POTATO FOLIAGE DEVELOPMENT

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INTRODUCTION

In 1950, Adams and Kelley (1), working on the field control of potato insects, noted that although nearly 100 per cent reduction of aphid populations could be obtained, the expected elimination of leaf roll did not follow. They suggested that the continued spread of the virus might be associated with aphid feeding that could occur between DDT sprays at a time when the potato foliage was developing so rapidly that unsprayed areas were constantly appearing in all plots.

In order to investigate the daily amount of foliage development during the spray season the present experiment was undertaken.

REVIEW OF THE LITERATURE

Although Artschwager (2) gave careful attention to the general development of the potato plant, he made little reference to the actual rate of growth. He described the complexity of cellular development in detail without relating it in any way to a time scale. In Australia, Bald (3, 4, 5) examined potato growth in connection with the spread of virus diseases, and showed the rate at which leaf area increased. Contrary to normal field practice, he did not hill the experimental plots. This may have influenced the rate of growth somewhat. Baten and Muncie (6), Davis (7), Gregory (8), Marshall (9), Stanley (10), Stone (11), and Withrow (12) examined possible techniques for the measurement of plant growth. The methods of all these investigators except Stone are either too complicated or expensive to be useful at the present time under field conditions in New Brunswick. Using a planimeter, Stone measured the development of Green Mountain foliage under field and greenhouse conditions. She found that the curve expressing leaflet or entire-leaf growth conformed to the typical curve expressing the rate and distribution of growth in any of the other plant organs, such as stem or root. Measurements, in all instances, were made until the time of flowering.

Stanley stated that, since the total area of the leaves to be treated with insecticides may become 5 to 10 times more than the ground acreage as the season advances, the amounts of chemical to be applied should be based, in part, on the plant surface area per acre of ground.

METHODS

Investigations were begun in the field at Woodstock in 1950 and continued at Lincoln, N. B., in 1951. By means of daily, replicated

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photographs, measurements of height and width were made. The date of crop emergence in 1950 was June 30.

In 1951, in addition to the photographic record, certain portions of the plant were measured manually. These measurements, in sixty-fourths of an inch, made daily from the emergence of the potato plants on July 4 until senescence, were as follows: (a) the internodal distances on the main stem from base to apex; (b) the stem thickness just above the union of each leaf and the main stalk; (c) the greatest width of the plant when the branches were extended horizontally.

Plants for these studies were selected at random from plantings of Katahdin Foundation seed. All the plots were planted by machine, and cultural practices were those of the commercial field.

RESULTS

**Rate of Increase in Height:** Increases in height of 19 plants in 1951, computed from the lengths of the internodes, are shown in figure 1. Maximum daily increases occurred during a seven-day period beginning July 30, or mostly during the fifth week after emergence. Daily increases over this period averaged 7/10 inch.

**Rate of Increase in Width:** Figure 2 shows the daily and weekly increases in width. The greatest increases occurred on August 2 and 3, or during the fifth week after emergence. Daily increases at this time were approximately 8/10 of an inch.

**Rate of Increase in Stem Thickness:** Figure 3 shows that major increases occurred during the latter half of July and the first three days of August. After this period, the rate decreased rapidly and leveled off approximately August 13. The greatest daily growth occurred during the fourth week after emergence.

**Daily Increases, Height x Width:** From the manual measurements figure 4 gives the results of the daily and average weekly rates of increase in height and width during 1951. It shows that, in this area of New Brunswick, potato foliage developed most rapidly during the fifth week after crop emergence. After the fifth week, rates of increase diminished, although a lesser growth peak occurred on August 22.

**Weekly Increases, Height x Width:** From the measurements by photographs, figure 5 shows the products of the average weekly rates of increase in height and width in 1950 and 1951. In 1950 the greatest increase occurred during the fifth week after emergence; in 1951, during the fourth.

DISCUSSION

The acceleration of growth of potato plants about the fifth week after emergence is obviously important in a spray program. If further investigation confirms that generally the greatest development occurs about this time regardless of variety, or provides a simple phenologic means of determining when it occurs, spray programs can be adjusted more suitably to the rate of plant growth. In the past, chemical control recommendations have involved almost arbitrary spray intervals — intervals dictated usually by the insect only, not on the basis of the growth of the plant. The authors contend that, to be effective, sprays must be