roneously diagnosed as excess salt, when in fact it is just the reverse. The problem has become more widespread in commercial pepper fields, even with container grown transplants, since many plant production houses no longer include any fertilizer in their seeding mix (personal communication). Until recently some fertilizer, usually a controlled release material, was incorporated into the seeding mix. This could supply nutrients to the seedling even though nutrients in the soil around the root-ball may be deficient. Secondly, in a dry season, when seep-irrigation is applied continuously, excess salts accumulate near the soil surface of the planting hole causing a reduction in plant stand and yield.

Since controlled release materials resist leaching and have a low salt index, the use of these as starter fertilizer placed in close proximity to seedling roots can substantially reduce both the lack of nutrients during wet weather and excess salt during dry weather.

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THE EFFECTS OF FERTILIZER COMPONENTS ON YIELD, RIPENING, AND SUSCEPTIBILITY OF TOMATO FRUIT TO POSTHARVEST SOFT ROT

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Abstract. **The effects of supplementary components of fertilizer on harvested tomato fruit were determined. The nitrate anion applied with either the potassium or calcium cation significantly increased the susceptibility to soft-rot decay of tomatoes grown on plastic mulched or uncovered beds. The chloride anion applied with the same cations had no significant effect on susceptibility to decay or rate of ripening. Plants given supplementary nitrate had significantly higher yields and longer ripening times for mature-green fruit than plants given supplementary chloride. The cations had no effect on yield, rate of ripening, or development of decay.**

In Florida, one of the most important recent changes in tomato growing is the use of plastic mulch covering for the planting beds (2). Also, the cultivar 'Walter' has become dominant, primarily because of its high-quality fruit and resistance to the races of Fusarium wilt present in Florida (4). With the use of plastic mulch and the 'Walter' tomato, the incidence of postharvest decay, especially bacterial soft rot due to *Erwinia carotovora* Jones, increased (3). Part of this increase might be due to the relatively high susceptibility of the 'Walter' to bacterial soft rot (1). However, this high susceptibility did not explain the differences in the incidence of decay between lots of 'Walter' tomatoes from various growers. It has been found that mulching increased the susceptibility to soft rot (3). Fertilizer components might influence this susceptibility. We conducted these tests to determine the effects of supplementary components of fertilizer on harvested tomatoes.

Materials and Methods

'Walter' tomatoes were grown from transplants at the Agricultural Research and Education Center, Bradenton, on beds covered with a plastic mulch and on uncovered conventional beds.

On the plastic mulch beds, all fertilizers (1000 lb of 18-0-25-2 and 500 lb superphosphate/A) were applied before the beds were covered. On uncovered beds, the same fertilizer treatments were added at the rate of 1000 lb/A split into 3 side-dressings at 2- to 3-week intervals. Treatments applied to both the mulched and uncovered beds included the basic (18-0-25-2) application and the basic application mixed with 1000 lb/A of one of the following supplements: calcium nitrate, potassium nitrate, calcium chloride, or potassium chloride. Each treatment was replicated, and the test was repeated for 3 growing seasons: spring and fall of 1973 and spring of 1974. Two harvests were made each season. Tomatoes were picked at the mature-green stage and the yields recorded. Following each harvest, the tomatoes were brought to the U.S. Horticultural Research Laboratory in Orlando for postharvest treatment and holding. Tomatoes from each field plot were graded to eliminate culls, and 50 fruits from each plot were randomly selected for inoculation. The tomatoes were washed in tapwater and sprayed with a suspension of *Erwinia carotovora* at a concn of 1 x 10^8 cells/ml, which simulated packinghouse contamination. A petroleum-based vegetable wax was brushed on in a commercial waxer. All lots of fruit were held for 3 weeks at 70°F (21°C) and 90% relative humidity. Inspections were made twice weekly during this holding period, and decaying fruit were identified, counted, and then removed to reduce secondary infection. Data were recorded as percentage of fruit decayed during the 3-week holding period. The ripening rate of the tomatoes was calculated by determining the percentage of green fruit in each lot at the first inspection,

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Table 1. Effect of fertilizer components and mulching on yield, ripening, and the incidence of bacterial soft rot in 'Walter' tomatoes.

