This presentation is concluded by underlining two options for effectively using gene expression work interfaced with plant breeding in order to enhance probabilities for the improvement of drought resistant crops.

Keywords: drought resistance, drought stress, plant breeding, genomics, methods, protocols, gene expression

Reference:

1. Blum, Abraham (2011) Drought resistance – is it really a complex trait? *Funct. Plant Biol., 38,* 753–757.

WATER STRESS AND ITS REGULATION ON THE GRAIN FILLING OF RICE

JIANHUA ZHANG

School of Life Sciences and State Key Laboratory of Agrobiotechnology,
The Chinese University of Hong Kong, Shatin, Hong Kong, China, e-mail: jhzhang@cuhk.edu.hk

Modern rice (*Oryza sativa* L.) cultivars, especially the newly bred "super" rice, have numerous spikelets on a panicle with a large yield capacity. However, these cultivars often fail to achieve their high yield potential due to poor grain filling of later-flowering inferior spikelets (in contrast to the earlier-flowering superior spikelets). Conventional thinking to explain the poor grain filling is the consequence of carbon limitation. Our earlier results, however, have shown that carbohydrate supply should not be the major problem because they have adequate sucrose at their initial grain filling stage. The low activities of key enzymes in carbon metabolism may contribute to the poor grain filling. Proper field practices, such as moderate soil drying during mid and late grain filling stages, could solve some problems in poor grain filling. Further studies are needed by molecular approaches to investigate the signal transport, the hormonal action, the gene expressions and the biochemical processes in inferior spikelets.

BREEDING STRATEGIES AND BREEDING RESULTS AGAINST FUSARIUM HEAD BLIGHT IN BREAD WHEAT

ÁKOS MESTERHÁZY, BEÁTA TÓTH, ÁGNES SZABÓ-HEVÉR, MÓNIKA VARGA and ÉVA TOLDINÉ TÓTH

Cereal Research Non-Profit Ltd. Company, P.O. Box 391, H-6701 Szeged, Hungary,
e-mail: akos.mesterhazy@gabonakutato.hu

In recent decades the toxigenic fungi have played an increasing role in food and feed safety. In breeding even now the yield is in the centre, other traits played only a secondary

role, especially toxigenic fungi that influence yield in most years. Most of the varieties and hybrids are much more susceptible than land races.

Resistance research has found in both wheat and maize close or very close relationships between disease severity and toxin contamination. In wheat from well planned experiments the relations are very close, so a breeding program that reduces susceptibility automatically decreases also toxin contamination. In the Szeged wheat breeding program we have bred numerous highly resistant lines and identified superior lines and cultivars among regular breeding material. The increased resistance might not be enough in highly epidemic years, but these genotypes can be protected effectively with fungicides securing toxin contamination below EU toxin limits.

Genetic research also helps this work, we detected that the 5A QTL from Sumai 3 (CM 82036) is as strong as the 3BS *(fhb1)*. These QTLs protect against kernel infection and toxin contamination. They influence the whole disease process and have general significance, additionally they are not Fusarium species specific.

In Mini Mano/Frontana QTLs were detected that controlled visual symptoms, kernel infections a DON contamination at the same time; several other QTLs influenced only one or two of them. So the genetic regulation is not simple.

In maize the situation is more complex, in some hybrids resistance was found to all toxigenic species, in others resistance to one pathogen could be accompanied with susceptibility to others. Therefore the breeding system is more complicated; more *Fusarium spp.* should be controlled at the same time. As this trait is also polygenic, no major QTLs were described until now as it is the case for wheat, an effective breeding system will need strong efforts.

The resistance screening of cultivars and hybrids shows clearly a very large variability among them. For this reason the cultivar registration can help to exclude highly susceptible cultivars from commercial production to lessen the food and feed safety risks.

We see also that resistance alone will not solve the problems. Updated agronomy, keeping the regulation a Good Agronomy Praxis (GAP), strongly modernized storage systems and processing can secure that the good quality at harvest could be secured until the product is coming to our table.

Keywords: *Fusarium* head blight, wheat, maize, Fusarium ear rot, *Aspergillus flavus,* DON, fumonisin, aflatoxin

This work was supported by a grant of European Union FP7 MycoRed KBBE-2007-2-5-05 contract No. 222690, by OTKA grant No. K84122 and by the János Bolyai Research Scholarship (B. Tóth) of the Hungarian Academy of Sciences.