

Plant breeding of Commercial Peppers

for disease resistance

Many forms of peppers varying widely in fruit size, shape, flavor, color and pungency are encompassed in the genus *Capsicum*. The commercial types grown in California include Bell or sweet peppers and Floral Gem for the fresh market and for processing; pimiento for processing; and pungent chili types for the fresh market, for canning, and dehydration.

The diversified types of peppers and conditions of production present an assortment of problems for the pepper industry. Research at Davis and Riverside has been directed toward development of resistance to tobacco and cucumber mosaic viruses, *Verticillium* wilt fungus, and root knot nematode. In addition, studies involve increased yield, color, and pungency of chili types, increased size of yellow pickling types, and development of a mature green-fruited Bell pepper.

Tobacco Mosaic

Inheritance of resistance in pepper to tobacco mosaic virus is controlled by a single dominant gene. Resistance has been transferred into California—Anaheim—and Mexican chili types, and into the California Wonder and Floral Gem varieties. An ample supply of homozygous resistant material is available in each of these types, with work continuing to improve commercial characters of fruit size and production.

Cucumber Wilt

The program of plant breeding for pepper resistance to the damaging cucumber mosaic virus has been complicated by the nonavailability of an initial source of genetic resistance. Numerous introduced lines and commercial varieties have been tested under controlled greenhouse conditions and in the field. In the greenhouse, plants from certain lines survive repeated inoculations of the virus which infects all control plants. Seed from the plants surviving inocula-

tions have been grown and retested but with the discouraging results that all progeny were highly susceptible. In the field in 1959 approximately 500 plant introduction lines were surveyed, with three lines exhibiting a high level of field tolerance or resistance. Progeny from selected plants indicated a high level of resistance in greenhouse studies. Major emphasis in the breeding program is being directed toward this serious disease for more rapid screening and testing of available materials.

Verticillium Wilt

The *Verticillium* wilt fungus, capable of living long periods in the soil, has become a limiting factor in pepper production in some areas of California. The organism causes severe stunting of young plants and loss of leaves and fruit set of older plants. The stunting characteristic is used as a measure of susceptibility to screen seed lines in the greenhouse. Susceptible four-week-old seedlings inoculated with the fungus will measure approximately one-half the height of noninoculated controls after an additional four-week growth period.

Although the program for obtaining resistance to *Verticillium* wilt has been underway for several years, none of the approximately 150 seed lines tested have provided a usable level of resistance. Materials indicated as resistant to pepper *Verticillium* in other states appear susceptible to California strains of the organism. The pepper plant breeding program is being enlarged to enhance discovery of genetic resistance.

Root Knot Nematode

Pepper is virtually immune from the root knot nematode—*Meloidogyne javanica*—and, recently, resistance to the root knot nematode—*M. incognita* var. *acrita*—was reported as being in the form of a single dominant gene. Highly resistant plants have been used in crosses to Cali-

fornia Wonder. The program involves backcross to the commercial parent to complete transfer of resistance. Two additional backcross generations are required to provide resistant materials for field trials.

Mexican and California chili peppers are grown predominantly for their pungent flavoring and red food coloring. Twelve advanced breeding lines of each chili type were evaluated for color and commercial characters in three separate areas in southern California during the 1959 season. Within the California chili types, color levels were not sufficiently greater than commercially available lines to warrant continued work with these lines. Crosses have been made between high color Guajillo and tobacco mosaic resistant California chili in an attempt to increase color level in the California type.

Individual plant selections from two Mexican chili lines showed a very favorable level of color. One line was consistently higher in color than commercial Mexican types with individual selections reading 40 units on the Lovibond scale, on the whole pod basis, as compared with commercial readings of 22–24 Lovibond. These selected materials will be increased and further selections accomplished for high color.

Large fruited, highly pungent peppers of the Cayenne type are desired by the dehydration industry. However, as fruit size increases, there is a decided decrease in pungency due to genetic causes and to dilution of the pungent factor. Selections from highly pungent lines have resulted in a pungency level of 30,000 to 58,000 heat units on the Scoville scale, and a pod length of 4"–6". These selections are resistant to tobacco mosaic virus and have the soft flesh gene.

Bell pepper fruit, eaten at the green immature stage of development, turn red at maturity. A mature green-fruited type, possible by interaction of two recessive genes, would permit greater scope in harvest and marketing of the fresh product. Crosses from green fruited parents to California Wonder have been made, with segregants in the F₂—second generation—possessing the green mature fruit color, but not acceptable shape. Backcrossing and selection are continuing to obtain commercial types.

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