Investigating breeding progress in winter wheat in Germany

Samuel Knapp (samuel.knapp@tum.de), J. Peter Baresel (baresel@wzw.tum.de)

Technical University of Munich, Chair of Plant Nutrition, Freising

Background

Plant breeding is a major source for increase in yield and resource use efficiency (Laidig et al., 2014) . However, as plant breeders select under and for certain environmental conditions and due to genotype-by-environment interaction, it can be hypothesized that plant breeding is more beneficial for certain environmental conditions. Thus, specific regions or cropping systems could benefit more from breeding progress than others. Furthermore, the increase in yield potential under beneficial conditions could be coupled with a decrease in stability (Calderini and Slafer, 1999).

Material and methods

In order to test the afore-mentioned hypotheses in Germany, we used data from the German network of variety testing for recommendation (Landessortenversuche, LSV). Data were extracted from publicly available pdfs and, for Bavaria, kindly provided by the Bayerische Landesforschungsanstalt für Landwirtschaft. The range of data covers the years 2001 – 2016. To also draw conclusions on changes in nitrogen (N) efficiency we also extracted protein content – besides grain yield – and subsequently calculated grain N uptake from grain yield and protein content. Genetic and non-genetic progress in yield was separated following Laidig et al. (2014). The analysis so far are only based on data from Bavaria.

Results and discussion

Preliminary results indicate that the estimated breeding progress (genetic) in yield is estimated to 0.41 dt/ha/year ($p<0.001$) while the protein content remained constant ($p>0.05$). While the genetic change showed to be robust against the chosen range of years for the analysis, the estimated non-genetic change is strongly dependent on the chosen range, and should thus not serve as an estimate for a discussion on agronomic changes.

The genetic increase in grain N uptake was estimated to 0.43 kg N/ha/year ($p<0.01$). This increase is mainly due to the increase in grain yield as there was no significant change in protein content detected ($p>0.05$).

When analysing each testing location separately, to test the difference in breeding progress between locations, the estimates for genetic change in grain yield ranged between 0.24 dt/ha/year and 0.71 dt/ha/year. However, the variation in estimated breeding progress among locations could not be related to the production potential of each location, when taking the average yield as a measure of the production potential, indicating that other factors must be responsible for the variation in breeding in progress between locations.

References

Calderini, D.F., and G.A. Slafer. 1999. Has yield stability changed with genetic improvement of wheat yield? Euphytica 107(1): 51–59.

Laidig, F., H.-P. Piepho, T. Drobek, and U. Meyer. 2014. Genetic and non-genetic long-term trends of 12 different crops in German official variety performance trials and on-farm yield trends. Theor Appl Genet 127(12): 2599–2617.