Temperature and Air Pollution Effects on Early Fruit Production of F_1 TOMATO HYBRIDS

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TABLE 1. TOTAL PRODUCTION OF RIPE TOMATO FRUIT FROM THREE PICKINGS FROM TWO EXPERIMENTAL BLOCKS IN RIVERSIDE TESTS.

Variety or hybrid	Harvested July 27 and August 6				Harvested July 27, August 6 and August 23			
	Block				Block			
	1	2	3	Mean	1	2	3	Mean
	lbs				lbs			
A	78	35	63	59	136	69	120	108
B	74	112	82	89	96	150	117	121
C	42	73	50	55	62	106	59	76
VFN8	6	15	19	13	26	47	60	44
VF36	22	54	51	42	28	87	95	70
VF6	1	5	1	2	48	60	35	48
			LSD	p = .05 27			LSD	p = .05 49
				p = .02 32				p = .02 61
				p = .01 38				p = .01 70

A—Hybrid of VF6 ms 31 × inbred line i.
B—Hybrid of VF36 ms 40 × inbred line i.
C—Hybrid of VFN8 × inbred line i.

EARLY FRUIT SETTING of tomatoes in experimental plots at Riverside, California, has been light in recent years. Unfavorable temperatures in late spring are a probable cause, but increasing atmospheric pollutants may also be involved since phytotoxic levels of total oxidants occur frequently in this area.

A randomized complete block of commercial tomato varieties and F_1 hybrids was sown March 9, and transplanted to the field on April 12, 1971, at Riverside. The three varieties used as seed parents, VF6, VF36, and VFN8, are productive in California; the nematode resistant VFN8 yielded notably well at Riverside in 1968. To what extent these tomatoes were injured by air pollutants is a matter of conjecture, since no control plants growing in pollution free air could be provided. However, records from an air monitoring station located less than 0.25 mile from the tomato plot revealed that from June 12 to August 31, 1971, total oxidants exceeded 0.1 ppm for 6 or more hours per day during 53 days. This is the level of total oxidants at which injury to susceptible plants occurs when they are exposed for 2 or more hours.

Accelerated senescence of the foliage and subsequent sunburn of the fruit occurred in all varieties, particularly in the hybrids. This is a recognized symptom of oxidant air pollutant injury, although the sunburn might have been reduced by closer planting or staking of the plants. Ethylene, a significant component of automobile-generated pollutants may have added to the adverse effect of oxidants.

Previous studies suggest that F_1 hybrids may be expected to perform better under adverse environmental conditions than commercial varieties. Superior, a genetically male sterile line (ms31 and ms40) of VF6 and VF36 and a male fertile variety (VFN8) were crossed with an inbred line *i*. The hybrids are referred to as A, B, and C in this paper. VF6 and VF36 are *Verticillium* and *Fusarium* resistant varieties similar to Pearson. VFN8 is also resistant to nematodes. Inbred line *i* originated from a cross of two linkage test lines and was inbred for eight generations. It is self-pruning, like VF6, VF36 and VFN8, lutescent l_2, brachytic *br* and very limited in growth with good, though restricted, early production.

A block containing ten plants of each sort with 5.5 ft between rows and between plants was replicated three times. An adjacent row contained 30 plants of

TABLE 2. TOMATO WEIGHT PER FRUIT (POUNDS), SOLUBLE SOLIDS AND TITRATABLE ACID EXPRESSED AS ANHYDROUS CITRIC ACID FOR SEVEN VARIETIES AND HYBRIDS

Variety or hybrid	Weight per fruit*	Soluble solids		Anhydrous citric acid	
		7/27	8/16	8/6	8/23
	lbs	%		%	
A	0.20	6.1	4.9	0.56	0.83
B	0.20	5.3	4.8	0.57	0.71
C	0.22	6.1	4.5	0.67	0.71
VFN8	0.32	5.3	4.9	0.50	0.59
VF36	0.39	6.1	.. ..	0.83	0.63
VF6	0.30	.. ..	5.3	0.63	0.51
Inbred line	0.16	.. ..	4.3	0.54	0.61

A—Hybrid of VF6 ms 31 × inbred line.
B—Hybrid of VF36 ms 40 × inbred line.
C—Hybrid of VFN8 × inbred line.
* Fruits harvested July 27 and August 6.

TABLE 3. RATING OF CONDITION OF TOMATO PLANTS FROM THREE HYBRIDS WHICH WERE TREATED AS SEEDLINGS WITH INOCULUM OF FUSARIUM LYCOPERSICI (F) AND TWO RACES OF VERTICILLIUM (V9) AND (C1).

Hybrid	Inoculant	Number of plants		
		Healthy	Slightly stunted	Vascular discolor.
A	F	50	0	2
B	F	27	0	1
C	F	37	0	0
VF36	F	14	0	0
Inbred	F	0	0	7
A	V9	14	7	1
B	V9	14	2	0
C	V9	6	2	0
VFN8	V9	5	0	0
A	C1	22	2	0
B	C1	14	2	0
C	C1	24	0	0
VFN8	C1	15	1	0

A—Hybrid of VF6 ms 31 × inbred line.
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inbred line *i*. Yield from the first two pickings, July 27 and August 6, showed significant differences among the three hybrids and seed parent varieties (table 1) with F = 14. All of the hybrids were significantly superior to the parent varieties, VF6, VF36 and VFN8. Hybrid B was significantly superior to hybrids A and C.

