

disease and ghost spot. Of equal interest, captan reduced ghost spot, but not the other two phases of the disease. This specificity for control of certain phases of the disease needs to be corroborated, but if this is true, inconsistencies in control of the disease by these two materials can be explained.

Dyrene and thiram were about equal and the best materials for the control of all three phases of the *Botrytis* gray mold disease. Other observations (4) are consistent with this. Ferbam was less effective than Dyrene or thiram against all three phases, but did reduce development of each phase of the disease.

On the basis of this work, Dyrene and thiram are recommended for control of the gray mold disease. Thiram should only be used on gray-leaf spot resistant varieties, because of relatively poor activity against the latter disease. Dyrene can be used on all varieties, but the present

relative cost of materials makes it desirable only on gray leaf spot susceptible varieties. Ferbam should be used only on gray leaf-spot resistant varieties and only then when the disease is expected to be mild, or under other specialized conditions.

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## SHOULDER POX, A NEW DISEASE ON TOMATO FRUIT

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Production of vine-ripened tomatoes on the lower east coast of Florida was estimated to be about 50 per cent of normal for the 1963-64 season. Sub-normal temperatures prevailing from early December through February were generally considered as the primary reason for this low yield. Another factor involved, however, was the widespread occurrence of a new fruit disease designated here as shoulder pox. The disease appeared in early January and persisted through February. Losses sustained from shoulder pox ran into the millions of dollars. Individual losses were as high as \$300,000.00. Several theories have been advanced concerning the cause of this disease. The purpose here is to present information on symptomatology and on conditions under which the disease developed, and to suggest possible causal relations.

#### SYMPTOMATOLOGY

Symptoms initiate on the shoulders of maturing, exposed fruit as superficial russetting (Fig. 1). These areas, irregular in outline and indefinite in size, vary in color from light to dark

brown. Tissue-collapse may occur within 72 hours resulting in definite sunken lesions (Fig. 2), or the affected fruit surface may retain its initial appearance indefinitely. Apparently through dehydration, affected tissues appear to harden with age and surrounding areas become shrivled (Fig.



Figure 1.—Shoulder Pox symptoms on tomato fruit: Top, early stages. Bottom, intermediate stages.

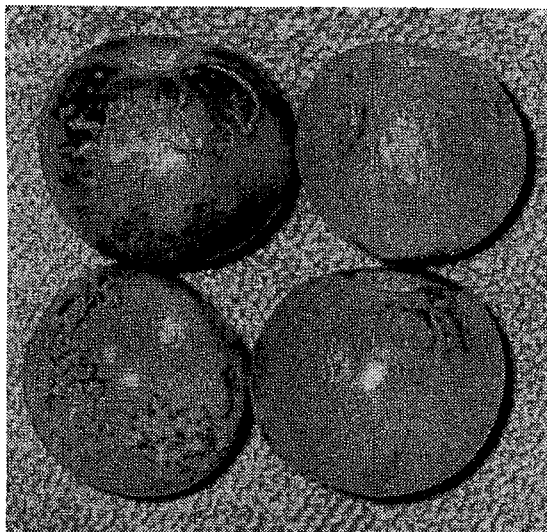


Figure 2.—Shoulder pox symptoms on tomato fruit: Advanced stages.

2, upper right). Once the diseased area is well-defined, further enlargement does not normally occur. An interesting observation was that secondary invasion by saprophytic organisms was not common. Affected fruit were not marketable.

#### ETIOLOGY

The cause of the disease has not been definitely established. However, it has been associated consistently with certain conditions which are enumerated below:

1. Maturing fruit. The disease appeared to predominate on fruit approaching the "star-breaker" stage of maturity.
2. Exposed fruit: The disease was not observed on fruit well-covered with foliage.
3. Temperature: The disease was initiated only during periods when the diurnal temperature range was from the low 40's (°F) to the low 60's.
4. Moisture: The disease was initiated only during periods of prolonged free-moisture accumulation on foliage and fruit.
5. Pesticide sprays: The disease did not develop in observed fields where emulsifiable concentrate insecticides and maneb-copper

combination sprays were discontinued during cool, wet periods even in the case of exposed fruit.

#### DISCUSSION

As noted above, exceptionally cool weather persisted from early December through February. Although rainfall was relatively light, foliage remained wet for extended periods. This resulted from dew formation at night and from persistent, misty rain during the day. It was during this period that the disease became evident.

Tomato fruit became "tenderized" under the conditions described, rendering them more susceptible to diseases both of pathological and of physiological origin. Also, free moisture is necessary to bring highly insoluble fungicides such as the fixed coppers and the dithiocarbamates into solution. It is also established that toxicity will occur only when such materials are in solution. Thus, the weather conditions set the stage for the disease by providing tender fruit and free moisture. The maneb-copper mixture, though formerly not recommended, has come into wide use because of its effectiveness against bacterial spot. In addition, it is ill-advised, according to many entomologists, to spray with emulsifiable concentrate insecticides when the temperature is below 60°F. Finally, mixing wettable-powder fungicides with emulsifiable concentrate insecticides, now a common practice, was not recommended until recent years.

With the above knowledge in mind, the writer advised against the use of maneb-copper mixtures and of emulsifiable concentrate insecticides during the period described. It should be noted parenthetically that this did not preclude the use of maneb alone or in mixture with certain other pesticides. Without exception, growers who followed this advice—and many of them did—escaped the entire season with only minor incidence of shoulder pox.

Although these observations do not definitely establish the causal relations of shoulder pox, they are suggestive. Until further information is available, it would appear desirable to encourage growers to exercise caution in the execution of their spray program during cool, wet weather.