Growth Competition between Rice (Oryza sativa) and Barnyardgrass (Echinochloa oryzicola) under Varying Mono-/Mixed Cropping Patterns and Air Temperatures

ABSTRACT

Increase in the concentration of atmospheric greenhouse gases significantly contributes to global warming, representing a substantial challenge for crop production. The study was conducted to determine the growth competition between rice (Oryza sativa) and barnyardgrass (Echinochloa oryzicola) under (i) different cropping patterns and (ii) elevated air temperatures in phytotrons under field condition, at two plant densities (4 and 16 plants per pot). Rice and barnyardgrass were planted with varying cropping patterns (rice: barnyardgrass mixture proportions); 100:0, 75:25, 50:50, 25:75 and 0:100. Air temperatures were maintained in phytotrons as follows: Ambient– A (Control), A +0.8 ◦C, A +1.9 ◦C and A +3.4 ◦C. Plant attributes such as plant height, number of effective tillers, shoot dry weight and grain yield of rice were recorded in this study in the rice/barnyardgrass mixture proportions in the order of 100:0 > 75:25 > 50:50 > 25:75. The highest rice grain yield (37.7 g/pot) was recorded in the monoculture (100:0 rice/barnyardgrass) under ambient temperature, whereas the lowest rice grain yield (0.3 g/pot) was recorded at the 25:75 rice/barnyardgrass mixture proportion under ambient +3.4 ◦C. The increase in temperature had a significant impact on growth, number of tillers and shoot dry weight of both rice and barnyardgrass plants and followed the order of ambient +3.4 ◦C > ambient +1.9 ◦C > ambient +0.8 ◦C > ambient. However, higher temperature negatively affected the yield of rice and resulted in a substantial decrease in the grain yield. Barnyardgrass showed the highest plant characteristics when grown alongside rice compared to the growth in monoculture. This indicates that barnyardgrass was highly competitive when grown under interspecific competition compared to an intraspecific competition. In contrast, rice grew better in monoculture than in mixture with barnyardgrass.