

Welcome to our training session !

Modern Plant Breeding

Beginner level

December 2021

Сколковский институт науки и технологий

Учебно-научный центр биотехнологии растений

Программы повышения квалификации,
краткосрочные курсы и семинары для специалистов,
работающих в селекции и семеноводстве растений

Современные технологии в селекции растений

Трехуровневая программа для селекционеров

Биотехнология в селекции растений

Трехуровневая программа для селекционеров,
генетиков и биотехнологов

Лабораторные практикумы

Серия практических семинаров по молекулярным и
клеточным технологиям

Летняя школа по современным технологиям в селекции растений для студентов бакалавриата

SciTrain Center of Plant Biotechnologies

Concepts of training Modern Plant Breeding

From a survey of the needs of Russian companies

Modern Plant Breeding Track

Scientific Training Center of Plant Biotechnologies: Skoltech
Educational Program in the frame of Technology Transfer
Project - Courses Curriculum

Module I. "How to carefully manage and characterize germplasm?"

Beginner Level

- How to multiply/maintain 'pure' germplasm?
- How to obtain/exchange genetic resources?

Regular Level

- How to create new genetic resources?
- How to characterize genetic diversity within germplasm? ← Population genetics

Advanced Level

- How to deeply characterize genetic diversity within germplasm from high-throughput genomic data?
- How to detect association between genomic variation and pedoclimatic conditions?

Module II. "How to make the best of phenotypic evaluation for key quantitative traits?"

Beginner Level

- How to deal with environment heterogeneity? RCB
- How to implement a well-suited experimental design for a powerful analysis? Augmented Block Design
- Mixed Linear Models (Fixed, random effects, BLUEs/BLUPs) and phenotypic prediction from unbalanced phenotypic dataset.

Regular Level

- How to phenotype large germplasm collections?

Advanced Level

- How to deal with large multi-environment/multi-year trials (MET)?

Module III. "How to decipher genetic control of key qualitative & quantitative traits? How such knowledge helps in plant breeding?"

Beginner Level

- Genetic analysis for qualitative traits (Mendelian laws, classical allelic ratios, χ^2 test, recombination fraction, genetic distance)

Regular Level

- How to analyse genetic architecture of quantitative traits and detect QTLs?

Advanced Level

- How to perform Genomic Prediction?

- How to decide which type of cultivars to be developed?
- Types of cultivars depending on reproduction modes, heterosis, easiness to control crosses (pure (isogenic ?) lines, hybrids -single and multiple cross-, blends, synthetic cultivar, populations...)
- Types of families (half-sib and full-sib)

- How to choose parental lines?

- How to select the best selection methods adapted to my breeding goals and means?

Beginner Level

1. Mass selection
2. Pedigree selection
3. Bulk method
4. Single-seed descent
5. Recurrent selection
6. Recurrent Reciprocal selection
8. Back-Cross
9. Clonal selection in asexually propagated plants

Module IV. "How to efficiently conduct a plant breeding program?"

- How to speed up breeding programs?

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Module IV. "How to efficiently conduct a plant breeding program?"

Beginner Level

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- How to speed up breeding programs?
- How to breed for disease resistant varieties when resistance is controlled by dominant or recessive major genes? (to be kept for 'tolerance to biotic stresses' dedicated workshop?)
- How to select the best parental lines for breeding hybrids and synthetic populations ?
- Breeding programs supported by QTL analysis:
 - Foreground/background selection
 - Foreground. F2 enrichment
 - Background. Advanced backcross (AB) QTL analysis
 - Marker Assisted-Recurrent Selection (MARS)
 - (Simple) multi-trait selection based on phenotypic data
- How to produce F1 hybrid seeds in a cost-effective way?
- When and how to integrate Genomic Selection in plant breeding programs?
- Plant Breeding project

Regular Level

Advanced Level

Module V. "How to use molecular markers to help and speed up plant breeding programs?"

