
Genotypic variation in social strategies: a promising path for future soybean breeding?

Emanuel Kopp^{*1,2}, Pascal Niklaus², and Samuel Wuest¹

¹Agroscope – Suisse

²Universität Zürich [Zürich] = University of Zurich – Suisse

Résumé

A key hypothesis of evolutionary agroecology is the existence of a trade-off between the performance of a plant genotype in a monoculture group and its individual fitness. Over millennia, natural selection has optimised traits that increase individual fitness, so it is unlikely that they still have high breeding potential. On the contrary, evolutionarily unstable 'cooperative' traits that reduce individual fitness but increase group performance may still be underexplored: such cooperative traits should be rare and unlikely to be found 'by chance' in modern breeding programmes. Here, we aim to exploit this trade-off to quantify genotypic variation in social strategies and identify more cooperative soybean genotypes and the traits and genes that underlie them. To do this, we conducted a factorial pot experiment in which 90 different soybean varieties were grown in hundreds of pairwise combinations.

According to game theory, more cooperative genotypes have relatively high yields in monocultures but low fitness when grown with more competitive neighbours, and vice versa. The experiment allowed us to rank the varieties from 'selfish' to 'cooperative', and to use this ranking to perform a genome-wide association study. This way we could identify a small genetic region in the soybean genome that is significantly associated with a varieties' social behavior, and we are currently investigating potential underlying processes. Identifying genes or traits that increase plant cooperation in crop species will be of great interest, as it will allow breeding for more cooperative genotypes in a way that fits seamlessly into modern breeding programmes.

Mots-Clés: soybean, cooperation, competition, breeding, GWAS, game theory

*Intervenant