

Detailed Programme ISP from 06/02 to 17/02

Topic: 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.

- **Monday 06/02: 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: Advanced Breeding Technologies (Danny Geelen, Rob Dirks, Nico Storme)**
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 – 10:30 11:00-12:30 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 trade marks. 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: 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: 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.

WEEK 2: Visits to plant breeding institutes: organisation in progress

13+14/2: Belgium

15+16/2: Netherlands

17/2: Presentation of the Case Studies + Multiplier Event