GROWTH STUDIES WITH LETTUCE

(LACTUCA SATIVA L)

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ABSTRACT

In a sand culture experiment carried out in a heated glasshouse, the effect of five levels of P (ranging from 7.75 p.p.m. - 124 p.p.m. on the growth of two cultivars of lettuce was examined. Samples were taken at weekly intervals for ten weeks and growth analysis, and chemical analysis of the whole plant were carried out for total N, P and K from the samples.

Significant differences between cultivars were found for net assimilation rate and leaf area ratio, with a slightly higher relative growth rate in young 'Cobham Green' plants. 'Cobham Green' had a greater leaf area ratio but smaller net assimilation rate than 'Webb's Wonderful'. The higher relative growth rate of Cobham Green at the early stages of growth was mainly due to its higher leaf area ratio, but net assimilation rate became an important component during later growth stages, possibly as a result of mutual shading.

Within each cultivar, however, the variation in relative growth rate was based on net assimilation rate rather than in leaf area ratio.

Both dry weight and the percentage of total P increased with increase in P supply. The percentages of total N and K decreased towards the market maturity but no general trend was observed in the percentage of total P.

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CHAPTER I

INTRODUCTION

Since Liebig developed his theories on the mineral nutrition of plants, the determination of the nutrient requirements of crops has been an important subject of physiological and agricultural research.

In the past, the use of chemical analysis has been qualitative (Goodall and Gregory, 1947) in the sense that an analysis of the plant material was performed in order to suggest or confirm a diagnosis of the disorder as due to the deficiency of a nutrient element. In many of the studies aimed at establishing a quantitative relationship between plant response and its chemical composition, the material for analysis was collected at harvest time (Goodall, 1948; Macy, 1936). In recent years interest has shifted from the analysis of plant material at harvest time to the analysis at earlier stages of development, with a view to using the information in improving the growth of these same plants.

Some of the techniques that have been developed for the assessment of the nutrient status or the nutrient requirements of crop plants are:

1. The diagnosis of nutrient deficiencies in plants based on the recognition of symptoms.
2. Chemical analysis of the soil or soil extracts to estimate the nutrient supply in the rhizosphere.
3. Chemical analysis of the plants or plant parts to determine their nutrient status.
4. The measurement of plant responses after the addition of nutrients in field experiments.

Specific symptoms are usually not apparent under moderate deficiency conditions and this restricts the usefulness of method 1. There are also cases where symptoms produced by pests and diseases, or by weather conditions, or even by sprays of hormones may be indistinguishable from mineral deficiency symptoms (Wallace, 1961). Methods 2 and 3 are in general based on the relationship between the concentration of certain nutrient elements in soil or plant extracts and the yield responses resulting from nutrient applications. The success of soil or plant analysis techniques depends on the agreement between the forecast and the yield increases obtained after fertilizer additions. The field experiment (method 4) is the ultimate test to which any diagnostic method must be submitted.

Growth analysis is now commonly used to study plant growth and to explain variations in crop yield. However, growth analysis has not been widely used to study the differences in plant growth between cultivars of lettuce in relation to their response to fertilizer treatment.

Lettuce has been found to respond to phosphorus application (Webster, 1969; Nichols, 1971b). The purpose of the present study was to find out the effects of different levels of phosphorus on the growth of lettuce using growth analysis techniques together with chemical plant analysis.