PROCEEDINGS

OF THE

CARIBBEAN FOOD CROPS SOCIETY

SECOND ANNUAL MEETING

BRIDGETOWN, BARBADOS

OCTOBER 19-23, 1964

VOLUME II

TOMATO BREEDING FOR THE TROPICS

H. Azzam [1/]

Introduction

The tomato is a very important vegetable in the tropics. Production is low in general, due to the lack of a suitable commercial variety. The commercial varieties grown have been developed for either temperate or subtropical conditions. The subtropical varieties may do rather well, but still are not considered perfect. Therefore, there is a great need for commercial tomato varieties developed for the tropics.

Tomato problems in the tropics are in many ways similar to the temperate zones, yet, it still has some peculiar problems of its own. These are entomological, horticultural and pathological problems. For instance, breeding for resistance to insects is not being carried out in the tropics, and thus the available commercial varieties lack the resistance to several important tropical insects. Therefore the control of all insects must be done by the use of insecticides.

Fruit Set

Fruit-set is considered among the most important horticultural problems. High night temperature contributes to poor fruit setting. In general tomato requires a night temperature of 65°F - 70°F for optimum set. The high temperature causes what is known as heat sterility. Pollen tube germination is best at about 70°F. Temperature above 90°F may roduce pollen sterility. Heavy rains may wash the pollen grains before fertilization or even prevent the opening of anthers. This will result in little or no pollination, and as a consequences no fruit set. Excessive soil moisture, such as tomato grown in poorly drained soil, could cause flower drop. Diseases and insects, especially those that can attack and damage tomato flowers, can cause poor set. The tropics are in need of tomato varieties that may overcome some of these difficulties.

Yield

Tomato yield could be devided into two major components (2): the total number of fruits depends on the number of clusters per plant and the number of fruits per cluster. The average fruit weight depends on the average number of locules

---

1/ Plant Breeder, University of Puerto Rico, Agricultural Experiment Station, Rfo Piedras, Puerto Rico.

and the weight per locule. The environment no doubt plays an important role on each of the components mentioned. Since there are several genes affecting yield (3) and to obtain maximums yield, there should be no limiting factors in any component. A desirable variety should posses all the desirable genes affecting each yield component.

Quality

The quality of tomato produced in the tropics is considered generally poor. However, some are produced with excellent quality. Tomato fruit quality depends on its external and internal features. The external features are: fruit shape, size, the scar at the blossom end, skin blemishes and cracking. The internal features are: the number of locules, flesh color, number of seeds, firmness and fleshiness. It is often noted that tomato fruits produced in the tropics are soft, cracked, with cat-face, of small size, and does not color well especially when picked mature-green. Any variety that is being developed for the tropics should have resistance to as many as possible of the above mentioned quality problems.

Mechanization

The gradual increase in labor man power in the tropics will in the future necessitate the development of a tomato variety adapted to mechanical harvesting. In addition, the increased interest in tomato processing will also demand the development of a tropical tomato variety suitable for that purpose.

Diseases

Tomato diseases in the tropics could be grouped into physiological and pathological diseases. Among the physiological disorders are: fruit cracking, blossom end rot, cat face, sun burn, softness and puffiness. The pathological diseases are those caused by bacteria, fungi, nematodes and viruses

Among the diseases caused by bacteria is the bacterial wilt caused by Pseudomonas solanacearum. The lack of a good resistant germ plasm materials is considered a handicap for breeding to its resistance. However few breeding lines were obtained that show some degree of resistance but their fruit quality are not commercially accepted.

Among the high costly items in tomato production is the frequent spraying with fungicides for the control of leaf and fruit fungi. Breeding for resistance to these fungi should help in cutting down the cost of production.

Nematodes are found everywhere in the topics. The root knot type is the most common one found on tomato roots. Varieties that were developed elsewhere for resistance to these nematodes were found not to be fully resistant in the tropics. This could be due to the differences in "races" or other reasons.

