

Intensive Study Programme on Hybrid Breeding

5-18 February 2017

This Intensive Study Programme (ISP) on Hybrid Breeding was organized at Ghent University – Faculty of Bioscience Engineering. 14 students followed the programme: 7 UPV + 3 SLU + 3 UGent + 1 Ege University.

Learning outcomes

When completing this training, participants:

- Have an insight into the main crop varieties that are commercialized as hybrids
- Understand the scientific developments supplying new elements to create hybrids
- Understand the legal restrictions regarding access to germplasm, biosafety and intellectual property rights
- Are able to link the theory with visits to practical breeding activities
- Can present a case study to an audience of international students and local plant breeders

General objectives

- To provide a training on a specialized topic which is not available at most universities
- To share knowledge and expertise between students/teaching staff in the field of plant breeding
- To give participants an intercultural experience because the class group consists of students from different countries

Programme

The first week of the programme consisted of theoretical classes, during the second week visits to breeding companies and research institutions have been made. On the last Friday the students has to do a multiple choice exam and present the group work they have been preparing during the 2 weeks of the programme. In annex 1 the detailed programme is included.

List of participants

In annex 2 the list of participants is included.

ANNEX 1

Detailed programme of the ISP Hybrid Breeding

WEEK 1: WORKSHOPS PLANT BREEDING

Description: A majority of crop varieties (arable crops, vegetables, ornamentals, energy crops) is commercialized as hybrids. Scientific developments continuously supply new elements to create hybrids. Emerging opportunities are confronted with legal restrictions regarding access to germplasm, biosafety and intellectual property rights. The intensive program will highlight important issues in all these topics, linking theory with visits to practical breeding activities.

- Sunday 05/02: arrival of the participants
- Monday 06/02:
 - 8.30: **'Welcome to the faculty' by Hilde Vandecasteele**
 - 9.00: **'Introduction to the case study' by Stefaan Werbrouck**
 - 9.30-15.00 **'Methods / Hybrid Breeding Systems' (Dirk Reheul)**

One of the most important insights in plant breeding was the observation that hybrid (F1) progeny typically are superior in size, growth characteristics and yield in comparison to their homozygous parents, a phenomenon known as heterosis. Its underlying driving mechanisms may be multiple and are unfortunately poorly understood. Nevertheless, it is widely adopted in plant breeding. Selection schemes, male sterility induction, heterosis, ... will be discussed.
- Tuesday 07/02:
 - 9.00: **"Doubled haploids and chromosome engineering." (Rob Dirks)**
 - 10.45: **"Meiotic cell division and recombination: fundamentals and applications in breeding." (Nico De Storme)**
 - 13.30: **"The good and bad of polyploidy." (Danny Geelen)**
 - 15.15: **"Reverse breeding and genomic selection, the disruptive tandem." (Steven Maenhout) - A1.066 (PC-Room D)**

Reverse breeding (RB) is a novel plant breeding technique designed to directly produce parental lines for any heterozygous plant, one of the most sought after goals in plant breeding. RB generates perfectly complementing homozygous parental lines through engineered meiosis. The method is based on reducing genetic recombination in the selected heterozygote by eliminating meiotic crossing over. Male or female spores obtained from such plants contain combinations of non-recombinant parental chromosomes which can be cultured in vitro to generate homozygous doubled haploid plants (DHs). From these DHs, complementary parents can be selected and used to reconstitute the heterozygote in perpetuity. Since the fixation of unknown heterozygous genotypes is impossible in traditional plant breeding, RB could fundamentally change future plant breeding. In this seminar, various applications of RB will be discussed

- Wednesday 08/02:
9:30 -12:30: **'Plant Breeders Right-patent' (Philippe de Jong - Altius IP Attorney office)**

Plant breeder's rights (PBR) are exclusive commercial rights for a registered variety of plant. The rights are a form of intellectual property (IP), like patents and trademarks. But what is the exact difference? Which exclusive rights does it give? What are the exceptions? What can be registered? What is a new variety, an essentially derived variety and a dependent variety? Are recent plant patent cases a threat to PBR? How to deal with GMO's with patented genes?

13:30-15:00: **'Nagoya protocol' (Stefaan Werbrouck)**

The Nagoya Protocol provides a transparent legal framework for the effective implementation of the fair and equitable sharing of benefits arising out of the utilization of genetic resources. For the breeder, who was used to freely collect germplasm all over the world, this is a dramatic change. What is the Nagoya Protocol and what is its objective? What does the Nagoya Protocol cover? What are the core obligations of the breeder with respect to genetic resources? How does the Nagoya Protocol address traditional knowledge associated with genetic resources and genetic resources held by indigenous and local communities?

