

P-041: "Adaptation of maize-based food-feed-energy systems to limited phosphate resources" (AMAIZE-P) – a new Sino-German international research training group.

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The new Sino-German international research training group jointly conducted by the University of Hohenheim (UHOH) and the China Agricultural University (CAU) started 01 October 2018. It is funded jointly by the German Research Foundation (DFG, 328017493/GRK 2366) and by the CAU for a period of 4.5 years in a first phase. Another funding period of 4.5 years is envisaged.

The fate of phosphate in the environment presents an open cycle. Phosphate is supplied by mining and fertilizer production, followed by different steps of phosphate utilisation, including primary production, animal feed, human food and conversion of biomass to energy and raw materials, with accumulation in soils, little return and in particular severe environmental losses. Most importantly, phosphate is a limited essential nutrient (350 years lifetime). It is unknown how the steps within the cycle will react and interact if phosphate is increasingly limited and economic pressure escalates as a result. Closing cycles and reducing phosphate consumption are fundamental future challenges.

Globally, maize is one of the most important crops, with high phosphate sensitivity, therefore, ideal for studying the consequences of phosphate limitation. China and Germany together cover the whole variation of maize production systems in food-feed-energy supply chains and a wide range of climatic conditions.

Research is driven by the hypothesis that under phosphate-limited conditions, high productivity and high phosphate use efficiency can be achieved simultaneously by adapting phosphate cycling and availability (sources) to the multipurpose phosphate demands (sinks) in maize-based food-feed-energy systems. In an interdisciplinary approach, we investigate (1) the genetic potential of maize populations and mechanisms of their ability to adapt to limited phosphate supply, (2) maize cultivation under limited phosphate supply at field scale, (3) mechanistic interactions of related products with their utilization in human and animal nutrition, and phosphate recovery by biomass conversion. (4) An economic evaluation will be done at plot, farm, regional and sector levels, taking market effects into consideration. Joint field experiments in China and Germany allow for complementary and comparative analyses. Genetic and molecular approaches, modern spectroscopic methods, economic surveys and modelling approaches at different scales will be used.

Based on supervision contracts, German and Chinese doctoral researchers will be guided by an individual advisory committee, by invited experts, by members of an international advisory board, and by staff for biometrical and econometric training. The educational programme in China and Germany includes joint block seminars, thematic field trips, case studies, methodological courses, doctoral researchers' conferences and intercultural training sessions.