

EFFECTS OF SEAWEED EXTRACT APPLICATION ON ANTIOXIDANT PROPERTIES OF TWO DIFFERENTIALLY CHILLING-SENSITIVE CULTIVARS OF MAIZE.

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ABSTRACT

Seaweed products are purported to provide enhanced germination and seedling establishment, increased chlorophyll content, root growth, nutrient uptake, and fruit set, improved resistance to pests, disease, and abiotic stresses such as drought, salinity, chilling and frost, as well as increased yield and improvements to yield quality and shelf life of produce. However, the mechanisms involved in the observed beneficial effects of seaweed extracts on plant performance remain uncertain. Research has determined that chilling stress in maize is characterized by increasing oxidative stress, and that antioxidant (both enzymatic and non-enzymatic) capacities are lower in more chilling-sensitive inbred and hybrid lines of maize than in those more tolerant. It was thus decided that the effects of seaweed extract on specific antioxidants and an indicator of oxidative stress would be evaluated in two commercial cultivars of maize differing in chilling tolerance. Both cultivars ('Spancross' and 'Golden Bantam') were grown for 18 d at 25°C in a growth chamber, then half of the plants were treated with Acadian Seaplants Limited's Soluble Seaweed Extract Powder (200 mL/pot of 100 mg/L). Controls received 200 mL/pot of water. After 3 days, half of the treated and control plants were placed in a 7.5°C chamber for four days, while the rest were kept at 25°C. Chlorophyll fluorescence of leaves (mid-leaf to tip) of the 4th, 5th, and 6th were evaluated on days 0, 1, 2, 3, and 4 of the temperature treatments; antioxidants and malondialdehyde (MDA), a secondary indicator of lipid peroxidation, were assessed on days 0 and 4 in the same tissue. Chlorophyll fluorescence (Fv/Fm), the index of relative chilling sensitivity, ranked 'Spancross' as relatively more chilling tolerant than 'Golden Bantam', and demonstrated that, though SSEP application increased the chilling tolerance of both cultivars, chilled 'Golden Bantam' was more responsive to SSEP application than 'Spancross' (Fig. 1). However, although MDA content increased when the maize cultivars were chilled, content of this compound did not differ between the two cultivars; moreover, SSEP application had no effect on MDA accumulation (data not shown). Similarly, while activities of ascorbate peroxidase (EC 1.11.1.11) increased in the more chilling-sensitive 'Golden Bantam' and activities of catalase (EC 1.11.1.6) decreased in both cultivars when chilled, SSEP application did not alter enzymic response (data not shown). Activities of superoxide dismutase (EC 1.15.1.1) did not respond to temperature or SSEP application (data not shown). Although there was little change in total ascorbate levels between control and SSEP treatments, SSEP application did induce a decrease in oxidized ascorbate in 'Spancross', but the oxidized:reduced ascorbate ratios were not affected by SSEP application in 'Golden Bantam'. It is concluded that the increase in chilling tolerance with SSEP application as measured by

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chlorophyll fluorescence does not appear to be related to the specific antioxidants determined in this study.

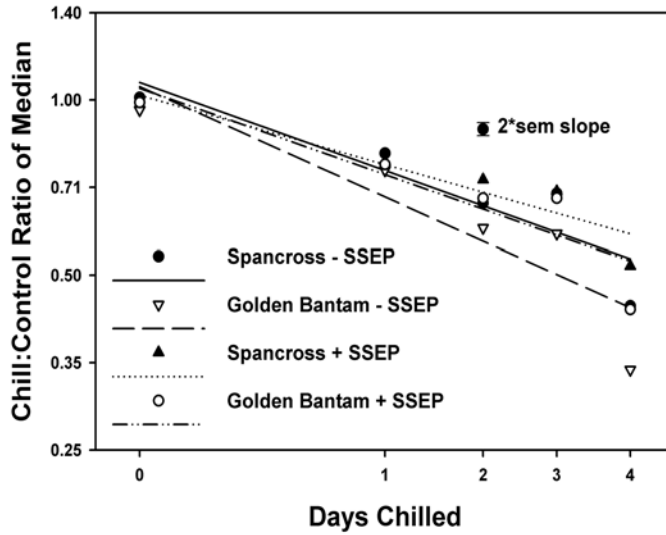


Figure 1: Chill: control ratio of 4th-6th leaf chlorophyll fluorescence of two maize cultivars