

consumer demand for tomatoes in the north was the reason the tomato industry developed in Florida. The northern consumer has demanded a higher quality tomato year after year and the Florida tomato industry has responded to this challenge with new varieties, cultural and handling practices, each of which improved the end product.

Ethephon treatment of green harvested fruit applied at the packinghouse appears to have promise as a new technique for further improving the quality of winter grown and shipped tomatoes. Ethephon applied as Ethrel has been labeled and approved by the Food and Drug Administration (FDA) for use on processing tomatoes applied at 1.6 pounds per acre (8.7 Kg/ha) ten days prior to harvest. It is not labeled for use as described in these experiments; however, there is no reason to anticipate Ethrel can not be labeled for use as a dip treatment after presentation of required data to the FDA. If dip treatment of fruit is approved and properly utilized by the farmer and packer,

the Florida tomato industry will be able to advance one more step in producing higher quality fruit for the American consumer.

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FEASIBILITY OF PRODUCING CANNING TOMATOES BY UTILIZATION OF NEW DISEASE RESISTANT FLORIDA LINES

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Abstract. A number of named varieties and Florida breeding lines of canning tomatoes were evaluated and three seasons results are reported. Comparisons between standard canning varieties and inbred lines with similar characteristics selected from the Florida tomato breeding program demonstrate the superior adaptability of these latter lines for Florida production. This superiority is associated with soil disease resistance and better horticultural characteristics. Yields based on a plant population of 15,938/ha ranged from

81.7 to 108.9 t/ha during several seasons. Evaluations of color, pH and solids are given for comparison.

The University of Florida tomato breeding program is designed for the development of superior fresh-market varieties; however, many of the segregating lines result in plant types which are small-fruited but having all the disease resistance plus desirable horticultural characters which make them suitable whole-pack canning types.

These Florida lines together with the Southern Tomato Exchange Program-Processing Type varieties (STEP-PT) have been evaluated on an annual basis at Bradenton since 1968 in anticipation of the time when the Florida canning industry would be forced to alter its present methods of operation.

At the present time a suitable tomato variety is not available for the whole-pack canning industry of Florida, primarily because the Florida canning industry exists as a salvage operation. The canner contracts with a fresh-market tomato

grower for his field after the fresh-market season is over. This usually provides the canner with most of the fruit set at the top of the vine which is too late and too small for fresh market. Such an arrangement has until recently been quite acceptable for the canning industry; however, the development of determinate varieties for fresh market use reduced the amount of fruit available for a salvage operation. The rapid adoption of varieties such as 'Walter' by Florida fresh market tomato growers has drastically reduced the amount of fruit available for canning because virtually all the fruit can be sold for fresh market consumption. Florida tomato canners periodically now find fruit unavailable for canning.

The evaluation of canning varieties has shown that all the available commercial varieties fail to perform in Florida because of disease susceptibility and generally poor color. Color and other quality measurements for Florida grown tomatoes were reported by Bates and Strobel (1). Matthews and

Bryan (3) showed that ripe tomatoes of Florida MH-1 salvaged from mechanical harvest operations had superior processing quality. The necessary disease resistances and yields required to offset the higher cost of Florida production were studied by Crill and Burgis (2).

The objective of this report is to summarize results from a continuing study of named varieties and various fixed Florida lines having possible variety status and adapted for Florida production and for use in the canning industry.

Materials and Methods

Prior to 1969, processing trials were conducted following the conventional method of ground culture. In these tests many fruits were lost to soil rots and yields were generally poor. Beginning in the spring of 1969 all experiments were conducted using a full bed mulch system where the flat topped bed was 25 cm high and 76 cm wide.

Table 1. Yields of red-ripe fruit of ten varieties and Florida breeding lines (metric t/ha).

