

# Germano Costa-Neto

## Predictive Breeding & Quantitative Genetics

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## EDUCATION

- **PhD Genetics & Plant Breeding (2021), University of São Paulo, Piracicaba, São Paulo, BR**

*Thesis:* Enviromics, nonlinear kernels and optimized training sets for a climate-smart genomic prediction of yield plasticity in maize

*Advisor:* Roberto Fritsche-Neto (USP) & Jose Crossa (CIMMYT)

- **MS Plant Breeding (2017), Federal University of Goiás, UFG: Goiânia, Goiás, BR**

*Thesis:* Integrating environmental covariates and thematic maps in genotype-environment interaction analysis in upland rice

*Advisor:* João Batista Duarte (UFG) & Adriano Pereira de Castro (Embrapa)

- **BS Agronomy (2015), Federal University of Goiás, UFG: Goiânia, Goiás, BR**

*Thesis:* On the use of crop simulation models to support environmental characterization in rice

*Advisor:* Alexandre Bryan Heinemann (Embrapa)

## AWARDS

2019 Winner at Rolland Vencovsky Award, III International Meeting on Plant Breeding/Corteva

2018 Finalist at Rolland Vencovsky Award, II International Meeting on Plant Breeding/Corteva

2017 Finalist at Young Talent Award, Embrapa Rice & Beans

## APPOINTMENTS

- 2021-present **Postdoctoral Associate in Genomics**

Institute for Genomic Diversity, Cornell University, Ithaca, NY, U.S.

*Objective:* Develop prediction-based tools merging different sources of omics

*Manager:* Edward Buckler

- 2021 **External Consultant (CGIAR Expert)**

International Maize and Wheat Improvement Center (CIMMYT): Remote

*Objective:* Implement envirotyping-aided approaches for optimize genomic prediction platforms

*Manager:* Jose Crossa & Juan Burgueño

- 2020 **Research Intern at Biometrics and Statistic Unit (BSU/CIMMYT)**

International Maize and Wheat Improvement Center (CIMMYT): Texcoco, MX

*Manager:* Dr José Crossa

- **2018-2021 Graduate Researcher (Quantitative Genetics in Maize Breeding)**  
Allogamous Plant Breeding Laboratory (Prof. Roberto Fritsche-Neto' Lab): Piracicaba, São Paulo, BR  
*Objective:* Develop data-driven tools to interplay ecophysiology and genomic selection for diverse environments
- **2018-2021 Remote Freelancer Consultant in Statistics for Marketing & Product Development**  
Limagrains Field Seeds (Marketing Sector, as an external consultant): Londrina, Paraná, BR  
*Objective:* Develop computational solutions to easy field-testing analysis of pre-commercial cultivars  
*Manager:* Lee Anderson Porto (2018-2020); Leandro Santos (2020).
- **2015-2017 Graduate Research Assistant at Rice Breeding Program**  
Brazilian Agricultural Research Corporation (EMBRAPA): Santo Antônio de Goiás, Goiás, BR  
*Objective:* Develop techniques to better use environmental data in cultivar testing and typing target regions;  
*Manager:* Alexandre Bryan Heinemann; Adriano Pereira de Castro
- **2017 Lecturer in Biostatistics**  
Universidade Paulista-Instituto Objetivo, Goiânia, Goiás, BR  
*Objective:* Develop teaching and communication skills
- **2013-2015 Undergraduate Research Assistant at Ecophysiology Lab of Embrapa**  
Brazilian Agricultural Research Corporation (EMBRAPA): Santo Antônio de Goiás, Goiás, BR  
*Objective:* Develop programming skills for modeling biological process of plants growth and development;  
*Advisor:* Alexandre Bryan Heinemann
- **2011-2013 Undergraduate Research Assistant at Agrometeorology Lab of UFG**  
Federal University of Goiás, UFG: Goiânia, Goiás, BR  
*Objective:* First contact with scientific research focused on modeling crops growing environments  
*Advisor:* Prof. Derblai Casaroli; Prof. Vládia Correchel.

## REFEREED PUBLICATIONS (last 2 years)

Costa-Neto, G., and Fritsche-Neto, R. (2021). Enviromics: bridging different sources of data, building one framework. *Crop Breeding and Applied Biotechnology* 21, 393521–393533. doi:10.1590/1984.

