nitrogen sufficiency level guidelines for midseason fertilization in corn. *Agronomy Journal*, 113, 1974-1980.
11. **dos Santos**, C.L., T.L. Roberts, L.C. Purcell. (2020). Canopy greenness as a midseason nitrogen management tool in corn production. *Agronomy Journal*. 112, 5279-5287.
12. **dos Santos**, C.L., M. Salmeron, & L.C. Purcell. (2019). Soybean phenology prediction tool for the Midsouth. *Agricultural and Environmental Letters*, 4, 190036.
13. **dos Santos**, C.L., A.F. De Borja Reis, P. Mazzafera, J.L. Favarin. (2018). Determination of the water potential threshold at which rice growth is impacted. *Plants* 7, 48.

UNDER REVIEW

1. Cleveringa, A., **dos Santos**, C.L., & Miguez, F.E. (2025). Introducing the quadratic-plateau-quadratic function: capturing the ups and downs. *Agricultural & Environmental Letters*.
2. **dos Santos**, C.L., Puntel, A. L., Bullock, S.D., & Miguez, F.E. (2025). Improving crop phenology detection through nonlinear modeling of satellite vegetation indices. *Agronomy Journal*.

EXTENSION PUBLICATIONS

1. Purcell, L.C., **dos Santos**, C.L., & Salmerón, M. (2021). Soybean development stage predictions. Cooperative Extension Service, University of Arkansas.
2. Hoegenauer, K. A., Roberts, T. L., Kelley, J. P., Morgan, R. B., & **dos Santos**, C. L. (2020). Investigating corn response to magnesium on a deficient soil in Arkansas. *Arkansas Soil Fertility Studies*, 38.
3. **dos Santos**, C.L., Roberts, T.L., & Purcell, L.C.(2020). Dark Green Color Index as a midseason nitrogen management tool in corn production systems. In N.A.Slaton (eds.). Wayne E. Sabbe Arkansas Soil Fertility Studies 2019, (In press). Arkansas Agricultural Experiment Station, University of Arkansas Division of Agriculture, Fayetteville.
4. **dos Santos**, C.L., Roberts, T.L., & Purcell, L.C. (2020). Nitrogen sufficiency level guidelines for pretassel fertilization in Arkansas. In N.A.Slaton (eds.). Wayne E. Sabbe Arkansas Soil Fertility Studies 2019, (In press). Arkansas Agricultural Experiment Station, University of Arkansas Division of Agriculture, Fayetteville.
5. **dos Santos**, C.L., Purcell, L.C., & Ross, W.J. (2018). Developing a new staging system for soybean. In: J.D. Ross (eds.). Arkansas Soybean Research Series 2016. (In press). Arkansas Agricultural Experiment Station, University of Arkansas Division of Agriculture, Fayetteville.

CONFERENCE ABSTRACTS

1. **dos Santos**, C.L. & Miguez, F. (2025). Modeling spatio-temporal variability of maize yield in on-farm precision experimentation. CANVAS, Salt Lake City, UT.
2. Carvalho-Moore, P., Norsworthy, J., Porri, A., **dos Santos**, C.L., Barber, T., Sudhakar, S., Meiners, I., & Lerchl, J. (2025). Is glufosinate resistance in Palmer Amaranth spreading in Mississippi County, Arkansas? Southern Weed Science Society Annual Meeting, Charleston, SC.
3. **dos Santos**, C.L. & Miguez, F. (2025). Steering clear of noise in on-farm yield data. NC1210 Data Intensive Farm Management Conference, Cleawater, FL.
4. Andrade Pereira, P., Carvalho Costa, K., Elli, E. F., & **dos Santos**, C. (2024). Diverging responses in transpiration of soybean genotypes to vapor pressure deficit. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX.
5. Elli, E. F., Fernandes, S. B., Noia, R. D. S. Jr., & **dos Santos**, C.L. (2024) Soybean phenology adaptation to climate change: a straightforward solution? ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX.

