

Do abiotic factors cause a gradual yield decline under continuous aerobic rice cultivation? A pot experiment with affected field soils

Abstract

Aerobic rice is a water-saving technology in which rice grows in non-puddled and non-saturated (aerobic) soil without ponded water. A gradual decline in rice yield was found in field plots at the farm of the International Rice Research Institute, Los Baños, Philippines, where rice has been cultivated continuously for 10 cropping seasons under aerobic rice conditions. We investigated whether abiotic soil factors lead to the observed yield decline. An aerobic rice pot experiment was conducted using field soils from flooded rice plots and from the 10-season-long aerobic rice cultivated plots (referred to as 1st-season and 11th-season aerobic rice, respectively). Subtreatments consisted of soil sterilization by oven heating (at 95°C or higher for 24 h) and a control treatment. The above-ground biomass of 1st-season aerobic rice was significantly greater than that of 11th-season aerobic rice in both the oven-heating and control treatments. Oven heating increased soil N availability and above-ground biomass accumulation over the control in both 1st-season and 11th-season aerobic rice, but the above-ground biomass in the oven-heated 11th-season aerobic rice was still significantly lower than that of the oven-heated and even the untreated (control) 1st-season aerobic rice. These results suggest that abiotic factors contribute to the gradual yield decline observed in the field plots.

Key words: abiotic factors, aerobic rice, pot experiment, soil sterilization, yield decline