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Plant Resistance to Nematodes: Symposium Introduction[1]

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The resistant plant is man's most energy efficient and environmentally safe means of minimizing yield losses due to plant pathogenic nematodes. Significant numbers of scientific years are being invested in research aimed at developing, understanding, and/or assessing resistant cultivars.

Traditionally, the development of nematode-resistant cultivars has included four stages.

I. Recognition and assessment of nematode damage. Such studies identify the need and justify the investment required to develop resistant varieties.

II. Genetic manipulation: sexual recombination of plant germplasm to introduce nematode as well as other types of resistance into plants with desirable agronomic or horticultural traits. Breeders and nematologists often collect wild plant species from their geographic origins for incorporation into breeding schemes.

III. Progeny evaluation: the screening of progeny to assess the influence of the nematode on plant growth and the plant's influence on nematode reproduction. Progeny which perform well are taken to the field.

IV. Field performance. An assessment is made of plant yield, growth, and nematode reproduction-population dynamics under field conditions.

This approach has been reasonably successful. Resistant cultivars are available in such crops as beans, citrus, cotton, tomatoes, and tobacco. However, attempts to develop nematode resistance in some other crops have been thwarted by an apparent lack of resistant germplasm (Cucurbitaceae infected by *Meloidogyne spp.*). In other instances, resistance is known to occur in wild species found to be sexually incompatible with their agronomically desirable relatives.

Technological advances in tissue culture techniques, somatic hybridization, and genetic engineering may be useful in solving problems of sexual incompatibility. They may also aid programs by shortening the time period involved in cultivar production (this is particularly important in perennial crops where several years growth occurs before flowering). And they may increase field resistance stability by increasing the potential for incorporating multiple genes or horizontal resistance into agronomic crops. Protoplast procedures are being examined and adapted to introduce nematode resistance into crops where none previously existed.

The value of research on the physiology of resistance has been generally overlooked in the process of developing resistant varieties. Research results on the mechanisms of plant incompatibility to nematodes have generally been treated as descriptive facts. However, definitive results in this area could provide useful tools and insights into the development of resistant varieties. Such research could, for instance, be used to guide plant breeders in the selection of parent crosses by identifying independent mechanisms of resistance and their germplasm sources. Identification of causal factors for incompatibility in nematode-plant interactions could also provide the breeder with better evaluation procedures. Incorporation of new research findings and techniques into

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cooperative breeding programs should facilitate the design of new nematode-resistant cultivars.

Finally, prior to release, the cultivar should be carefully studied to determine its level of resistance to parasitism (including its response to various types or races) and its effect on nematode reproduction. The prolonged use of resistant cultivars is dependent upon providing the grower with, not only seed, but a formula for success based on an integrated approach to nematode control.