Caging Tomatoes
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CAGING TOMATOES

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COVER: *(Left)* Field of half-grown caged tomato plants in southwest Michigan. *(Right)* Tomato plant 10 days after covering with cage.

INTRODUCTION

Staked or trellised tomatoes generally command a higher market price than fruit from plants allowed to spread on the ground. The former are brighter, smoother, more regular in appearance and possibly have a longer shelf life. It is estimated that as many as 1150 man hours are required to produce an acre of trellised tomatoes.[1] A major portion of this time is spent tying and pruning the crop. Supporting tomatoes in cylindrical cages is an attempt to realize the quality advantages of staking or trellising at a much lower labor cost. Caged tomatoes are neither tied nor pruned.

FABRICATION AND COST OF CAGES

Cages are easily formed from 5-ft. wide, 10-gauge, 6 x 6 in. mesh, concrete reinforcing wire. Using bolt cutters to remove the center horizontal wire from a 4-ft. length makes two cages (Figs. 1a & 1b). Each cage is 2 ft. tall after the eight 6-in. long vertical wires are pushed into the soil. Small hooks are bent on the ends of the five horizontal wires to hold the cage together (Fig. 1c). When taken to the field, it is bent to form a cylinder about 16 in. in diameter (Fig. 1d), placed over the plant, and the vertical wires pushed into the soil. Be sure the hooks are fastened and cages are not leaning when placed over the plant to avoid being blown over when they become top heavy with fruit. Place the hooks in a common position on each plant so pickers can avoid them.

Wire for cages can be purchased in 5 x 150 ft. rolls at building supply stores for approximately $28.00 or 38 cents for a cage 2 ft. tall and 15 in. in diameter. Tests indicate that cages 3 ft. high or more are easily blown over unless they are more than 15 in. in diameter. Increasing the diameter increases cage cost and makes early fruit harvesting difficult. Cages should last for 5 years or longer if care is taken in handling them and the wires that are pushed in the soil are treated to prevent rusting.

The cost of using cages varies with plant spacing. In these studies, plants were spaced 3 ft. apart in rows 5 ft. apart. This is about the minimum spacing to plant most semi-determinate varieties and still allow for rapid harvesting and satisfactory fruit size. Spacing plants 3½ x 5½ or 6 ft. would probably have considerable harvesting advantage in a year of vigorous plant growth. The annual cost per cage (material and labor), based on a 5-year life, is approximately 10 cents or $290 per acre for plants spaced 3 x 5 ft. Additionally, labor cost, including placing and removing the cages and the extra work in picking the first few harvests with $2.00 per hour labor, is estimated at 10 cents per cage or $290 per acre. If No. 1 tomatoes are worth 5 cents a pound on the plant, 4 lb. more per cage will cover the cost. If prices are higher or the improved quality results in a better price, the practice may be profitable with a smaller yield increase.

[1]Duncan, H. E. et. al. (1971). Growing trellised tomatoes in Western North Carolina. Circular 475.

