

## Effects of kelp (*Macrocystis integrifolia* and *Ecklonia maxima*) foliar applications on bean crop growth and nitrogen nutrition under varying soil moisture regimes

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### Abstract

A greenhouse experiment was designed to test the effects of two kelp (*Macrocystis integrifolia* and *Ecklonia maxima*) concentrates, when prepared as foliar sprays, upon bean (*Phaseolus vulgaris*) growth and N nutrition under three soil moisture regimes. Plant growth and developmental responses in this greenhouse experiment have demonstrated the effectiveness of the two kelp foliar sprays as plant growth regulating substances. Bean growth and developmental responses to the kelp foliar spray treatments were dependent upon the soil moisture regime to which they have been subjected. Although the two kelp foliar sprays had varying and sometimes contrasting effects on bean growth and N nutrition, which were dependent on the soil moisture treatment, their developmental effects upon the number of nodes, shoot/root ratio, leaf area ratio and specific leaf area were quite similar. A soybean callus bioassay demonstrated the presence of cytokinin-like substances and a callus growth antagonist in the kelp concentrate. Increasing dilution of the kelp concentrate disproportionately reduced the callus growth antagonist relative to the growth promoting or cytokinin-like activity.

### Introduction

Recent field plot trials have demonstrated that the South African kelp (*E. maxima* (Osbeck) Papenfuss) concentrate "Kelpak 66" and the British Columbia kelp (*M. integrifolia* Bory) concentrate, when diluted with water prior to foliar application, were effective in increasing bean (*P. vulgaris* L.) yields (Temple and Bomke, 1989). According to Abetz (1980) kelp foliar sprays may be effective in increasing marketable yields of various crops under environmental stress conditions. However, we are unaware of any documented research which supports the claim that kelp foliar sprays are most effective under water stress conditions.

The cytokinin phytohormones have been postulated as the active constituents of kelp foliar

treatments (Finnie and van Staden, 1985; Sanderson and Jameson, 1986; Tay *et al.*, 1985). Foliar applied cytokinins have been shown to be effective in alleviating some of the plant symptoms associated with drought and waterlogging stress (Levitt, 1980). Environmental factors such as drought and waterlogging decrease yields, increase plant elemental concentrations and reduce total uptake (Datta, 1985; Gerakis *et al.*, 1975; Mengel and Vonbraunshweig, 1972; Marais and Wiersma, 1975; Mattison, 1973; Nambiar, 1976). Interactive effects between the environment and plant may be important factors which determine the efficacy of kelp foliar sprays and the types of plant growth and nutritional responses recorded with their use.

The objectives of this greenhouse investigation were to determine the effect of the kelp foliar sprays on bean (*Phaseolus vulgaris* L.) growth, develop-