GROWTH STUDIES

WITH

LETTUCE

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Michael Adair Nichols

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ABSTRACT

Growth studies were made in the field using two cultivars of head lettuce, Webbs Wonderful (a crisphead type) and Cobham Green (a butterhead type).

In a fertilizer and density experiment using a systematic spacing design superimposed on a rotatable fertilizer design evidence is presented to suggest that the 'normal' reciprocal yield-density model

$$W^{-1} = A\rho + B$$

(when W is the mean plant weight at density ρ, and A and B are constants) is only applicable when there is competition at all densities. A 'modified' model is proposed which includes an additional parameter C, the density at which competition begins. The modified model is:

$$W^{-1} = A\rho + B \quad \text{if } \rho > C$$

$$W^{-1} = AC + B \quad \text{if } \rho \leq C$$

The plant weights in a non-competitive situation were fitted to a logistic model using a 'heat unit' environmental time scale, and an analysis of the logistic parameters showed a response only to serpentine superphosphate. This quadratic response was due to an increased relative growth rate (due mainly to an increased net assimilation rate) from the use of serpentine superphosphate up to 40 cwt./acre.

At low plant densities Webbs Wonderful has a higher relative growth rate compared with Cobham Green due to a slower rate of leaf production, and a higher net assimilation rate. This net assimilation

rate difference is attributed to the heavier leaves of Webbs Wonderful being light saturated at a higher radiation level than the leaves of Cobham Green. This theory is supported by the similarity in the yields from the two varieties at high densities.

The optimum marketable yield spacing for Cobham Green was found to be 1.4 plants/sq.ft. and for Webbs Wonderful 1.1 plants/sq.ft. In spite of a lower plant density the marketable yield from Webbs Wonderful was approximately double that from Cobham Green (at their respective optimum densities) due mainly to the later maturity of Webbs Wonderful, but also due to its higher growth rate.

In an experiment carried out in England, and later in New Zealand, successive sowings (over a total period of 22 months) were sampled at regular intervals from emergence until past maturity. The dry weight per plant data were then fitted to a logistic model, with a single set of parameters for each variety over all the sowings, using chronological time, and a number of environmental time scales. All the environmental time scales tested provided a better fit than chronological time, with solar radiation being superior to 'heat units'. A further improvement with the solar radiation time scale was obtained by valueing all radiation above a certain daily integral at only 50%.

In spite of the marked improvement when using environmental time scales, the results have little commercial application at present as a predictive tool because substantial differences were found in the logistic parameter estimates for the two sites, and also in the estimates of the

asymptotes for the different sowings.

It is essential that the asymptotes be the same over all sowings, or that the reason for any variation be known, because being based on a log. scale even a small variation would result in a large difference in absolute weight.

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