

Antioxidants activity and free-polyamine levels stimulated by ozone in two rice cultivars

Su Yeon Lee^{1*}, Jwa Kyung Sung², Seon Woong Hwang³, Mun Hee Park³, Tae Wan Kim¹

¹Department of Plant Resource Science, Hankyong National University, Ansong

²Department of Agronomy, Chungbuk National University, Cheongju

³Division of Plant Nutrition, NIAST, RDA, Suwon

오존에 의한 항산화효소 활성과 폴리아민 생합성

이수연^{1*}, 성좌경², 황선웅³, 박문희³, 김태완¹

¹한경대학교 식물자원학과, ²충북대학교 농학과, ³농업과학기술원 식물영양과

Objectives

To observe the effects of ozone(O₃) on antioxidative metabolism in rice plants, the activity of enzymatic antioxidants, such as superoxidase dismutase (SOD), catalase (CAT) and guaiacol-peroxidase (POD), and polyamine biosynthesis were measured.

Materials and Methods

Seeds of ozone-resistant or -susceptible rice cultivars, Jinpumbyeo and Chucheongbyeo, respectively, were surface-sterilized with a 2% (w/v) solution of sodium hypochlorite. The germinated plants were transferred to an environmentally controlled chamber and grown at day/night temperatures of 25/20 °C, 70% relative humidity and 300~400 μmol photons m⁻² s⁻¹ photosynthetically active radiation (PAR; 400-700 nm) in a 12 photoperiod. At panicle formation stage, two rice cultivars with different nitrogen application were exposed to ozone regime.

Fresh leaves of both cultivars were sampled at 0, 1, 3, 5, 8 and 12 hr after ozone (100±10ppb) exposure. Leaves were frozen in liquid nitrogen immediately after harvesting and stored at -70°C. Protein content was measured according to the method of Bradford(1976) with bovine serum albumin as a standard. Determination of SOD (E.C. 1.15.1.1) activity was performed by the method of Beyer and Fridovich(1987). Catalase (E.C. 1.11.1.6) activity was determined by monitoring the decomposition of H₂O₂ (extinction coefficient 39.4 mM cm⁻¹) at 240nm following the method of Aebi. Peroxidase (E.C. 1.11.1.7) activity was determined by monitoring the formation of guaiacol dehydrogenation product (extinction coefficient 6.39mM cm⁻¹) at 436nm following the method of Pütter. For free polyamine determination, benzoyl-PAs was detected on LC-MS with slightly modification of Redmond and Tseng method(1978).

Results

- Catalase activity in both rice cultivars was momentarily decreased for initiation time, *i.e.* within 1hr after ozone fumigation. However, its activity was reactivated 3hr and 5hr after fumigation. Thereafter, the activities of antioxidative enzymes were profoundly reduced. Effects of nitrogen supplement on catalase activity didn't appear a significant difference.

- Total polyamine synthesis was considerably enhanced in tolerant Chucheongbyeo than in susceptible Jinpumbyeo. In particular, putrescine(diamine) level was highly influenced by an increase of ozone exposure and nitrogen application whereas spermidine(triamine) and spermine(tetraamine) was not changed.

Correspondence author : suyoun1014@hotmail.com, TEL : 031-290-0260 (포스터발표입니다)

