# Germano M F Costa-Neto

Quantitative Genetics, Phenomics & Envirotyping

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Brazilian, 30 year-old, married, one-child.

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## EDUCATION

- PhD Genetics & Plant Breeding (2018-expected June 2021), University of São Paulo, Piracicaba, São Paulo, BR
  - *Thesis*: Novel enviromic-aided approaches for genomic prediction in maize across diverse environments
  - *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
  - *Adivsor*: João Batista Duate (UFG) & Adriano Pereira de Castro (Embrapa)
- BS Agronomy (2015), Federal University of Goiás, UFG: Goiânia, Goiás, BR
  - *Thesis*: Use of crop simulation models to support environmental characterization in rice
  - *Advisor*: Alexandre Bryan Heinemman (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

- 2018-present    PhD Candidate fellow on Quantitative Genomics and Enviromics
  - 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
- 2020    Research Intern at Biometrics and Statistic Unit (BSU/CIMMYT)
  - International Maize and Wheat Improvement Center (CIMMYT)**:** Texcoco, MX
  - *Objective:* Gather experience in predictive breeding applications over a global company
- 2018-2020    Remote Freelancer Consultant in Statistics for Marketing & Product Development
  - Limagrain 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 and apply 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)

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 Boletin, 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 (next 6 months)**

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)

Costa-Neto, G., Borges, K. L. and Fritsche-Neto. On the importance of additive and dominance marker effects in modeling the reaction-norm in tropical maize. *Article* (in preparation)

Crossa, J., Montesinos-López, O,. Pérez-Rodríguez, P., Costa-Neto, G., Montesinos-López, A., Fritsche-Neto, R., Martini, J.W.R., Ortiz, R., Cuevas, J., Rincent, R. Genome and environment based prediction models and methods of complex traits incorporating genotype × environment interaction *Book Chapter in press*

Costa-Neto, G., Borges, K. L. and Fritsche-Neto. Envirome-to-phenotype associations for modeling unstructured covariance matrix of environmental relatedness in genomic prediction. *Article* (in preparation)

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)

Fritsche-Neto, R., Galli, G., Alves, F. C., Sabadin, J.F., Lyra, D. H., Costa-Neto, G., Morais, P.P.P., Andrade, L.R.B., Granato, I., Borges, K. L. R. and Crossa, J. Optimizing training sets and models to predict tropical maize hybrids  (under review, review paper for the Genomic Selection Edition of the *Frontiers in Plant Science*)

Costa-Neto, G., Montesinos-López, O., Crossa, J. and Fritsche-Neto. [provisional] Deep Learning and Crop models for G×E analysis *Article* (in preparation).

**INVITED TALKS**

- Envirotyping-informed tools for G×E analysis. *I Intergen, 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