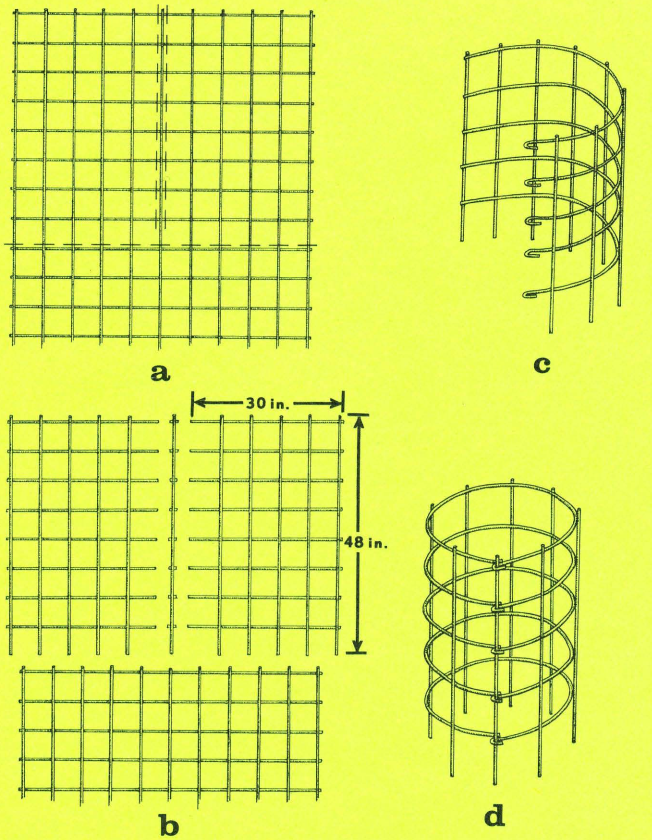

Fig. 1. Steps in constructing cages from concrete reinforcing wire.

CAGING STUDIES

During 1970, '71 and '72, fruit quality and yield of three tomato varieties (California Ace, Heinz 1350, Campbell 1327) grown in cages and on the ground with two irrigation levels, were evaluated in replicated trials in southwest Michigan. Plants were started in 2¼ in. peat pots and planted in the field, 3 ft. apart in 5-ft. rows in late May. The area was fertilized with 10-20-20 at the rate of 600 lb. per acre and later sidedressed with 125 lb. of NH_4NO_3 per acre. Place the cages over the plant within 10 days after planting to avoid plant damage. Tests were conducted in the same manner on the same area for all 3 years.

Two types of irrigation were practiced. Three replicates of each treatment were irrigated when the soil moisture fell to 50% of field capacity. Three others were similarly irrigated and, in addition, were sprinkled at the rate of about 0.05 in. per hour for 4-6 hr. when plants were under water stress (indicated by temperatures above 85°F. and relative humidity below 50%). Under these conditions, pan evaporation was generally over 0.25 in. per day. The climate varied greatly among seasons, resulting in different quantities of water applied and in wide differences in crop yield and quality.

Tomato fruit were harvested weekly from early August to late September and graded, sized and weighed. Grading and sizing followed practices of growers that deliver their crop to the Benton Harbor, Michigan market. Grades followed U.S. standards and very irregular, catfaced, blossom-end-rotted, blotchy, poorly colored, cracked and decayed fruit were graded as unmarketable culls. Grade No. 1 fruit was virtually free of the above defects and Grade No. 2 contained some irregular shaped fruit and/or less well colored fruit with some ground stain. Because fruits over 2⅝ in. in diameter generally bring the highest price per pound and cost the grower less per pound to pack, practices and varieties that result in large fruits are favored.

RESULTS

Effects of caging on grade, size and quality are indicated in Table 1 for the 3 test years as averages of three varieties in pounds per plant. At the spacing used, each pound per plant is equivalent to 2900 lb. per acre. Climate was more favorable for tomatoes in 1971 than in the other years as indicated by average yields of 21.5 lb. of large No. 1 fruit in cages as compared to 12.0 in 1970 and 7.4 in 1972. Caging resulted in a greater increase in percent of large tomatoes in the poorer tomato years of 1970 and 1972 than in 1971, as indicated by the data in Table 1.

Caging was associated with an increase in the total yield per plant and in the percent of marketable fruit. Although the increase in the quantity of marketable fruit was larger in 1971, the percentage increases were highest in the two less favorable seasons. The data (Table 1) indicate an increase in early yield even

Caged Heinz 1350 tomato plant at time of first harvest.

Table 1. Influence of caging on fresh market tomato yields for three seasons (average of 3 varieties in pound/plant)

	1970			1971			1972		
	Ground	Cage	% Change	Ground	Cage	% Change	Ground	Cage	% Change
Grade 1 (Large)(a)									
Early	4.2	4.5	7	6.8	8.6	27	1.5	2.1	38
Total	9.1	12.0	33	17.5	21.5	22	4.8	7.4	55
Grade 1 (Small)(b)									
Early	1.6	2.1	33	1.6	1.8	13	.54	.60	10
Total	3.0	5.0	66	3.1	5.2	62	1.9	2.8	51
Grade 2 (Total)	3.3	3.7	15	3.7	3.7	0	3.5	4.1	18
Green (End of Season)	3.3	2.1	−37	3.1	3.0	−3	4.1	5.4	32
Unmarketable	6.1	4.0	−38	8.5	4.1	−47	10.3	10.5	2
Total Yield	24.7	27.3	11	36.0	37.5	4	24.5	30.1	23

(a) Greater than 2⅝ in. in diameter
(b) Less than 2⅝ in. in diameter

though the fruit is partially shaded which might delay maturity.