- Thursday 09/02:
9.30-12.30: **'GM Crops & Biosafety' (Sylvie De Buck)**
While the technology of changing the genome of plants has been gradually refined and increasingly implemented, the commercialization of GM crops has exploded, but not in Europe. Concerns of ecological and food biosafety have escalated beyond scientific rationality and the popular press, stimulated by colourful protest groups, has left the general public with a sense of imminent danger. What is the real risk and how does the European GMO legislation cope with science? Classical transformation technologies will be compared with new genome editing technologies, which cannot be distinguished anymore from natural mutants. Will CRIPR-CAS revolutionize plant breeding? Are the resulting varieties GMO's?
- Friday 10/02:
9.30-12.30: **'Interspecific Hybridisation in vitro technologies' (Stefaan Werbrouck)**
Interspecific hybridization, the process of interbreeding between individuals of different species, often fails, due to early abortion. Embryo rescue is used to assist in the development of plant embryos that otherwise might be aborted before becoming viable plants. Offspring produced by hybridization may be fertile, partially fertile, or sterile. In the latter case, the technique has to be combined with chromosome doubling. Somatic hybridization (Protoplast fusion) produces symmetric or asymmetric hybrids, or cybrids. In extreme cases they have the nuclear genome of only one fusion parent but the cytoplasm of both the fusion partners. Bottleneck is the in vitro plant regeneration. Also artificial in vitro graft chimeras will be discussed, as they allow to combine two plant species (or genera) in one plant.
- Saturday 11/02:
11.00-13.00: guided tour in Gent

WEEK 2: VISITS TO PLANT BREEDING INSTITUTES

- Monday 13/02:
9.30: Departure at the Faculty of Bioscience Engineering (Coupure Links 653, Gent)
10.00-12.00: VIB Flemish Institute for Biotechnology
12.30: Lunch Garden (De Sterre)
14.30-16.00: Gediflora/Paraty Breeding
- Tuesday 14/02:
8.20: Departure at the Faculty of Bioscience Engineering (Coupure Links 653, Gent)
ILVO: Governmental Breeding Institute:
9.00-10.30 breeding of agricultural crops, nematode resistance breeding
10.30-12.00: Ornamental breeding and in vitro breeding techniques
14.00-16.00 Exotic Plants
- Wednesday 15/02:
6.00: Departure at the Faculty of Bioscience Engineering (Coupure Links 653, Gent)
10.30-16.00: Bejo
A specialist in breeding, production, processing and sale of premium quality vegetable seeds.
17.30: Van der Valk Hotel A4 Schiphol
- Thursday 16/02:
9.30-12.00 Royal Van Zanten
Royal Van Zanten is an innovative family-run ornamental breeding company
13.00-14.15 Lunch in Intratuin Zevenhuizen
14.30-16.30 Anthura
Breeding and production of Anthurium and Phalaenopsis
Spectacular greenhouses, breeding and show greenhouse of new varieties.
- Friday 17/02:
10.00-12.00: Examination
14.00-17.00: Presentation of the Case Studies
19.30: Goodbye dinner (Het Pand, Onderbergen 1, 9000 Gent)

* Saturday 18/2 departure

ANNEX 2

List of participants

Nr.	First Name	Family Name	email	Home Univ
1	Johan	Toussaint	Johan.Toussaint@UGent.be	UGent
2	Ramsés	Gómez Rodríguez	ramgmero@posgrado.upv.es	UPV
3	Andrés Elcias	Crespo Ibor	ancreib@etsiamn.upv.es	UPV
4	Miguel Antonio	Bracho Gil	mibragi@etsiamn.upv.es	UPV
5	Irene	Ferrandis Maldonado	irfermal@alumni.upv.es	UPV
6	Neiva	Cuadrado Cazorla	neicuaca@posgrado.upv.es	UPV
7	Alejandro	Moreno Urbano	almour@posgrado.upv.es	UPV
8	Josep	Escribà Lacuesta	joesla@alumni.upv.es	UPV
9	Jon	Bančič	jon.bancic@gmail.com	SLU
10	Hernán Dario	Capador Barreto	hoca0001@stud.slu.se	SLU
11	Marcelle	Johnson	mejn0005@stud.slu.se	SLU
12	Selin	Altıntas	altntsselin@gmail.com	Ege Univ.
13	Aamir	Saleem	aamir.saleem@ugent.be	UGent
14	Bousso	Williane	bousso.willane@ugent.be	UGent

Join the Intensive Study Programme on Hybrid Breeding

Organized by the European Plant Breeding College at Ghent University, Belgium



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Practical information

The programme is designed for participants

- who are registered in a Master Programme in a field related to Plant Breeding
- who have followed at least a basic course of Plant Breeding before the start of the programme
- who are fluent in English (min. CEF level B2)

The Intensive Training Programme counts for 5 ECTS to add to your curriculum

- Certification requirements:

Attend all courses; Participate to the excursions; Prepare and present case study in a satisfying way; Pass a multiple choice examination

Language of instruction: English

Location of the programme and registration:

- Ghent University, Faculty of Bioscience Engineering, Coupure Links 653, Ghent, Belgium

Programme duration: from 6 February 2017 till 17 February 2017



How to enroll

Only 10 more places available!

Registration deadline: 13 January 2017

Tuition fee: € 1.750

Contact person:

Wim Hoste

fci.fbw@ugent.be

+32 9 264 59 10

www.epbc.eu/isp/

Detailed programme

Monday 06/02

Methods / Hybrid Breeding Systems

One of the most important insights in plant breeding was the observation that hybrid (F1) progeny typically are superior in size, growth characteristics and yield in comparison to their homozygous parents, a phenomenon known as heterosis. Its underlying driving mechanisms may be multiple and are unfortunately poorly understood. Nevertheless it is widely adopted in plant breeding. Selection schemes, male sterility induction, heterosis and other relevant terminology will be discussed.

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Reverse Breeding



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Saturday 11/02

Cultural Visit Ghent

Sunday 12/02

Free day

Monday 13/02, Tuesday 14/02, Wednesday 15/02, Thursday 16/02

Visits to breeding companies in Flanders & The Netherlands

Friday 17/02

Multiplier event