Biochemical Alterations of Rice in Response to Plant Submersion and Herbicides

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Abstract

Extreme rainfall events are expected to be more frequent with the climate change, increasing the chances of prolonged flooding in rice producing areas. Therefore, it is important to understand the response of rice plants to flooding events that would result in plant submersion and it is interaction with herbicide applications. To achieve the objectives two studies were conducted in Southern Brazil (Pelotas, RS). Experiment 1 was conducted with ten rice cultivars and six submersion periods (one, five, seven, 15 e 20 days of plant submersion plus a check treatment. In the check treatment plants were kept under a flooding regime (water layer of 10 cm).). Experiment 2 was conducted with two cultivars, two water regimes (flooded and submerged) and six herbicides (clomazone, bispyribac sodium, penoxsulam, imazethapyr + imazapic, imazapyr + imazapic and an untreated check). Shoot dry matter, chlorophyll levels, total carotenoids, total phenolic content, levels of hydrogen peroxide and activity of catalase (CAT), ascorbate peroxidase (APX) and superoxide dismutase (SOD) were assessed in plant samples. The results observed in the first experiment showed that cultivars Puitá INTA CL, IRGA 417 and IRGA 422 CL were the most tolerant to submergence. The most susceptible cultivars were IRGA 424, BRS Querência, EPAGRI 108 and BRS Taim. In general, the cultivar Puitá INTA CL has lower oxidative damage than BRS Querência when submerged. In order to cope with excessive free radicals, BRS Querência demonstrated higher activity of SOD, APX and CAT enzymes compared to cultivar Puitá INTA CL. Imidazolinone formulated mixtures of herbicides imazethapyr + imazapic and imazapyr + imazapic caused greater reduction in total chlorophyll content and carotenoids.

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