Caging did not reduce unmarketable fruit in 1972. This may have been due to the higher humidity favoring disease development. Caged plants, due to their heavy foliage in a confined area, are probably as prone to foliage disease as ground-grown plants in a wet, cool season. The values shown in Table 2 for the variation in yield among the varieties for the 3 years in relation to evaporative cooling, tend to confirm this. In 1970, a year of water stress, evaporative cooling of caged tomatoes resulted in a yield increase of 70-90% over ground-grown tomatoes without evaporative cooling; in 1972, yields of caged plants were reduced by evaporative cooling.

Growing the crop off the ground allows more air to move through the plants. This increases their water loss if the air is dry. In wet years, plant water loss is quite beneficial because it reduces the water moving into the fruit and tends to reduce cracking and blotchiness while increasing the fruits' soluble solids content. In a dry year, caged tomatoes require more water than ground-grown tomatoes to maintain fruit size and prevent blossom-end-rot.

The quality of caged tomatoes can probably be manipulated more easily with water than a ground-grown crop. In 1970 and 1971, the average size of No. 1 tomatoes was about 0.40 lb., with the caged fruit averaging only 3% smaller than ground-grown fruit. The benefit from caging, then, was not related to a larger tomato but to 20% more marketable fruit.

Fruit temperature fluctuation of many of the fruit on a caged plant varies less during a 24-hr. day than fully exposed fruit on the ground. Afternoon temperatures of partially shaded caged fruits were 4-12°F lower than that from a more open ground plant. At night, the temperature of caged fruit does not drop as low as that of ground fruit because the foliage partially protects it from heat loss. This difference may partially explain why caged tomatoes sometimes have a longer shelf life or remain firmer than ground-grown tomatoes.

Yields from tall or spindly varieties do not benefit from caging because their stems bend over and break when they grow several feet above the cage. If they are too vegetative, they appear to be susceptible to foliage diseases. Of the varieties grown, the following have performed well in cages in southwest Michigan: Jet Star, Campbell 1327, Campbell 721, Heinz 1350, and Setmore. There are many others that should do equally well.

On the basis of three widely differing years, it appears that caging results in greater early and total marketable yields and a reduction in unmarketable fruit. As these tests were conducted on sandy soils, greater benefits might be expected on heavier soils where wetter conditions and slugs and worms often cause damage to many fruit in unfavorable years. On an average, the cost of caging is less than the value of the additional fruit. For markets that require quality fruit and pay a premium for it, caging should be a profitable practice.

Table 2. Influence of evaporative cooling on ground and cage-grown tomatoes (in pounds per plant of Grade 1 fruit)

	1970		1971		1972	
Variety and Irrigation	Ground	Cage	Ground	Cage	Ground	Cage
Ace Normal Irrig.	9.2	10.8	19.6	29.9	4.1	4.6
Evap. Cooling	10.9	17.9	21.8	24.9	3.1	4.3
Camp. 1327 Normal Irrig.	10.0	12.3	18.7	25.4	8.0	12.2
Evap. Cooling	12.7	17.5	17.5	22.9	5.4	11.5
Heinz 1350 Normal Irrig.	13.7	18.9	22.2	29.6	11.1	15.6
Evap. Cooling	14.9	23.6	24.4	27.1	8.0	12.6
Avg. 3 Var. Normal Irrig.	**11.0**	**14.2**	**20.3**	**28.3**	**7.7**	**10.8**
Evap. Cooling	**13.1**	**19.9**	**21.2**	**25.0**	**5.6**	**9.4**

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