crease in soluble solids through 12 days and a decrease during 12 to 15 days. Manapal showed a decrease during 6 to 9 days and increased thereafter. Again, this increase may have been due to loss of moisture as conjectured with the dry weight changes. STEP 419 was somewhat intermediate in soluble solid changes.

The locular tissue had higher soluble solids than the pericarp tissue, which was the reverse of the dry weight situation.

Discussion

Based on this experiment, it appears that varieties may differ in rate of softening during the time of ripening. Manapal fruits showed a decrease in softening rate after 9 days while STEP 461 and Marion fruits continued to soften at nearly the same rate. The time of making varietal comparisons is important, since Manapal and STEP 461 fruits were similar in firmness at 6 and 9 days after turning but not at 12 and 15 days.

The results also point out the necessity that each variety be of the some physiological stage of ripeness. For instance, if Homestead 24 fruits 7 days after turning had been compared with Manapal fruits 9 days after turning, no difference would have been found in color values. *Also,* if Homestead 24 fruits 7 days after turning were compared with STEP 461 fruits 9 days after turning, the conclusion would have been that the locular tissue of STEP 461 was more acid than that of Homestead 24.

Acknowledgment

Appreciation is expressed to Dr. James M. Walter of the Gulf Coast Experiment Station, Bradenton, for supplying the fruits.

LITERATURE CITED

1. Anderson, R. E. 1957. Factors affecting the acidic constituents of the tomato. Ph.D. Thesis, University of Illinois, Pp 63.
2. Foda, Y. H. 1957. Pectic changes during ripening as related to flesh firmness in the tomato. Ph. D. Thesis, University of Illinois, Pp 66.
3. Hall, C. B. 1963. Effect of storage temperatures after ripening on the color, firmness and placental breakdown of some tomato varieties. Proc. Fla. State Hort. Soc. 76: 304-307.
4. Hall, C. B. 1964. The effect of short periods of high temperature on the ripening of detached tomato fruits. Proc. Amer. Soc. Hort. Sci. 84: 501-506.
5. Hall, C. B. 1964. Firmness and color of some tomato varieties during ripening and according to harvest dates. Proc. Amer. Soc. Hort. Sci. 84: 507-512.
6. Hall, C. B. 1964. The ripening response of detached tomato fruits to daily exposures to high temperatures. Proc. Fla. State Hort. Soc. 77: 252-256.
7. Thompson, A. E., R. W. Hepler, R. L. Lower, and J. P. McCollum. 1962. Characterizzation of tomato varieties and strains for constituents of fruit quality. Illinois Agr. Exp. Sta. Bull. 685. Pp 32.

SUSCEPTIBILITY OF MANAPAL AND GROTHEN'S GLOBE TOMATOES TO ALTERNARIA ROT

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Introduction

It has been recognized that decay of tomato fruit caused by *Alternaria tenuis* auct. follows such defects in the field as sunscald, blossom-end rot, faulty blossom scars, and growth cracks (1). Subjecting tomatoes to "chilling" temperatures also increases the susceptibility of tomatoes to decay by *A. tenuis.* After epidermis injury and inoculation by the causal organism, susceptibility of tomatoes to alternaria rot increased as temperatures were reduced from 50° to 32° F (1). More than 95 hours of temperatures below 60° the week prior to harvest, without postharvest chilling, were found necessary to predispose tomatoes to alternaria rot (2).

In a study on ripening characteristics of tomatoes of varieties grown in Florida, large differences in susceptibility to alternaria rot were found among fruit of the several varieties (3). However, because of inconsistencies in results, relative to season and location, no conclusions could be drawn as to the inherent varietal susceptibility to alternaria rot following field or postharvest chilling. A study was made, therefore, to determine whether the two varieties, Manapal and Grothen's Globe, differ in susceptibility to *A. tenuis.*

Materials and Methods

Tomato plants of two varieties, Manapal and Grothen's Globe (Fusarium wilt *resistant* strain), were grown in parallel rows in a com-

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mercial field near Delray Beach, Florida. The plants were pruned to a single stem and trellised.

Tomatoes were harvested at the mature-green stage from each of the two varieties at 1- or 2-week intervals during the 1963-64 and 1964-65 seasons. Nine harvests of tomatoes were made between December 18, 1963, and February 27, 1964. Four harvests were made between January 6 and February 3, 1965, from one planting, and ten between January 27 and March 31, 1965, from a second planting.

Hours of temperature below 60° F during the week before harvest ranged from 11 to 102 in the 1963-64 season and 0 to 86 in the 1964-65 season.

Tomatoes were brought to Orlando the day after harvest. For each harvest in 1963-64 about 50 fruits of each variety were randomized into two equal lots; one lot was held at 35° F for 1 week and the other at 55-60° for 1 week. Both lots were then moved to 70° and held 1 week for ripening.