Fritsche-Neto, R., Galli, G., Costa-Neto, G., Borges, K. L. R., Alves, F. C., Sabadin, J.F., Lyra, D. H., Morais, P.P.P., Andrade, L.R.B., Granato, I., and Crossa, J. Optimizing genomic-enabled prediction in small-scale maize hybrid breeding programs: a roadmap review (under review, review paper for the Genomic Selection Edition of the *Frontiers in Plant Science*) doi: 10.3389/fpls.2021.658267

Crossa, J., Fritsche Neto, R., Montesinos-López, O.A., Costa-Neto, G., Dreisigacker, S., Montesinos-López, A., and Bentley, A.R. (in press). The modern plant breeding triangle: optimizing the use of genomics, phenomics and enviromics data. *Frontiers in Plant Science* doi:10.3389/fpls.2021.651480

Costa-Neto, G., Galli, G., Carvalho, H. F., Crossa, J., and Fritsche-Neto, R. (2021). EnvRtype: a software to interplay enviromics and quantitative genomics in agriculture. *G3 Genes/Genomes/Genetics*. doi:10.1093/g3journal/jkab040.

Galli, G., Sabadin, J.F., Costa-Neto, G. and Fritsche-Neto, R. (2020) A novel way to validate UAS-based high-throughput phenotyping protocols using in silico experiments for plant breeding purposes. *Theoretical and Applied Genetics*. <https://doi.org/10.1007/s00122-020-03726-6>

Costa-Neto, G., R. Fritsche-Neto, and Crossa, J. (2020) Nonlinear kernels, dominance, and envirotyping data increase the accuracy of genome-based prediction in multi-environment trials. *Heredity* (Edinb) <https://doi.org/10.1038/s41437-020-00353-1>

Costa-Neto, G., O. P. Morais-Júnior, A. B. Heinemann, A. P. de Castro, and J. B. Duarte (2020) A novel GIS-based tool to reveal spatial trends in reaction norm: upland rice case study. *Euphytica* 216: 1–16. <https://doi.org/10.1007/s10681-020-2573-4>

Costa-Neto, G., Duarte, J. B., de Castro, A. P., and Heinemann, A. B. (2020) *Uso de Informações Ambientais na Modelagem e Interpretação da Interação Genótipo × Ambiente*. Embrapa Rice & Beans Boletim, Santo Antônio de Goiás [Portuguese for ‘Use of environmental information in modeling and interpreting G×E’]

Costa-Neto, G., Galli, G and Fritsche-Neto, R. (2019) Genomic × envirotyping kernels drive to a better prediction and understanding of maize yield plasticity, III International Meeting in Plant Breeding (conference-poster)

Costa-Neto, G., Galli, G. and Fritsche-Neto, R. (2019) Ecophysiological models improve prediction accuracy in genomics-assisted maize breeding. 10th Brazilian Congress in Plant Breeding (conference-poster)

Heinemann, A. B., J. Ramirez-Villegas, J., Rebolledo, M. C., Costa Neto, G., and Castro, A. P. (2019) Upland rice breeding led to increased drought sensitivity in Brazil. *F. Crop. Res.* 231: 57–67. <https://doi.org/10.1016/j.fcr.2018.11.009>

Costa-Neto, G. and Heinemann, A. B., (2018) Envirotyping for identifying regional impacts in upland rice breeding strategies over the last 30 years in Brazil. II International Meeting in Plant Breeding (conference-poster)

## **WORKS IN DEVELOPING (under review)**

Costa-Neto, G., Crossa, J. and Fritsche-Neto, J Enviromic assembly increases accuracy and reduces costs of the genomic prediction for yield plasticity. *Article* (Abstract accepted, under review)

Gervatovsky, R., Carvalho, H. F., Costa-Neto, G., Montesinos-López, O.A., Crossa, J. and Fritsche-Neto, J Enviromic-based Kernels Optimize Resource Allocation with Multi-trait Multi-environment Genomic Prediction for Tropical Maize. *Article* (under review)

Heinemann, A. B., Costa-Neto, G. and da-Matta, D. H. Enviromic prediction is useful in defining the limits of climate adaptation for dry beans in Brazil (Abstract accepted, under review)

## **INVITED TALKS**

- EnvRtype: tutorial for implementing a envirotyping pipeline in R, *Workshop*, UFS, 2021 (remote)
- Corteva PhD student Seminar, Remote, 2021
- Modeling G×E using phenotypic, genomics and enviromics. *Workshop EuGeM, UFG*, 2021
- Envirotyping-informed tools for G×E analysis. *I Interagen, Plant Science Symposia Series*, Brazil, 2020
- Envirotype-to-phenotype modeling in genomic prediction across multiple environments. *ESALQ Seminars*, 2020
- Genotypic adaptation by factorial regression and geographical covariates. *VII International Symposium on Genetics and Breeding*, 2016

## SOFTWARE

I develop the following software:

- E2PA (envirome-phenome association analysis, under development) *R package*
- EnvRtype (interplay enviromics and genomics in agriculture) *R package*, <https://github.com/allogamous/EnvRtype>
- frGIS (with thematic maps for crop adaptation diagnosis) *R package*, available at: <https://github.com/gcostaneto/frGIS>