	Spring 1969	Fall 1969	Spring 1970	Fall 1970
Roma	15.8			73.2
La Bonita	32.7			43.1
Chico Grande	27.8		81.1	90.7
Campbell 28		34.6	74.6	88.0
Fla 442	42.8	46.6		
Fla 920-1	39.2	54.7		
Harvester	18.2		11.2	
Fla 407		34.6	54.5	65.9
Fla 1346		56.4	29.1	59.1
Fla 2086		68.6	64.8	80.6

Each area was prepared by applying an initial broadcast application of 672.5 kg/ha of super-phosphate containing 5.6 kg of fritted trace elements (FTE-503). After the beds were formed (137 cm row spacing) 1681.3 kg/ha of an 18-0-25-2 fertilizer was placed in narrow bands near each bed shoulder prior to installing the cover. The cover in this case was a 24.9 kg craft paper with a 0.25 mil layer of polyethylene on both surfaces. Irrigation was supplied by a seep ditch system in which each 7 rows were separated by a water ditch.

Each experiment was arranged in a randomized block design with 4 replications on a Myakka fine sand (pH 5.8 to 6.2). Each experimental unit contained 4.57 M of row and the transplants were spaced 45 cm apart.

Data for each crop were obtained by a once over destructive harvest and weighing the red-ripe marketable fruit produced per plot.

There is good evidence (2) that the yield of canning tomatoes must exceed 82 t/ha if production in Florida is to be profitable. Thus, any of the Florida lines having a potential of 82 t/ha or more may be considered varietal candidates and comparisons based on statistical differences in yield will be made when lines which perform well in Florida are available.

As of 1971 none of the named varieties or any of the STEP-PT or Florida lines had resistance to race 2 of the *Fusarium* wilt fungus which is essential if the tomato is to be grown in Florida. Thus, in 1971 all the existing lines were discarded. The 2 seasons (Spring and Fall) of 1971 were devoted to screening the available Florida material.

Since the coreless whole-pack seems destined to revolutionize the canning industry, screening of selections was confined to obtaining a small stem scar, round fruit, red color and jointless pedicel (J_2). Presently the Florida lines have this J_2 character which facilitates stem removal from the fruit during harvest.

The 1972 Fall trial was a test of selected Florida material. Because the lines varied in maturity, one half of each plot was sprayed with 8.7 kg/ha of ethephon 20 days before anticipated harvest and lines were reselected at harvest.

The 1973 Spring test was a yield comparison among three canning varieties and three Florida lines. These plots were grown on fumigated soil in order that the full yield potential of the varieties could be observed.

In most seasons fruit were sent to the IFAS Food Science Department for determination of pH,

Table 2. Yields of red-ripe fruit from control and ethephon treated plots. Fall 1972 (metric t/ha).

	Non-treated	Ethepon treated
Fla 6027-3	37.3	106.2
6027-4	46.0	112.2
6034	41.9	63.4
6095	31.0	53.1
1050-1	52.8	89.6
1050-2	55.6	115.2

titratable acidity, soluble solids, ascorbic acid and color by methods previously reported (3).

Results and Discussion

Table 1 shows the yields obtained in 4 seasons. 'Chico Grande' and 'Campbell 28' were the best yielders of any of the named varieties. However, under Florida conditions all the varieties tested, except 'Campbell 28', showed yellow top (top or side exposed to sun does not turn red) in varying degree and had poor color. 'Campbell 28' has a medium to large core which must be removed for whole tomato packs.

Table 3. 1972 single plant evaluation for blossom scar, diameter and stem depth of selections from Fla. 1050-1 and Fla. 1050-2.