Fertilizer treatment	Percent soft rot			Percent green fruit			Bushel/acre		
	mulched[z]	uncovered[z]	avg	mulched	uncovered	avg	mulched[z]	uncovered[z]	avg
18-0-25-2	30.0	26.1	28.2	42.2	39.1	40.6	892	684	788
18-0-25-2 + $Ca(NO_3)2$	36.7[y]	34.1[y]	35.4[y]	46.1	45.5	45.8[y]	884	692	788
18-0-25-2 + KNO_3	40.0[y]	36.8[y]	38.4[y]	42.7	44.6	43.6[y]	978	728	853
18-0-25-2 + $CaCl_2$	24.6	17.1	20.8	35.2	34.7	34.9	854	622	738
18-0-25-2 + KCl	28.8	18.2	23.5	35.1	42.0	38.7	868	552	710
Avg of all treatments	32.0	26.5	29.2	40.3	41.2	40.7	892	656	775
Avg of anion-supplemented treatments									
NO_3^-			36.9[x]			44.7[x]			817[x]
Cl^-			22.2[x]			36.7[x]			724[x]
Avg of cation-supplemented treatments									
Ca^{++}			28.1			40.4			646
K^+			29.2			41.1			657

[z]Mulched significantly higher than uncovered at the 1.0% level.
[y]Nitrate salts significantly different from chlorides at the 1.0% level.
[x]Nitrate anion significantly different from chloride anion at the 1.0% level.

4 days after harvest. The data were analyzed statistically by use of analysis of variance.

Results and Discussion

Susceptibility to bacterial soft rot was significantly higher in tomatoes grown on beds covered with plastic mulch than in tomatoes grown on uncovered beds (32% vs 26.5%—Table 1). For all 5 fertilizer treatments, the incidence of decay was higher in fruit grown on mulched beds than in those grown on unmulched beds.

Susceptibility to decay was also influenced by applications of supplementary fertilizer. Fruit from plants receiving supplementary applications of nitrogen, as calcium nitrate or potassium nitrate, developed a significantly higher incidence of soft rot than did fruit from plants receiving either no supplementary fertilizer or calcium or potassium chloride (Table 1). Nitrates significantly increased decay of fruit from plants grown on both mulched and unmulched beds. Although the differences are not significant, fruit from plants receiving calcium chloride (on both mulched and unmulched beds) and potassium chloride (on unmulched beds only) had a lower incidence of decay, than those receiving only the basic 18-0-25-2 fertilizer application. Combining all the treatments for plants receiving supplementary anions and cations illustrates the significant effect of nitrate ions over chloride ions on the incidence of soft rot decay (36.9% vs 22.2%) and the lack of effect of the cations calcium and potassium (28.1% vs 29.2%). These data show that supplementary nitrate had the greatest effect on susceptibility to bacterial soft rot.

Fertilizer supplements also affected rate of color development following harvest (Table 1). Fruit from plants receiving supplementary nitrate ripened significantly more slowly than fruit from plants receiving supplementary applications of chloride (44.7% green fruit vs 36.7% green fruit). Calcium, potassium, and mulching had no significant effect on color development.

The applications of supplementary fertilizer also affected yield (Table 1). Plots receiving supplementary nitrate averaged 817 bu/A, which was significantly more than the 724 bu/A produced by those receiving supplementary chloride. However, there were no significant differences between the plots receiving the 18-0-25-2 only and those receiving this fertilizer plus additional nitrate or chloride. Yields with potassium nitrate were higher than those with calcium nitrate, but these differences were not significant at the 5% level. As reported previously (2), plants grown on mulched beds were significantly more productive than those grown on uncovered beds. This effect of the plastic mulch on yield was not affected by any of the fertilizer applications.

Bacterial soft rot of tomatoes has been considered primarily a postharvest problem. However, in these studies, we showed that certain fertilizer components, when applied to the beds on which the tomato plants are grown, influence the susceptibility of tomatoes to postharvest decay. In addition, these same fertilizer components influence the rate of ripening of the tomatoes after harvest. Specifically, high nitrate significantly increased susceptibility of the tomato fruit to bacterial soft rot and also decreased the rate of ripening of the mature-green tomato after harvest. The supplementary application of nitrate did not significantly increase yield. Supplementary applications of chloride had little effect on susceptibility to decay, rate of ripening, or yield.

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