THE PHYSIOLOGY OF TOMATO PLANTS INFECTED WITH ROOT-KNOT NEMATODE, *MELOIDOGYNE JAVANICA*

by

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SUMMARY

The purpose of this research was to study the influence of infection by *Meloidogyne javanica* on the growth and physiology of tomato plants. The research is, therefore, mainly concerned with the pathology of the host plant in an attempt to ascertain the importance of some of the physiological components of the plant and how they affect plant growth and nematode populations.

Initial experiments assessed the effect of different levels of nutrients, temperature and soil water and interactions between these factors and inoculum density of nematodes on plant growth. Although root weights increased with increase in the density of inoculum, due to galling, there was little indication that the nematodes influenced top growth at different temperatures or soil water levels. Interaction occurred between levels of soil nutrients and initial population density of nematodes on plant growth. In general top growth was maintained in spite of nematode infection. How growth was maintained and how the nematode damaged the plant were then studied.

Histological studies by light and scanning electron microscopy indicated that the xylem vessels close to nematodes in the roots were disrupted. Giant cells formed in the provascular region even before the xylem pattern was established. The development of giant cells from the parenchyma cells inhibited cambium production, consequently no secondary xylem was formed. Abnormal xylem was not arranged longitudinally but was dispersed in a diffuse and disconnected manner. Thus the efficiency of the xylem as a conducting system was probably impaired. Measurements of the resistance of infected roots to water

flow and of water potential in the leaves supported this hypothesis. Nevertheless plants did not wilt and were not stunted. Measurements of stomatal diffusivity indicated that at the same water potentials, stomata in leaves of infected plants had a higher diffusive resistance than those in uninfected plants. Here is one mechanism that appears to maintain the integrity of the infected host plant by conserving water. Measurements of gibberellic aicd, cytokinins and abscissic acid suggested that the enhanced stomatal regulation in infected plants might be controlled by such hormones.

Studies on the amino acid composition of infected and uninfected plants indicated that total free amino acids, particularly proline and its precursors, increased in the infected roots. Higher concentrations of proline occurred in roots during the initiation of egg laying suggesting that proline was required for the production of eggs. High proline concentrations in eggs, egg sacs, females and galls supported this. Such studies suggested that a metabolic sink was created at sites in the roots where nematodes had formed giant cells and were reproducing. The possible significance of proline in the nematode-plant relationship and its use as a means of nematode control are discussed.