Nederlandse Vereniging voor Plantenbiotechnologie en -Weefselkweek
Netherlands Society for Plant Biotechnology and Tissue Culture
KvK nr. 40121960 NL42INGB0004240007 www.nvpw.nl info@nvpw.nl

Samenvattingen van de lezingen van het NVPW najaarssymposium, vrijdag 11 december 2015,
Summaries of the lectures on the NVPW spring symposium, Friday, December 11th 2015
Hotel de Nieuwe Wereld, Marijkeweg 5, 6709 PE Wageningen.

De ontwikkeling van hyperhydriciteit in weefselkweek

dhr. dr. Frans Krens – Wageningen UR

In vitro conditions are very stressful for tissue-cultured plantlets. Repeated wounding, very high relative humidity and high hormone concentrations are harsh circumstances. It is clear that such adverse conditions will have a negative effect on the quality of the plants. We have studied the hyperhydricity (HH) syndrome. The amounts of water and air in the apoplast were determined in several species (*Arabidopsis*, apple and statice) in both hh-tissue that had been cultured on Gelrite and in control tissue grown on agar. The amount of active oxygen species was determined with nitroblue tetrazolium staining. Stomatal apertures were determined microscopically and hh- and non-hh-seedlings were taken to extract mRNA and to determine expression of hypoxia-associated genes by qRT-PCR. Transcriptome analysis was done using microarrays and differences in expression were screened. Gene-ontology-groups that were either up- or downregulated in hh-seedlings were identified. The results of this physiological and molecular research will be presented. We have shown that in hyperhydric plants (hh-plants) the apoplast (in particular the intercellular spaces) is flooded and that hh-plants suffer from hypoxia indicating an inhibition of gas exchange by cells. Many groups of genes were expressed differentially in hh- versus non-hh-seedlings. Interesting genes were among others involved in salicylic acid, jasmonate and ethylene signalling, and phospholipase and lignin biosynthesis (up) and in cuticular wax biosynthesis and fatty acid biosynthesis initiation (down).

New breeding technologies applied in new crops for biobased applications

Dhr. dr. E.N. van Loo (Robert) – Plant Breeding Wageningen UR

An overview will be given of the breeding and development of a few new oil crops for biobased applications. Examples will be shown of various new technologies and crops: e.g. QTL-analysis of oil traits in jatropha, GM towards wax ester (jojoba-oil) in crambe seed, mutation breeding to change the fatty acid profile of crambe seeds and the use of new genome editing techniques to modify oil seed traits. Today we have a vast array of technologies from classical breeding using naturally occurring variation, with selection based on phenotyping (e.g. gas chromatography) or on marker selection to induction of genetic variation using classical mutagens (e.g. EMS) or by use of new genome editing techniques that may or may not involve use of transgenic plants up until the use of genetic modification to insert genes from the species itself (cisgenesis) or from other species (transgenesis). We will show some results of the use of these techniques in oil crops and discuss options that now are available.

Improving pollen thermotolerance in tomato

dhr. dr. Ivo Rieu – Radboud Universiteit

One of the main effects of high temperature on plants is reduction of fertility. To be able to understand and improve plant reproductive processes under high temperature, we study the response of tomato to this stress factor. As with other plant species, pollen development appears to be the limiting factor for fertility of tomato under heat and timing experiments show that it is sensitive to prolonged moderately elevated temperature especially around meiosis. High temperature causes problems with cell division during meiosis-II in a subset of spores, but phenotypically normal microspores continue to fail over subsequent developmental stages. The latter may be a consequence of the aberrant development of the surrounding support tissue, the tapetum. The importance of this tissue is confirmed by the increased heat tolerance of plants over-expressing *HEAT SHOCK FACTOR A2* in a tapetum-specific manner. We identified loss of cell identity as one of the possible causes of heat-induced pollen defects. Our current QTL analyses using crosses between cultivated tomato and highly tolerant wild tomato species should pinpoint natural tolerance genes useful for breeding and give further clues about the processes limiting pollen development upon heat.

A transposable element insertion in the susceptibility gene *CsaMLO8* results in hypocotyl resistance to powdery mildew in cucumber

dhr. Jeroen Berg MSc. – Wageningen UR

Powdery mildew (PM) is an important disease of many crop species, including cucumber. Obtaining loss-of-function mutants of so-called susceptibility genes (S-genes) is thought to be a potent strategy to obtain durable, broad spectrum resistant plants. The best known example of a S-gene is the barley gene *MLO*, PM resistant mutants of which were first found in mutagenized barley populations in the 1940s and still cultivated today. Over the last decennium, *MLO* homologs in several other crop species have been identified, which have been shown to function in a similar way. In cucumber, one *MLO* homolog, *CsaMLO8*, is located on the interval of the "hypocotyl resistance" QTL, a locus contributing to partial powdery mildew resistance characterised by PM-free hypocotyls. In our research project, we cloned *CsaMLO8* alleles from both PM resistant and susceptible cucumber lines, and found a retrotransposable element insertion in the coding sequence of the resistant *CsaMLO8* allele. We expressed both alleles in a PM resistant tomato *mlo* mutant, and showed that heterologous expression of the allele from the susceptible cucumber line restored susceptibility of tomato, whereas the allele from the resistant cucumber line failed to restore susceptibility. This shows that *CsaMLO8* is a functional susceptibility gene, and insertion of the transposable element is a loss-of-function mutation. Furthermore we studied *CsaMLO8* expression in different tissues of cucumber after inoculation with powdery mildew, and showed that *CsaMLO8* is specifically upregulated in hypocotyl tissue, explaining the tissue specificity of the "hypocotyl resistance" QTL.

