STUDIES ON THE GROWTH AND DEVELOPMENT OF THE TOMATO (*Lycopersicon esculentum* Mill.)

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ABSTRACT

During the propagation of tomato plants a high and a low level of nitrogen was applied in factorial combination before and after initiation of truss 1. The high level of nitrogen prior to initiation produced earlier flowering and an increased yield in truss 1. It was suggested that a contributing factor to the latter response was that, where a change in nitrogen level was involved, the change from high nitrogen to low nitrogen produced a more productive plant response than when the sequence of applications was reversed. Flower number and earliness of flowering of certain trusses was increased by the high level of nitrogen applied after initiation. Initially the plants grew faster and cropped earlier in response to high nitrogen, but there were no differences in either the final amount of growth or the final crop.

The response of the plants to a change in nitrogen level suggested that some of the increase in yield due to exposure of young plants to cold temperatures, may be due to the change in temperature level. Warm and cold temperatures were therefore applied in factorial combination before flower initiation (9 nights) and for a subsequent period (14 nights) which included the flower initiation stage, with single-truss tomato plants. Cold temperatures during both stages increased yield and number of fruit and decreased

mean fruit weight. The early treatment was the most effective. It was suggested that low temperatures produced an enhanced supply of assimilates to the apex, which then initiated more flowers and that cold temperatures appeared to influence yield solely due to its effect on flower number. Shoot growth was reduced as yield increased and it was suggested that competition occurs for assimilates between the leaves and fruit.

The remaining investigations were devoted to the relationship between vegetative and reproductive growth (source sink relationship) in the tomato plant. By the use of leaf removal treatments a study on the importance of the amount and position of leaf tissue on the yield of single-truss tomato plants was carried out. A close positive relationship was shown to exist between leaf dry weight and yield, while leaf position did not appear to be important. The leaf and root tissues were shown to be in competition with the reproductive tissues for dry matter.

The nitrogen experiment indicated that competition occurred between fruit trusses for assimilates. By allowing plants to develop different numbers of trusses and then examining the effects of these treatments on the yield of a particular truss, competition effects between trusses were shown to exist with all trusses except truss 1.

The final investigation was designed to demonstrate that the yield of truss 1 could be reduced by competition for assimilates. The treatments consisted of 3 leaf levels, 2 pollination levels and 3 truss numbers in factorial combination. Competition effects reduced the

yield of truss 1 and it was shown that such effects were influenced by the level of sink strength. Total yield was increased by increases in leaf level when sink strength was high and by additional trusses or extra pollination when the amount of leaf tissue was adequate.

Evidence was presented in the last three studies that economic yield in the tomato plant can be limited simultaneously by lack of both source and sink strength. The studies on competition effects between trusses indicated that the net assimilation rate in the tomato plant can be depressed by lack of sink strength. Aspects of the source sink relationship in the tomato plant are discussed.

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