For each harvest in the 1964-65 season, 100 tomatoes of each variety were divided into two lots. The tomatoes in both lots were graded for the presence or absence of surface defects, and those with surface defects were classified and coded for stem-end concentric cracks, stem-end radical cracks, stem-end bruises, and defects on the remainder of the fruit. The tomatoes from one lot at each harvest were mechanically wounded by being rolled over nails protruding 1 mm above a flat board (4). The mechanically wounded tomatoes were then dipped into an aqueous spore suspension of *A. tenuis.* Both lots of tomatoes were ripened at 60° F for 2 weeks instead of 70° for 1 week as was done in the 1963-64 season.

Decay caused by *A. tenuis* was determined by inspection following all the holding periods for both seasons. The type of defects and injuries present on the fruit before ripening were related to alternaria rot occurrence on the same fruit after ripening in the 1964-65 season.

RESULTS

Manapal tomatoes had a higher incidence of decay caused by *A. tenuis* than Grothen (Table 1). In the 1963-64 season, the incidence of decay in Manapal fruit was about twice as great as in the Grothen fruit. As expected, decay was greater following the 35° F holding period than following the 55-60° holding period. From the two 1964-65 plantings with a 60° holding period, the incidence of decay in Manapal tomatoes was slightly greater than in the Grothen variety.

In the 1964-65 season, the relation between alternaria rot and fruit surface defects or mechanical injuries of Manapal and Grothen tomatoes was determined (Table 2). The types of defects varied in importance between tomatoes of the two varieties. Predisposition to alternaria

Table 1. Percentage of alternaria rot in mature-green harvested Manapal and Grothen tomatoes1/

Range of harvest dates	Number of harvests	Postharvest holding periods and temperatures	Alternaria decay	
			Manapal	Grothen
Dec. 18, 1963 - Feb. 27, 1964	9	7 days 35°; 7 days 70°	35	19
Do	9	7 days 55-60°; 7 days 70°	23	9
Jan. 6, 1965 - Feb. 3, 1965	4	14 days 60°	17	12
Jan. 27, 1965 - March 31, 1965	10	14 days 60°	19	15
		Average	23	14

1/ The tomatoes were "field-run", so included some defects.

Table 2. Alternaria rot following naturally-occurring defects and mechanical injury on Manapal and Grothen tomatoes from all harvests during 1964-65 season

Type of defect or injury	Percent of tomatoes with defects or injuries at harvest		Percent of alternaria rot on tomatoes with defects or injurics following 14 days at 60°F	
	Manapal	Grothen	Manapal	Grothen
Radial cracks (stem-end)	13	26	37	16
Concentric cracks (stem-end)	15	11	45	42
Bruise (stem-end)	12	12	28	20
Other defects	21	12	13	15
Total defects and average decay following all defects	61	61	30	23
Postharvest 1 mm puncture and inoculation	100	100	27	9

rot was influenced by the types of defects and by the tomato varieties. Manapal tomatoes had more stem-end concentric cracks, while Grothen tomatoes had more stem-end radical cracks. Concentric stem-end cracks predisposed fruit of both varieties to more decay than other defects. Radial cracks occurred on half as many Manapal as Grothen fruit, but more than twice as high a percentage of Manapal fruit with this defect decayed. There was little difference in decay between tomatoes as a result of other naturally occurring defects. Following postharvest wounding and inoculating, three times as many Manapal tomatoes decayed as Grothen tomatoes. Fruit of both varieties with stem-end surface defects were more susceptible to decay than fruit with mechanical injuries and inoculations.

Discussion

The consistency with which decay of Manapal tomatoes exceeded decay of Grothen under test conditions during 2 seasons indicates that Manapal tomatoes are more susceptible than Grothen to decay by *A. tenuis*. This susceptibility was not due to a higher incidence of surface defects. Stem-end radial cracks occurred on approximately twice as many Grothen tomatoes, yet decay from infection initiated at the cracks was approximately equal for both varieties. Combining resistence to radical cracks of Manapel with resistance to alternaria rot of Grothen should result in a variety of tomatoes with lower susceptibility to decay than now found in any variety commercially grown in Florida. In Florida and California, where tomatoes are grown in the winter, they may be chilled while still on the vine. Resistance to alternaria rot should to be an important criterion in the selection and breeding of varieties.

LITERATURE CITED

1. McColloch, L. P., and J. T. Worthington. 1952. Low temperature as a factor in the susceptibility of mature-green tomatoes to Alternaria rot. Phytopathology 42: 425-427.

2. Morris, L. L. 1954. Field and transit chilling of fall-grown tomatoes. Proc. Conf. on Transportation of Perishables. Davis, Calif. 101-105.

3. Segall, R. H., N. C. Hayslip, and J. M. Walter. 1963. Effect of postharvest temperatures on several tomato varieties harvested at the mature-green stage. Proc. Fla. State Hort. Soc. 76: 172-177.

4. Smoot, J. J., and C. F. Melvin. 1961. Effect of injury and fruit maturity on susceptibility of Florida citrus fruit to green mold. Proc. Fla. State. Hort. Soc. 74: 285-287.