

Early growth performance of soybean cultivars and bradyrhizobia strains under cool growing conditions

Abstract

In short-season production areas, low soil temperature in spring is a major factor limiting early growth of soybean (*Glycine max* L. Merrill). The purpose of this study was to identify soybean cultivars, bradyrhizobia strains (*Bradyrhizobium japonicum*) and particularly suited combinations of both for cultivation under cool growing conditions in Central Europe. Therefore, 20 early-maturing cultivars were inoculated with 5 inoculants with different bradyrhizobia strains (incl. USDA 30) and an inactivated strain as control. Plants were grown in pots for six weeks in a growth chamber with day/night temperature of 13.0/12.5 °C. Data were collected on nodule number and volume, chlorophyll content (SPAD), shoot and root biomass formation, N uptake and symbiotic N₂ fixation of shoots. We used the natural abundance (NA) method for the quantification of N₂ fixation. USDA 30, Product A and C enhanced nodule formation (number and volume) and early growth significantly better than Product D and G. However, N₂ fixation rates and nodule efficiency was highest with Product G at this early growth stage. Soybean cultivars showed significant differences in the assessed traits, whereas significant soybean x bradyrhizobia interactions were only detected for nodule volume and number of leaves. Among the soybean cultivars we also identified well nodulating and growing genotypes on the one hand and well N₂ fixing ones on the other hand. Field studies or prolonged pot experiments are required to assess the influence of successful nodulation during early growth stages under cool growing conditions on N₂ fixation and protein yield at harvest.