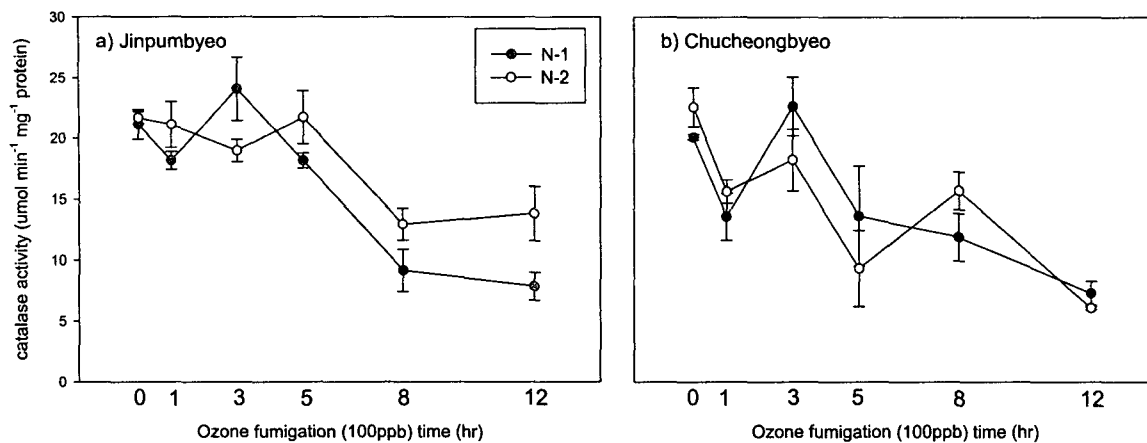


Fig. 1. Catalase activity in rice leaves after ozone exposure at panicle formation stage. The error bars represent standard errors (n=3).

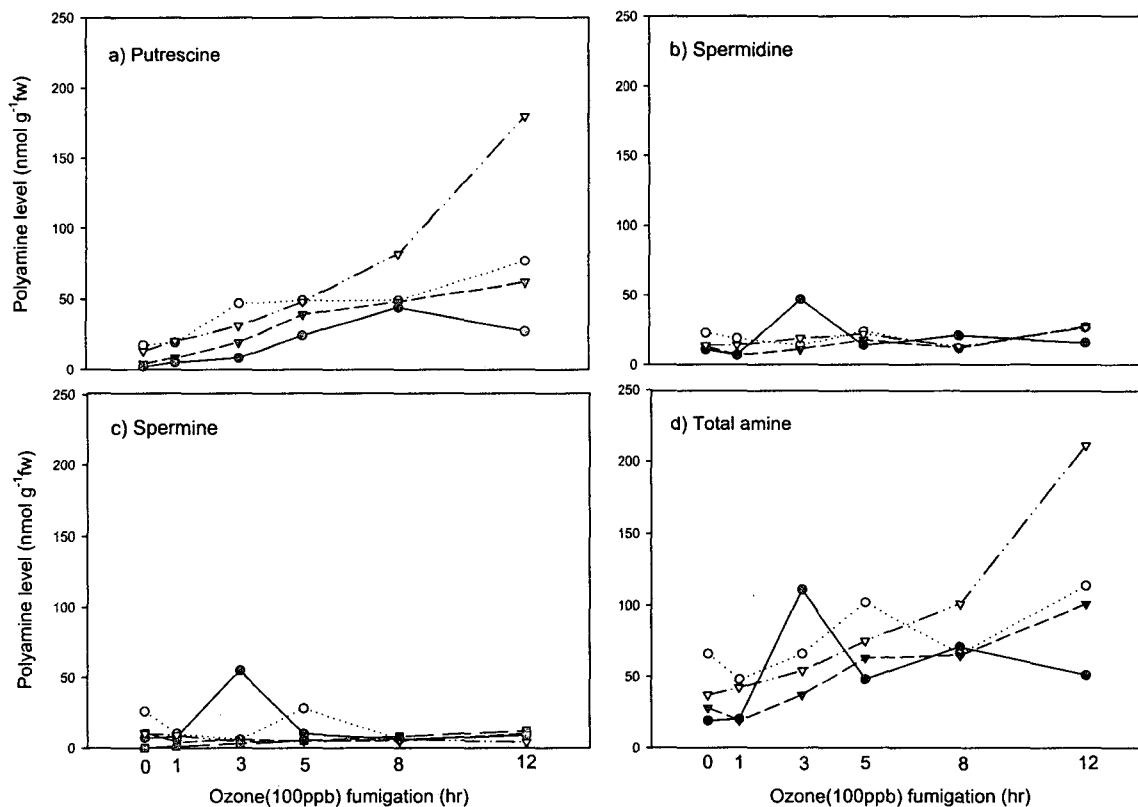


Fig. 2. Effect of ozone on polyamine levels in two rice cultivars with different N application. Each symbol indicates Jinpum-N-1(●), Jinpum-N-2(○), Chucheong-N-1(▼) and Chucheong-N-2(▽), respectively. The error bars represent standard errors (n=3).