Yield differences

Differences in yield, including a third picking on August 23, were significant at the 0.05% level (table 1) with an F = 4.1. The mean square for error for the three pickings was 3.2 times that of the first two. Hybrid B yielded about 8.7 tons per acre in spite of the wide spacing and the fact that 18% were infected with the lethal disease, curly top. Curly top was most severe in May and extended into June, increasing the error variance. Yield of the F_1 hybrids was concentrated into a shorter harvest period than that of the seed parents. The smallest difference in yield was between VFN8 and its hybrid C.

Low fruit weight was a partially dominant characteristic in inbred *i* (table 2). Hybrid B, the highest in yield, weighed only 0.20 lb. Fruit weight invariably decreased as the season advanced. On August 23 some deep cracks occurred in the parent varieties, especially VFN8, but fewer appeared in the hybrids. Sunburn was severe on fruit picked on August 23, especially on the hybrids. The injury might have been less if plants had been closely planted.

Inoculation

The F_1 hybrids were inoculated in the greenhouse by dipping young seedlings in suspensions of *Fusarium lycopersici* (F) and two races of *Verticillium alboatrum* (C1) from cotton and V9 from tomato. No symptoms of *Fusarium* wilt appeared except in two plants of hybrid A and one plant of hybrid B (table 3). When inoculated with V9 about one-half of the plants of hybrids, A, B and C were stunted. C1 was apparently less virulent since very few plants of hybrids A, B and C were affected. The *Fusarium* resistance of V36 was confirmed by these results. The inbred line *i* was susceptible to *Fusarium*. As expected, resistance to *Fusarium* was dominant but resistance to *Verticillium* was only partially dominant. Nematode resistance of hybrid C was not tested.

The percentage of soluble solids was estimated by refractometer readings on juice from samples of 10 to 20 fruits. It was similar in the hybrids A, B and standard varieties and was lower in all cases in the August 16 picking (table 2). VF36 had the highest soluble solids of the parent varieties. Titratable acidity (table 2) measured August 8 and August 23 varied with date of sampling and variety. On August 23 it was higher in hybrids A, B and C than in the parent varieties VF6, VF36, VFN8 and inbred *i*, but the differences probably were not significant. In all hybrids and parents, acidity increased significantly from August 8 to August 23. Acidity of VF36 was highest on August 8 with 0.83 and VFN8 was lowest with 0.50. Of the parent varieties VF36 had the highest soluble solids, titratable acidity and production.

Hybrids superior

On the whole the hybrids were superior to the parent varieties in early fruit production. The fruit was smaller, similar in soluble solids and slightly less inclined to cracking. Flavor and keeping quality of the hybrids was very satisfactory. Hybrid B produced the highest fruit yield. Hybrids of male sterile (ms) parents and their inbred produced more early fruit. The relatively expensive hybrid seed may be justified for fresh fruit and home gardens in areas where air pollutants are high but may be prohibitive for processed tomatoes. The longer style of ms31 is more accessible for hand pollenation than that of ms40; and ms-VFN8 was not available. Accordingly, the fruit harvested July 27 and August 6 originated from flowers that set fruit in mid-June. Air polluting oxidants were very high on June 12, 1971, through June 26, 1971. It seems probable that yield was related to air pollution conditions early in the flowering season. In the absence of controls, however, this was not proved. Evidently, under severe atmospheric pollution the F_1 hybrids were superior to the parent varieties.

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ANZA–

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ANZA, A SPRING WHEAT variety released by the University of California in 1971, offers growers a new choice for a variety in the medium-to-late maturity range. Named in honor of Don Juan Baptiste de Anza, who led settlers from Sonora, Mexico to California in about 1775, the variety has followed a similar route.

Anza originated from a hybrid made at the Centro de Investigaciones Agricolas del Noroeste (CIANO) near Cuidad Obregon, Sonora, Mexico by scientists of the Mexican Government and the International Maize and Wheat Improvement Center (CIMMYT). The parentage of Anza is (Lerma Rojo × Norin 10 – Brevor) × [(Yaktana 54 × Norin 10 – Brevor) × Andes^s] and the hybrid and selection number is II8739-4R-1M-1R. A selection from this cross was sent from the station in Sonora to J. C. Williams at Davis by N. E. Borlaug in 1964. Another selection from this cross was entered in the International Spring Wheat Yield Nursery in 1969 from the wheat improvement program in the Sudan. The Sudanese selection was subsequently released and named Mexicani in the Sudan. A similar variety (WW15), selected from the same hybrid was released in Australia. Anza was not released in Mexico because of its susceptibility to certain races of stem and leaf rust that occur in the state of Sonora. Anza has performed well in the world-wide international yield nursery and is now known to be adapted to much of California's wheat producing area.

Description

Anza has a spring growth habit with medium to late maturity. Tillering is profuse and the leaves are moderately short and narrow. The spikes are fully awned, mid-dense, and erect with a tendency to nod at maturity. Glumes are cream to white in color and the peduncle is slightly S-shaped (see photograph). The variety is somewhat shorter than INIA 66R, Pitic 62, and Siete Cerros 66, but 3 to 6 inches taller than "triple dwarf" varieties such as Cajeme 71, Saric