Effects of elevated CO_2 and different climatic conditions on photosynthesis of leaves and pods of oilseed rape (*Brassica napus*)

Ivan Guzman Bustamante, Petra Högy, Iris Schmid, Jürgen Franzaring, Andreas Fangmeier
Universität Hohenheim

Institute for Landscape and Plant Ecology, Area Plant Ecology and Ecotoxicology

Abstract

In the medium term, global change will affect several aspects of agroecosystems. Atmospheric CO_2, which is the main greenhouse gas, will reach a concentration that is c. 50% higher than presently at the end of the 21st century. Concomitantly, the global mean temperature is likely to increase by around 2°C, referring to scenarios that assume the best case (IPCC, 2007). As a consequence, higher CO_2 and changes in climatic conditions may directly affect photosynthesis and thus regional agricultural production. Determining the effects on crops will help to develop new strategies in crop production and land use.
The aim of this study is to determine the effects of elevated CO_2 concentration on the photosynthetic activity of oilseed rape (OSR) using a mini-FACE (free-air CO_2 enrichment) field exposure system and to compare the photosynthetic parameters, taking also into consideration the different regional climatic conditions.
OSR was cultivated at the Heidfeldhof (Stuttgart) close to the University of Hohenheim at ambient (400 ppm) and elevated (550 ppm) CO_2 concentration. Two other agricultural field sites (Kraichgau and Swabian Alb) that differ in climatic conditions were used in order to compare the results with those from the Heidfeldhof. The data will be used to improve crop growth models within the framework of quantifying the effects of climate change on the regional scale of Baden-Württemberg.
Net photosynthesis rate (A) and A/C_i curves (c_i, internal leaf CO_2 concentration) were measured at the Heidfeldhof, and light dependency curves of photosynthesis at the sites in Kraichgau and at the Swabian Alb. The A/C_i curves were fitted to the Farquhar photosynthesis model in order to determine the maximum rate of Rubisco carboxylation (V_{cmax}), RuBP limited rate of electron transport (J_{max}) and mitochondrial respiration rate (R_d). Light dependency curves were made in order to determine photosynthetic capacity (A_{max}), quantum yield of photosynthesis (ϕ) and light compensation point (Γ).