6. **dos Santos**, C.L. & Miguez, F. (2024). PACU: Precision Agriculture Computational Utilities. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX.
7. Cesario Pereira Pinto, J. G., Balboa, G. R., Mueller, N. D., Slater, G. P., Frels, K., **dos Santos**, C.L., Miguez, F., & Puntel, L. A. (2024) Evaluation of apsim next generation for simulating winter wheat growth, phenology, and yield response to N. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX.
8. **dos Santos**, C.L. & Miguez, F. (2024). Steering clear of noise in on-farm yield data. ASA, CSSA, SSSA International Annual Meeting, San Antonio, TX.
9. **dos Santos**, C. L., Puntel, L., Bullock, D. & Miguez, F. (2024). Integrating nonlinear models and remotely sensed data to estimate crop cardinal dates. ICPA-ISPA, Manhattan, KS.
10. **dos Santos**, C., Puntel, L. A., Bullock, D., & Miguez, F. (2023) Integrating nonlinear models and remotely sensed data to estimate crop cardinal dates. ASA, CSSA, SSSA International Annual Meeting, St. Louis, MO.
11. Cesario Pereira Pinto, J. G., Mueller, N. D., Balboa, G. R., **dos Santos**, C., & Puntel, L. A. (2023) Assessing APSIM's performance in simulating winter wheat growth, phenology, and nitrogen uptake in Nebraska. ASA, CSSA, SSSA International Annual Meeting, St. Louis, MO.
12. Di Salvo, J., Elli, E. F., **dos Santos**, C., Damecharla, H., Gilsinger, J., Coulibaly, I., Pita, F., Cavanagh, C., Licht, M. A., Cooper, M., Hammer, G. L., & Archontoulis, S. V. (2021). Modeling growth and development of soybean maturity groups 0 to 7 in Iowa. ASA, CSSA, SSSA International Annual Meeting, Salt Lake City, UT.
13. **dos Santos**, C., Thies, A., Verhagen, G., King, K., Baum, M. E., Sciarresi, C., Di Salvo, J., Wright, E. E., Danalatos, G. J. N., Olmedo Pico, L. B., Mensah, C., Eudy, D., Miguez, F., Topp, C., Trifunovic, S., Lamkey, K. R., Vyn, T. J., & Archontoulis, S. V. (2021) Leaf appearance rates of maize hybrids released from 1980 to 2020. ASA, CSSA, SSSA International Annual Meeting, Salt Lake City, UT.
14. Sciarresi, C., Thies, A., **dos Santos**, C., Baum, M. E., Danalatos, G. J. N., Di Salvo, J., King, K., Ruiz, A., Trifunovic, S., Eudy, D., Topp, C., & Archontoulis, S. V. (2021) Root front velocity in maize hybrids released from 1980 to 2020. ASA, CSSA, SSSA International Annual Meeting, Salt Lake City, UT.
15. Kalogeropoulos, G., **dos Santos**, C., Baum, M. E., King, K., Wright, E. E., Ruiz, A., Lamkey, K. R., Trifunovic, S., Eudy, D., Vyn, T. J., & Archontoulis, S. V. (2021) Leaf area profiles of Bayer maize hybrids released from 1980 to 2020. ASA, CSSA, SSSA International Annual Meeting, Salt Lake City, UT.
16. Hoegenauer, K., Roberts, T. L., Kelley, J. P., Mulloy, R., & **dos Santos**, C. (2019) Investigating the effects of potassium and magnesium application rates on corn. ASA, CSSA and SSSA International Annual Meetings (2019), San Antonio, TX.
17. Mulloy, R., Roberts, T. L., Kelley, J. P., Hoegenauer, K., **dos Santos**, C., Hurst, B., Dillion, D., & Bolton, D. (2019). Do side-dress nitrogen rates influence pre-tassel nitrogen uptake in corn? ASA-CSSA-SSSA International Annual Meeting, November 11, San Antonio, Texas.
18. Hurst, B., Roberts, T.L., Ross, W.J., Mulloy, R., Dillion, Dr., **dos Santos**, C.L., Hoegenauer, K., Bolton, D., Short-term influence of winter cover crops on yield in a corn-soybean rotation. ASA-CSSA-SSSA Internation Annual Meeting, November, 11, San Antonio, Texas.
19. **dos Santos**, C.L., M. Salmeron, L.C. Purcell. (2019). Soybean phenology prediction tool for the Midsouth, ASA-CSSA-SSSA International Annual Meeting, November 11. San Antonio, Texas.
20. **dos Santos**,C.L., T.L. Roberts, & L.C. Purcell. (2019). Managing corn nitrogen fertility based on data from an unmanned aerial system, ASA-CSSA-SSSA International Annual Meeting, November 11. San Antonio, Texas.
21. **dos Santos**, C.L., M. Salmeron, L.C. Purcell. (2019). Soybean phenology prediction tool for the Midsouth, Arkansas Crop Protection Association Meeting, November 19. Fayetteville, Arkansas.
22. **dos Santos**,C.L., T.L. Roberts, & L.C. Purcell. (2019). Managing corn nitrogen fertility based on data from an unmanned aerial system, Arkansas Crop Protection Association Meeting, November 20. Fayetteville, Arkansas.