	% stem scars 1/4 inch or less	% core 1/2 inch or less depth
1050-1-1	60.0	100
1050-2-4	92.7	90
1050-1-10	61.6	80
1050-1-12	52.0	100
1050-1-13	80.1	100
1050-2-13	85.9	90

Table 4. Yields of red-ripe fruit together with stem scar and core depth evaluation from replicated trials, Spring 1973.

	t/ha	% stem scar 1/4 inch or less	% core depth 1/2 inch or less
Campbell 28	104.8	0	0
Potomac	98.0	99	0
Merit	98.8	99	0
1050-1-13	106.5	82	70
1050-2-4	85.0	94	90
1050-2-13	103.5	90	100

Table 5. Quality evaluation of Florida grown red-rip tomatoes^z.

	pH	Titrateable acidity (%)	Soluble solids (%)	Ascorbic acid (mg/100 g)	Color a/b
Campbell 28	4.31c ^y	.32b	4.6d	15.88a	1.68d
Potomac	4.27cd	.34ab	4.4e	13.22b	1.76bc
Merit	4.42a	.30c	4.4e	13.54b	1.69cd
1050-1-13	4.26d	.35a	4.8c	15.47a	1.80b
1050-2-4	4.38b	.35a	5.2a	15.43a	1.97a
1050-2-13	4.37bc	.33b	5.0b	15.02a	1.77bc

^zMean of 12 analyses

^yMean separation, within columns by Duncan's multiple range test at the 5% level.

The yields were greatly improved by an application of ethephon (Table 2). The 6095 line was very late, followed closely by 6034. The 1050-1 and 1050-2 lines were early with round to oblate fruit and had a good uniform red color. Based on the evaluation of stem scar size and depth of single plant selections (Table 3) the three best lines were grown in replicated trials in the 1973 spring season.

The 1973 spring test grown on Vorlex treated soil produced satisfactory yields for all varieties (Table 4) and the evaluations of fruit characteristics show that at least one of the Florida lines (1050-2-13) should be considered for varietal status. It has the J_2 character, is resistant to races 1 and 2 of the fusarium wilt fungus, has round to oblate fruit, good red color, acceptable stem scar and extremely good core depth.

Evaluation of processing quality of varieties and Florida lines for the 1973 Spring crop (Table

5) showed that the 3 Florida lines were equivalent to or superior in color to the whole pack varieties which were grown for comparison. Acidity was below pH 4.6 which is required for processing as an acid food. The titratable acidity was very close to or at the .35 level which allows processing under standard conditions. Soluble solids and vitamin C contents were in the range generally associated with Florida produced tomatoes (4). Florida lines had superior color.

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CUCUMBER RESPONSE TO COPPER RATE AND FERTILIZER PLACEMENT¹

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Abstract. The effects of Cu rates and fertilizer placements on fruit yield and foliage Cu content of cucumber were evaluated in two field studies. In both years, early and total marketable yields were increased by application of increased rates of Cu from zero to 8 lb/acre. Interactions between Cu rate and fertilizer placement on Cu content in plant foliage, on early yield and on total yields were significant. Similar yields were obtained with both broadcast and band placement of fertilizer without Cu. With an increase in the rate of Cu application, yield increased with both placements. However, mean yield increases in response to increased rates of Cu were 141 percent with the band placement and 243 percent with the broadcast placement during the two seasons. The Cu concentrations of leaf tissue also increased with increased rates of applied Cu and

were greater with the broadcast than with band placement.

Although Cu is an essential element, plants are easily injured by excess rates of application (6). Since differences in adequate and toxic levels are small, placement of fertilizer that contain large amount of Cu is critical (6). In work with watermelons, Locascio *et al.* (5) reported that yield response to Cu rate interacted with fertilizer placements. They found that as the rate of Cu fertilization increased to 8 lb/acre, watermelon yields were reduced with band placement but increased with broadcast placement. Similar responses were obtained with $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and with F.T.E. 503 as the Cu source.

The purpose of this study was to evaluate the effects of Cu rate and fertilizer placement on yield and mineral composition of cucumber tissues.

Experimental Procedure

Experiments were conducted during 1971 and 1972 on two newly cleared areas at the Horticultural Unit in Gainesville. The soil was a Leon fine

¹Florida Agricultural Experiment Stations Journal Series No. 5117.