Durable late blight resistance in potato through cisgenesis: some scientific and societal results of the DuRPh project
dhr. dr. ir. A.J. Haverkort (Anton) - Plant Research International

From 2006 through 2015 a research project on Durable Resistance in potato against Phytophthora infestans (DuRPh) was carried out at Wageningen University and Research Centre. Its objective was to develop a proof of principle for durable resistance against late blight, using cisgenesis. A stack of multiple R genes was inserted into established varieties, thereby creating a dynamic variety in which the composition of the stacks may vary over space and time. Cisgenic plants were selected based on expression of all inserted R genes and true-to-type. Within the project R genes from wild potato species were genetically mapped and some were cloned. Four varieties were transformed with 1 to 3 R genes. R genes from several wild species, their location, specificity, how they perform in different varieties somaclonal variation and stability were studied. Phytophthora monitoring population studies and monitoring assure the durability of the resistance. Communications through media and field demonstrations were manifold to allow public and policymakers to decide if cisgenesis is an acceptable tool to make potato farming more sustainable.

Life cycle shortening in bulbs: How to speed-up vegetative and sexual propagation?
dhr. prof. dr. ir. Richard Immink – Wageningen UR

The Netherlands is leader in ornamental bulb production, holding 75% of the total world production and tulips are probably the most iconic products of this sector. Currently, the sector is facing some serious threads, including particular diseases, upcoming new markets and consumer demands of more sustainable production. In order to provide the sector with ways to respond faster to new demands and enable them to introduce new traits in a shorter period, life cycle shortening is of importance. In this respect, flowering time control and propagation capacity are studied. Furthermore, it is of interest for tulip bulb growers and for bulb forcers to have a better understanding of flowering time regulation. In this presentation, I will shed light on the way temperature is translated into a flowering time signal in tulips and how outgrowth of axillary buds is regulated at the molecular level.

Phenotyping – large scale and small scale
Dhr. dr. Marcus Jansen – LemnaTec GmbH

In recent years, the value of sensor based plant phenotyping has been firmly established by breeders and scientific publications across the world. Although early work involved pot grown plants in laboratory and greenhouse environments, the demand for systems to address both smaller and larger plant samples is also growing. At the lower end, systems aim to characterise plants, in particular roots of model plants growing on agar-plates. At the higher end, scientists and especially breeders also need solutions to phenotype field-grown plants. LemnaTec's Field Scanalyzer measures comprehensive sets of phenotypic data on a plot area using a multi-sensor measuring head mounted on a gantry crane. In addition to this deep-phenotyping approach for a single field plot, LemnaTec is also developing wheeled vehicles equipped with sensor technology that can be moved between different breeding fields. LemnaTec is establishing image acquisition procedures and data analysis pipelines for both field and laboratory applications. The latter will enable scientists to quantify phenotypic properties of seedlings on agar-plates from germination to the early developmental stages with temporal and spatial resolution. Such agar-plate trials are widespread for gene function studies in basic research.

Wat gebeurde er na de "de aardappeleters" door van Gogh. De kunst van het kiezen
Dhr. prof. dr. ir. Evert Jacobsen – Laboratorium voor Plantenveredeling. Wageningen UR

Van Gogh is beroemd geworden mede door het schilderij van "de aardappeleters". Tegenwoordig zijn ook andere kunstenaars bezig met aardappel. In de tijd van van Gogh begon de op wetenschap gebaseerde aardappelveredeling op gang te komen. Hugo de Vries herontdekte de wetten van Mendel en werd beoemd om zijn mutatietheorie. Geert Veenhuizen en meester de Vries waren de eerste aardappelkwekers. Zij selecteerden samen meer dan 200 rassen waarvan er steeds nog enkele bestaan en gebruikt worden zoals Bintje en Eigenheimer. Er zal verder ingegaan worden op enkele moderne aspecten van de aardappelveredeling met o.a. focus op genisolatie, GMO en (moderne) gengerichte mutatie-inductie. De ideale tijd van Hugo de Vries, aangegeven rond 1900, dat alleen eigenschapgerichte mutaties in rassen mogelijk zijn, is nu aangebroken. Deze nieuwe ontwikkeling zal voor tetraploide aardappel uitgelegd worden. De amylose-vrije aardappel zal als voorbeeld hiervoor besproken worden. Deze nieuwe zetmeeleigenschap is tegenwoordig op 3 manieren te realiseren.

Exposanten:

Amphasys AG: dhr. Peter Swinkels: peter.swinkels@amphasys.com / www.amphasys.com

Eco2NV: mevr. Ann Matthys: ann@eco2box.com / www.eco2box.com

Staxs the Netherlands B.V.: dhr. Ronald Nelemans: RN@staxs. eu / www.staxs.eu

Duchefa Biochemie B.V.: dhr. drs. Frank Kors: f.t.m.kors@ duchefa.nl / www.duchefa.nl