International Conference
FROM SEED TO PASTA III
A Sustainable Durum Wheat Chain
for Food Security and Healthy Lives
Bologna - Italy, 19-21 September 2018

HOW TO BREED FOR A COMBINATION OF HIGH YIELD WITH HIGH GRAIN PROTEIN CONTENT?

M. Rapp, V. Lein, F. Lacoudre, J. Lafferty, E. Müller, G. Vida, V. Bozhanova, A. Ibraliu, P. Thorwarth, H. P. Piepho, W. L. Leiser, T. Würschum, and C. F. H. Longin*

M. Rapp, W. L. Leiser, T. Würschum, C.F.H. Longin, State Plant Breeding Institute, University of Hohenheim, 70599 Stuttgart, Germany
V. Lein, 20 rue de la Ferme de L'Ermitage, 60190 Rémy, France
V. Bozhanova, Field Crops Institute, 6200 Chirpan, Bulgaria
A. Ibraliu, Department of Plant Science and Technology, Agricultural University of Tirana, 1029 Tirana, Albania
F. Lacoudre, Limagrain Europe, 11492 Castelnaudary Cedex, France
J. Lafferty, Saatzucht Donau, 2301 Probstdorf, Austria
E. Müller, Südwestdeutsche Saatzucht GmbH & Co. KG, Im Rheinfeld 1-13, 76437 Rastatt, Germany
G. Vida, Centre for Agricultural Research, Hungarian Academy of Sciences, 2462 Martonvásár, Hungary
H. P. Piepho, Biostatistics Unit, University of Hohenheim, 70593 Stuttgart, Germany

Grain yield and protein content are very important traits in durum wheat breeding, but their negative correlation makes their simultaneous improvement difficult. With respect for this, the grain protein deviation (GPD) and the protein yield were proposed as selection targets. Our aim was therefore to investigate the potential of different indices to simultaneously improve grain yield and protein content in durum wheat and to evaluate their genetic architecture towards genomics-assisted breeding. We evaluated two different durum wheat panels comprising 159 and 189 genotypes, which were tested in numerous locations across Europe and genotyped by a genotyping-by-sequencing approach. The phenotypic analyses showed significant genetic variances for all traits and heritabilities of the phenotypic indices in a similar range as those of grain yield and protein content. The GPD revealed a high and positive correlation with protein content, while protein yield was highly and positively correlated with grain yield. Consequently, selecting for a high GPD would mainly increase the protein content while a selection based on protein yield would mainly improve grain yield. A combination of both indices, however, allows to balance this selection. The genome-wide association mapping showed a complex genetic architecture for all traits with most QTL having small effects and being detected only in one germplasm set, therefore restricting the potential of marker-assisted selection. In contrast, genome-wide prediction appeared promising but its efficiency strongly depends on the relatedness between training and prediction sets.