

## Effects of kelp (*Macrocystis integrifolia* and *Ecklonia maxima*) foliar applications on bean crop growth

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### Abstract

In 1983 and 1984 field plot experiments were established to assess the effects of a foliar applied (2 or 4 L ha<sup>-1</sup> × four applications per season) kelp *Macrocystis integrifolia*, concentrate on growth and nutrition of bean, *Phaseolus vulgaris*. A commercial kelp concentrate, prepared from *Ecklonia maxima*, was also used as a test comparison. In the first year a phytohormonal extract of the *M. integrifolia* concentrate, designed to extract the cytokinin, auxin and gibberellin phytohormones, was also applied to the crop to test the thesis that these phytohormones are active constituents. In each of the two field seasons the kelp concentrates increased harvestable bean yields on average by 24%. The phytohormonal extract also increased yields, but was less effective than the kelp concentrate itself. Bioassay results demonstrated the presence of phytohormone-like substances in this crude extract.

### Introduction

Various kelps have been processed commercially for worldwide use as crop foliar sprays. Much of the early research has been reviewed by Abetz (1980). In the late 1970's a kelp (*Ecklonia maxima* (Osbeck) Papenfuss) concentrate called "Kelpak 66", for use as crop foliar spray was manufactured by Kelp Products Ltd. of South Africa. The South African process involves physical disintegration of raw fresh kelp by milling and high pressure (> 40,000 kPa) homogenization to reduce the particle size of the kelp to approximately 50 µm (South African Patent 78/3281). Selected crop responses include increased seed germination and plant growth and altered development and nutrition (Featonby-Smith and van Staden, 1983a; 1983b; Kotze and Joubert, 1980; Nelson and van Staden, 1984a; 1984b). Cytokinin-like substances have also been detected in the kelp concentrate and are suspected to be active constituents (Featonby-Smith and van Staden, 1983b; Finnie and van Staden, 1985), although 1-aminocyclopropane-1-carboxylic acid (ACC), the immediate precursor to the

phytohormone ethylene, is also implicated (Nelson and van Staden, 1984b and 1985).

Field studies were designed to investigate the potential use of the kelp, *Macrocystis integrifolia* Bory, processed as a concentrate for use as a kelp foliar spray on bean (*Phaseolus vulgaris* L.) crop productivity. The *M. integrifolia* kelp concentrate was compared to a crude phytohormonal extract of the *M. integrifolia* concentrate. This was a test of the hypothesis that natural growth promoting phytohormones, such as auxin, gibberellin and cytokinin, may be active constituents. This phytohormonal extract was subsequently bioassayed for the presence of growth promoting phytohormones cytokinin, auxin and gibberellin-like substances. The commercially available South African kelp (*E. maxima*) concentrate, "Kelpak 66", was applied as an already documented and effective comparison.

### Material and methods

#### *Design of experiment*

*1983 Field trial.* On May 13, 1983 fresh kelp, *M.*