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Simulating a Wheat-Maize Intercropping System with the DSSAT Crop Growth Model

Heike Knörzer, Simone Gräff-Hönninger, Wilhelm Claupein

University of Hohenheim, Department of Crop Production and Grassland Research, Germany

Abstract

Interspecific competition is not only a survival of the fittest, but can also result in an optimal use of ecological niches. Agriculture can utilise interspecific competition in order to adjust and improve cropping systems, *e.g.* in intercropping systems. Intercropping, defined as growing two or more crops simultaneously on the same field is widespread all over the world. Especially in smallholder farming like in Africa (Malawi: 80–90 of soybean cultivation), India (17 % of arable land) or China (25 % of arable land), intercropping is a common cropping system. In times of climate change, rising food prices, shortage of arable land and food in third world countries and countries with a rapidly increasing population, adjusted traditional cropping systems become more and more important. Relay intercropping, where the maturing annual plant is interplanted with seeds of the following crop, *e.g.* 75 % of wheat is sown in autumn and a few days or weeks before wheat harvest, maize is interplanted, is an example for an optimised usage of scarce arable land. It showed that it is possible to increase grain yields of summer maize without a decrease of winter wheat productivity. But there is an additional summer maize yield because of an elongated growing season. The study is a first approach to model a wheat/maize intercropping system with the DSSAT crop growth model. Field trials were conducted in alternating plots of wheat and maize within a restricted randomised complete block design and four replications. First results of the modelling showed, that intercropped wheat had an increased ability to acquire more nitrogen compared with monocropped wheat. Nitrogen withdrawal from intercropped wheat straw was twice as high as nitrogen withdrawal from monocropped wheat straw. Because of the increased solar radiation, the increased top soil temperature and the higher agressivity of wheat in comparison to maize, the mineralisation of nitrogen might be favoured. Wheat grain yields increased significantly. Maize suffered at the beginning of the growing season but reacted with a recovery-compensation growth.

Keywords: DSSAT, intercropping, maize, modelling, wheat

Contact Address: Heike Knörzer, University of Hohenheim, Department of Crop Production and Grassland Research, Fruwirthstrasse 23, 70593 Stuttgart, Germany, e-mail: knoerzer@uni-hohenheim.de