Among the most common tomato viruses that are widely noted are the tobacco mosaic and the cucumber mosaic. Commercial varieties that may have some resistance to either virus do not produce well in the tropics.

Tomato species other than Lycopersicon esculentum often carry genes for disease resistance. The following are some diseases and the corresponding species in which resistance could be found:

L. pimpinellifolium: bacterial canker, bacterial wilt, fusarium wilt, stemphylium, cladosporium, verticillium wilt and spotted wilt virus.

L. hirsutum: Septoria and Tobacco mosaic virus.

L. peruvianum: Root know nematodes, Alternaria, leaf mold, Curly top virus, spotted wilt virus, Tobacco mosaic virus and bacterial spot.

L. chilense: Curly top virus.

Resistance to other diseases are found now and then in the above mentioned species as well as others.

The interspecific hybrids has their own problems. These are in most cases Genetical and Cytogenetical aspects including incompatibility, sterility and linkages.

The inheritance mechanism of certain plant characters and the inheritance to some diseases, should be studied, if they are yet unknown. This will contribute to a better understanding of the characters that are being bred.

It is sometimes a problem for a breeder to determine the most suitable method of selection. Could he select for one trait at a time, or use a total score method in which to select for all traits simultaneously or set a certain level for each trait and eliminate any plants that falls below that level?

Selection methods will depend on the condition of each case, the breeding objectives and the characters that are being selected for or against.

Natural Cross-Pollination "NCP" is rather high under certain conditions. In Puerto Rico (1) it varies between 3 and 32% depending on insect activities and distances between breeding plots. The solitary bee, Exomalopis glubosa F, which is common in Puerto Rico and other minor insects were found to be the pollinating agents. NCP could be studied with the use of simple gene characters such as the potato leaf, pigment and some male sterile lines. The determination of the isolating distances needed to minimize the effect of NCP, is vital, not only to the breeding project, but also for future seed production of the varieties that will be developed. There have been cases in other self-pollinated crops that newly developed varieties lost some of its important characters within few years. NCP during seed multiplication is possibly among the reasons that contributed that loss.

In a tomato breeding program with the previously mentioned objectives, shor. cut methods should be used, as much as possible, in order to achieve most of the objectives in the least time possible. Some of these short cut methods could be: to screen for disease resistance to the most virulent isolates in the seedling stages, correlating seedling characters with mature plants, predictio. of fruit shape by observing the ovary shape of the first flowers to develop and the selection for some plant characters in the young stage. In addition and due to the fact of freedom from frost in the tropics, several generations could be obtained in one year. These methods will undoubtedly help in the rapid release of new varieties.

The final goal in a breeding project for a tropical tomato variety should be to combine the resistances to as many diseases as possible and in the mean time to maintain good horticultural characters.

The search for new germ plasms, the exchange of information and materials among tomato breeders in the tropic as well others, the cooperation of a Plant Pathoiogsit and Entomologist, and above all the work as a team, are of extreme importance to the success or failure of any breeding project.

SUMMARY

Tomato problems in the tropics in as much as they are similar to the temperate zones, still has some problems. Heat sterility; internal and external qualities of fruits; yield; diseases; insects and others, represent a great challenge in breeding for tropical varieties. Natural cross-pollination, in relation to seed production should be investigated. Discussion involves, breeding systems, methods, materials used, and emphasis is given to combined disease resistance.

LITERATURE CITED

1- Azzam, H., "Natural Cross Pollination of Tomato in Puerto Rico", Proceeding A. S. H. S. (Caribbean Region) 4:85-86, 1960.

2- Guffing, B., "An analysis of tomato yield components in terms of genotypic and environmental effects", Iowa State Agric. Exp. St. Research Bul. 397:324-380, 1953.

3- Powers, L. et al, "Partioning method of genetic analysis applied to quantitative characters of tomato crosses. U.S.D.A. Tech. Bul. 998: pp. 56, 1950.