



5th – Genomic Selection in Plant Breeding A hands-on short course in R

1-4 SEPTEMBER 2020

Lanzarote Island, SPAIN

Instructors:

Dr. Julio Isidro Sanchez

Dr. Deniz Akdemir

Contents

1	Course Description. Why a course in Genomic Selecion.	2
2	Target Audience and Prerequisites	2
2.1	Prerequisites	2
3	Program	3
3.1	Day 1-June 2 nd	3
3.2	Day 2-June 3 rd	3
3.3	Day 3-June 4 th	3
3.4	Day 4-June 5 th	4
4	Costs	4
5	Computers	4
6	Location	4
7	Online registration	4
8	Accommodations	4
9	Contact	5

1 Course Description. Why a course in Genomic Selecion.

The rapid decline in the costs of genotypic profiling per individual has led to a great explosion of many forms of data in the phenotypic-genomic spectrum in recent years in the forms of marker and sequence information, gene expression phenotypes, chromatin structure, RNA expression, protein, biochemical traits, physiological traits, metabolomics and microbiome data enriched with annotations; which, in turn, is leading to the development of new genetic tools that are transforming the way we understand biology as a whole.

Genomic selection (GS) is a new breeding approach that uses genome-wide molecular markers in prediction of breeding values for multi-genic quantitative traits. Many public and private breeding efforts have adopted GS as a new breeding tool.

The aim of this course is to provide a basic quantitative and statistical framework to apply GS in a routine manner. In this sense, the course is focusing on the application of plant breeding concepts through practical exercises in R. The course will provide participants with the relevant theory of GS models, as well as with hands-on experience with relevant GS techniques.

The learning outcomes upon course completion are:

- To have the fundamental knowledge to build GS models from the scratch.
- To have a basic understanding of the main statistical concepts of GS methods.
- To learn how to apply GxE models, Multi-trait analysis and Hybrid prediction.
- To learn about optimal parental contributions and mating designs for multi-criteria breeding.

A certificate of attendance will be provided at the end of the course. This course will be equivalent to 2.5 credits. For those participants who wish to obtain a certificate of attendance of the equivalence of 2.5 credit module, a series of reading and exercises will be provided before, during and after the course to assure the student achieves the learning outcomes.

2 Target Audience and Prerequisites

The course is aimed at plant breeder scientists, graduate students, postdocs and professionals in the field of plant-crop production who are interested to learn concepts in a problem-based learning approach.

2.1 Prerequisites

Although, the course is not aimed at researchers with advanced statistical skills. Participants should be familiar with plant breeding and statistical concepts. Course tutorials will use statistical packages in R, and experience is R is recommended but is not essential.

3 Program

3.1 Day 1-June 2nd

Quantitative Genetics/R programming/ Linear models

We will focus on quantitative genetics, especially on:

- Review of Quantitative genetics/ Quantitative trait loci
- Sources of quantitative trait variation
- Breeding Values and Heritabilities
- Response from selection
- Resemblance among relatives
- Big Picture of Genomic selection/ Machine learning approach
- Linear Models/ANOVA/GLM

3.2 Day 2-June 3rd

Genomic Selection in R

- Factors affecting Genomic Selection.
- Optimization of GS.
- Fixed-Random Effects
- Best Linear Unbiased Estimator
- Best Linear Unbiased Predictor

3.3 Day 3-June 4th

Statistical concepts for Genomic Selection analysis in R

- Pedigree vs Kinship matrix
- Imputation
- Statistical Models
- Genotype X Environment interaction
- Multi-trait analysis
- Hybrid prediction

3.4 Day 4-June 5th

- One-step model
- Two-Step models
- Cross-Validations
- Parental proportion and genomic mating

4 Costs

- Regular fee: €899
- Student fee: €499

These fees include, morning and afternoon breaks and one group dinner. Accommodations are not included. Scholarships or reduced fees are unavailable.

5 Computers

Class notes will be distributed during the course, and a Dropbox/Google drive folder will be used to share R code, lectures and exercises. Please bring your personal. R and Rstudio should be installed in your computer to run the analysis.

6 Location

The tentative main hub for the course will be the Cabildo of Lanzarote's within the Public Library <https://goo.gl/maps/B9vah7EWXWFzW4wA6>. If you want to visit Lanzarote, check this video https://www.youtube.com/watch?time_continue=128&v=bntfbxTLF4Y.

7 Online registration

Space is limited to 25 participants. At the bottom of the website, www.gscourse.com, there is a registration link. Please click in your option, and enter your details. Registration is complete when you pay the fee of the course.

8 Accommodations

Participants are responsible for their own accommodation. There are many hotel options in the area, this is an example <https://goo.gl/maps/FEGCp5YpbUs>. Airbnb <https://www.airbnb.es> is a great option too.

9 Contact

For further information do not hesitate to contact me. jisidro@upm.es.

Note: Organizers could cancel the course due to unforeseen circumstances or if the number of participants in less than 10.