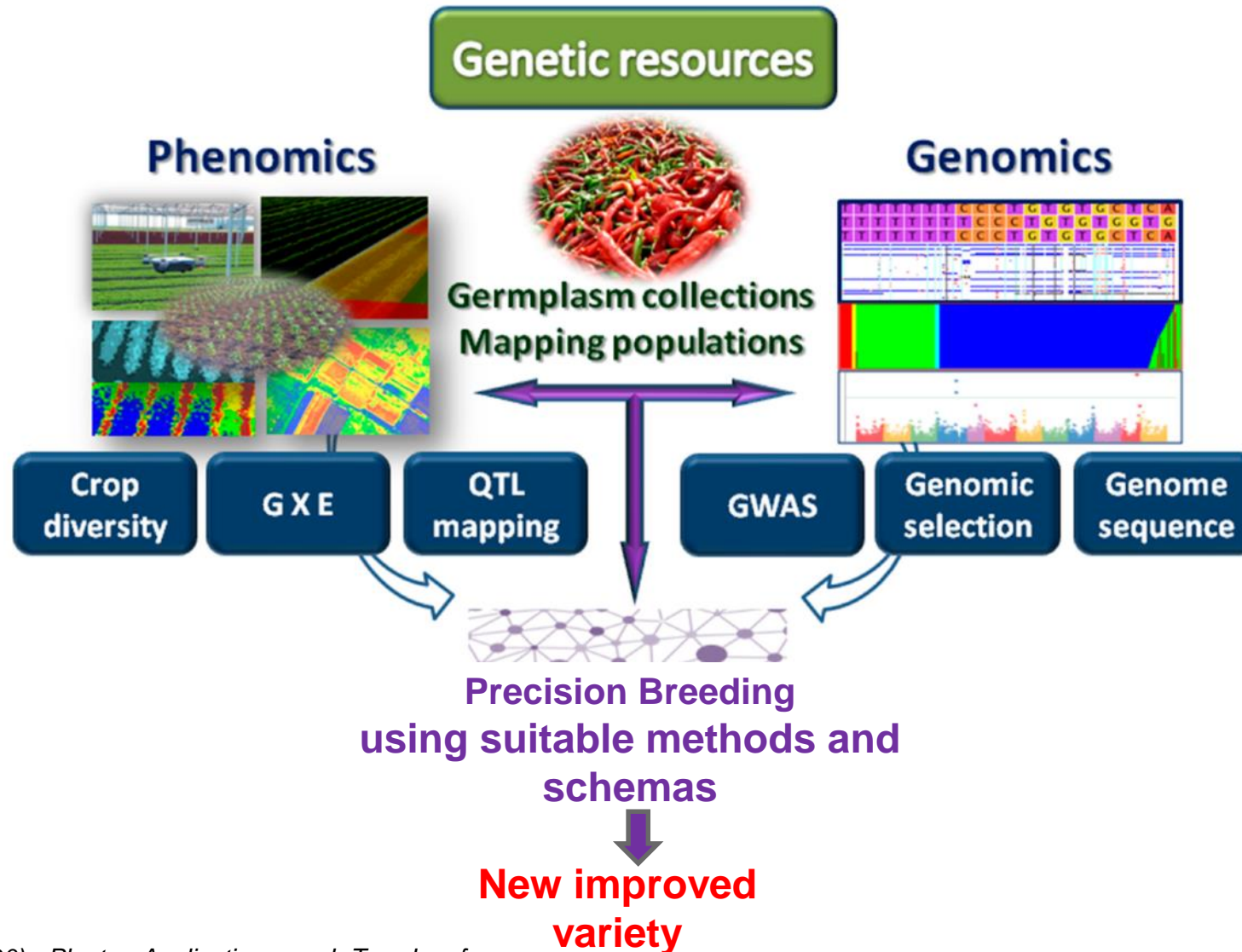
Beginner Level

- Practical 'at the bench' Workshop. I: Analysis of genetic diversity on candidate genes and loci in a collection of natural accessions or segregating populations from (bi-)parental crosses.
- Practical 'at the bench' Workshop. II: Species/variety purity (DHS)
- Practical 'at the bench' Workshop. III: GMO detection?
- How to develop molecular markers following QTL detection analysis?
- How to perform high-throughput genotyping?
- How to computationally deal with high-throughput genotyping data?

Regular Level

Advanced Level

What will we talk about? What will we learn with M.P.B. ?



Project Center for AgroTechnologies, mission:

Mission

To provide new tools and techniques for implementing modern breeding techniques in plants and animals, to address the question of digital agriculture in optimizing decisions and practices in agriculture, and to contribute to secure the seed, semen, food and feed sectors in Russian Federation

Strategic goal

To establish at Skoltech a highly impactful interdisciplinary center of fundamental and problem-driven research aimed at advancing our knowledge and innovations in the agriculture sector in the broad sense, with particular dedication to the relationships with industrial partners

Main Objectives

- To design a coherent research structure through the combination of computational, big-data and experimental approaches in plant and animal sciences, and including economical analyses.
- To build a sustainable system for continuous generation of **innovative and practically applicable tools** transferred into spin-off / start-ups for potential commercial exploitation.
- To build a new **application-oriented model of education** for Masters and PhD students in Agronomy for training executives and specialists capable of leading and improving the food, feed and agro-supply sectors.
- To **train current specialists** from the Russian leading research centers and agro companies, using a combination of online and innovative skills-based methods.
- To **establish** formal **Joint Laboratories** between Skoltech and leading industries
- To serve as a **focal point of international collaborations** with leading international initiatives and BRICS countries.
- To lead **fundraising** activities for project on digital agriculture and implementation of new breeding technologies.