

**THE EFFECT OF SEAWEED CONCENTRATE  
ON PLANT GROWTH**

**By**

**I. J. CROUCH**

**Submitted in fulfilment of the requirements for the degree of**

**DOCTOR OF PHILOSOPHY**

**in the**

**Department of Botany, Faculty of Science  
University of Natal, Pietermaritzburg**

**December 1990.**

## ABSTRACT

The application of seaweed concentrates to plants has been shown to enhance growth and improve yield parameters. How these natural products elicit their beneficial responses is still unclear. While many of the growth responses have been attributed to cytokinins, it is obvious that this group of plant hormones cannot account for all the beneficial effects incurred from seaweed use. This study was therefore initiated to investigate the effects of a commercial seaweed concentrate (Kelpak) on several aspects of plant growth and development.

Tentative determination of plant growth regulators in the seaweed concentrate (SWC) using bioassay systems, indicated the presence of compounds with gibberellin-, abscisic acid- and auxin-like properties. Tentative identification of the auxins present in the SWC and *Ecklonia maxima* using High Performance Liquid Chromatography revealed the presence of tryptophan, indole-3-acetamide, indole-3-acetic acid, indole-3-carboxylic acid and indole-3-acetaldehyde.

The effect of SWC on the growth of nodal potato explants cultured *in vitro* was examined. 0.2% SWC significantly accelerated shoot growth and development. When applied at a concentration of 0.4% the number of axillary shoots per node increased. This treatment also stimulated the development of potato tubers on the shoots.

The SWC was also shown to enhance the growth of tomato (*Lycopersicon esculentum* Mill.) roots cultured *in vitro*. Filtration of the SWC indicated a promotory filtrate phase and an inhibitory cell wall phase. The application of the SWC to nematode-infested roots, cultured *in vitro*, reduced the degree of infestation in susceptible roots but induced host/parasite compatibility in a resistant variety.

One of the most pronounced effects noted with seaweed application was the promotion of adventitious roots on several species of garden plants. The application of similar dilutions to *Eucalyptus* cuttings increased the average root mass but had little effect on the number of roots initiated per cutting. The rooting factors, purified by HPLC, were tentatively identified as indole-3-acetamide, indole-3-acetic acid, indole-3-carboxylic acid or indole-3-acetaldehyde by co-chromatography with authentic standards.

Finally, the effect of seaweed concentrate on the growth of tomato plants grown in nematode-infested soil was investigated. SWC applied as a soil drench, improved plant vigour, significantly increased shoot and root fresh weights and resulted in a marked reduction in the number of nematode galls per unit length and per unit weight of root. Plants treated with a foliar spray of SWC were invariably the first to produce ripe fruit. Total yield was improved by over 10%. Ashing the SWC indicated that the active constituents are possibly of an organic nature. Filtering the SWC confirmed earlier reports that promotory and inhibitory compounds are present in the concentrate. Chromatographic separation of the SWC into 10 R<sub>f</sub> zones indicated the presence of several components with growth regulatory properties. It was found that the same fractions that improved plant growth also reduced nematode infestation.

The significance of these findings and the possible relationship between the endogenous plant growth regulators in *Ecklonia maxima* and the effect of the SWC on plant growth is discussed.