23. dos Santos, C. L., J.L.C. Baptista, & R.A. Migliavacca. Desenvolvimento das raízes do algodoeiro submetidas a doses crescentes de fertiliz antes minerais e organominerais. In: 14º Encontro nacional de plantio direto na palha, (2014), Bonito. Anais do 14º Encontro nacional de plantio direto na palha. Dourados: Embrapa Agropecuária Oeste, 2014. v. 1.

FELLOWSHIPS, HONORS, AND AWARDS

Oustanding Paper Award	2025
• Paper titled “Determining Cardinal Temperatures for Eight Cover Crop Species”	
• ASA-CSSA-SSSA,	
Research Excellence Award	2025
• Graduate College, Iowa State University	
3rd Place in the PhD Poster Competition	2024
• Precision Agriculture Systems Community, CANVAS, San Antonio, Texas, US	
Preparing Future Faculty Fellow	2024
• Graduate College, Iowa State University	
Agronomy Teaching Fellowship	2023
• Department of Agronomy, Iowa State University	
Outstanding Master’s Student	2020
• Department of Crop, Soil, and Environmental Sciences, University of Arkansas	
2nd Place in the master’s division at Gamma Sigma Delta Student Competition	2019
• Fayetteville, Arkansas, US	
Undergraduate Research Fellowship	2017
• The São Paulo Research Foundation (FAPESP)	
<i>Research title: Determination of the water potential threshold at which rice growth is impacted</i>	

SOFTWARE AND RESEARCH TOOLS

pacu: Precision Agriculture Computational Utilities	2024
• https://github.com/cldossantos/pacu	
• R package for working with precision agriculture data, such as yield monitor, satellite, and weather.	
nlraa: Nonlinear Regression for Agricultural Applications	2023
• https://cran.r-project.org/package=nlraa	
• Authored the functions “SScard3” and “SSscard3” to fit cardinal temperature responses	
Soystage – Online decision support tool for the Midsouthern U.S.	2019
• http://soystage.uark.edu	
• Webtool that predicts timing of lifecycle events for soybeans grown in the Midsouthern US.	

PROFESSIONAL SERVICE AND LEADERSHIP

Member of the Curriculum Committee of the Crop, Soil, and Environmental Sciences Major	2019
• University of Arkansas, Fayetteville, Arkansas, US	
President of the Crop, Soil, and Environmental Sciences Graduate Student Club	2019
• University of Arkansas, Fayetteville, Arkansas, US	
Vice president of the Crop, Soil, and Environmental Sciences Graduate Student Club	2018
• University of Arkansas, Fayetteville, Arkansas, US	

PROFESSIONAL MEMBERSHIPS

American Society of Agronomy (ASA)	2018 - present
Crop Science Society of America (CSSA)	2018 - present
Soil Science Society of America (SSSA)	2018 - present
International Society of Precision Agriculture	2024 - present

LANGUAGES

English - Fluent
Portuguese - Native

PROGRAMMING LANGUAGES

R, Python, C#, and JavaScript