

String Weave

Fresh Market Tomatoes

Summer & Fall Production Guide



String Weave Fresh Market Tomatoes Summer and Fall Production Guide

Charles R. O'Dell, Extension Horticulturist, Commercial Vegetable Production, Virginia Tech

Charlie Conner, Extension Agent, Southwest District

Richard C. White, Extension Agent, Central District

Henry Snodgrass, Extension Agent, Southwest District

Reviewed by Allen Straw, Extension specialist, Southwest Agricultural Research and Extension Center

Introduction-String Trellising of Tomatoes to Improve Quality and Profits

Tests to compare caging, ground culture, and trellising systems of tomatoes were conducted at the Virginia Tech Horticulture Research Farm in the early 1970's with earlier determinate or short growing tomato varieties. Varieties with fewer vines and "self-topping" types were grown in short cages on mulches as early season companions to later-maturing trellis varieties. Many growers adopted short cage culture, using black plastic mulch under the determinate vines.

However, many tomato varieties are larger determinate-vined in their growth form, falling into a middle category between dwarf, determinate growth, and the tall, rankly-growing vines of indeterminate varieties. Good examples of this type are the varieties Mountain Spring and Mountain Fresh.

Since cages are very expensive, and single stem trellising requires several hundred hours of labor per acre to construct, many growers are now using a Florida system called "string trellising" or "string weaving."

This system was first reported in Bulletin 710, University of Florida Agricultural Experiment Station, *Tomato Production on the Sandy Soils of South Florida*, May 1966. Now this system is universally popular with certain varieties for vine-ripe markets. Virginia growers have been string trellising since the early 1970's. Also, this management system has become very popular on the Eastern Shore and is being used there annually on several thousand acres of tomatoes.

To erect a string trellis, heavy stakes at least 1" x 1" diameter, or even 1" x 2", are driven down the center of each row after every second plant, usually soon after transplanting, but before plants fall over. Heavy grade polypropylene or nylon twine is tied to the end stake, about 8 inches from the ground, then a continuous string is applied horizontally from stake to stake, looping the twine around each stake, tied only at end-stakes. *The procedure is repeated on both sides of each row*, feeding the twine from the center of the twine ball. String is available commercially in feeder boxes that can be attached to the worker's belt. Twine is not wrapped around plants—they simply "lean" against the tight string. For harvest ease, leave breaks down each row every 100 feet so pickers can place fruit containers in harvest/spray lanes for pick-up.

As plants continue to grow and are about ready to fall over again, and after nearby blossoms have set fruit, a second string is added, 8-10 inches above the first. For Mountain Spring or Sunbeam varieties, up to 5 or more horizontal strings may be needed for good support.

For those varieties "in-between" ground culture and extremely tall growing types, string trellising should be tested, especially where a high percentage of 1 grade fruit is desired, as compared to ground culture. String trellising will also improve marketable fruit yields of short-growing varieties that are commonly ground culture grown.

The amount of pruning done with plants in the string trellis varies with variety *and with the season*. If early fruit set occurs, vines will not be so rank and less pruning is needed. If unfavorable conditions cause loss of the first or even second fruit cluster, vines may need some pruning, similar to cage culture. Hot weather fall tomatoes may need only the first suckering to remove ground or basal suckers.

Tobacco stakes are not heavy enough for tomato stakes. One-half acre of tomatoes on 5-foot row centers would require about 2 balls of twine, 4000 foot size, *for each string*, or a total of about 8-12 balls of twine for a 4-6 foot "string" crop, plus about 875 heavy stakes.

Best estimates, based on 1988 Southside Virginia growers' time on task experiences for string trellis tomato production labor, are for about 20 hours of labor per 1/2 acre hand-driving stakes, plus 4 hours labor per 1/2 acre *per stringing*, (2) plus 30 hours per 1/2 acre for suckering early tomatoes (20 hours for fall crop basal suckers removal only), plus 8 hours per 1/2 acre for spreading straw mulch, plus 210 hours harvest labor per 1/2 acre, plus about 12-1/2 hours for string and stake removal after harvest is complete, for a total of about 300 hours of labor for 1/2 acre of string weave tomatoes. Tillage, herbicides incorporation, preplant fertilizers application and bedding are not included (see Table 3). Improved fruit quality and yields will more than repay these costs in most seasons.

Plant pathologists warn growers to treat old stakes previously used *for tomato string trellis* with a 10 percent bleach dip to prevent possible infection of tomatoes with wilt diseases and to eliminate old spores of early Blight disease.

Production recommendations are given in brief, capsule form for easy and quick grower reference by headings, as suggested by Extension agents for this enterprise. Production budgets for both spring and fall tomatoes are included as Table 2 and 3.

Description

Tropical or heat loving members of the Solanaceae family, closely related to eggplant, tobacco, potato, and pepper. Not tolerant to cold soil or air temperatures. Plantings should be made after all danger of frost is past.

Varieties - Mountain Delight, Celebrity, Mountain Spring, Mountain Fresh, Sunbeam, Solar Set (trial for fall crops).

Seeds Per Pound - 150,000 - 160,000

Seeding Rate Per Acre -2 ounces for transplants from field beds, 4 ounces for direct field seeding of fall crops preferably with pelleted or coated seed for more uniform stands.

Pollination Requirement -Tomatoes, like other members of the Solanaceae family, are self pollinating with perfect flowers (each flower contains male and female parts within the same flower).

Fertilizer Needs for Sprinkler Irrigated Crop - (See p. 6 for strip fertilization and in-season fertigation of Drip Irrigated Crop)

Preplant -50# N, 150# P205, 150# K20 per acre on medium fertility sites, but always by soil test report. One half of this amount should be banded at planting, 3-4 inches on both sides of each row and 2-3 inches deep; the other half should be broadcast and disked in before planting. Banded or in-row amounts should be soil incorporated before laying plastic mulch for early summer tomatoes. Use 100 bales per acre of straw mulch or no-till culture on fall tomatoes to cool soil and conserve moisture.

Add 2 lb/A Boron blended into preplant fertilizers for tomatoes.

Sidedressing -30# N/A when first fruits are set and are from dime to nickel size in diameter and again 3 weeks later, or fertigate through trickle irrigation system as per page 4.

Soil pH -*Must be 6.5*. Lower soil pH reduces fruit set, fruit size, increases Blossom End Rot disease, and may increase sunscald injury from sparse foliage. Lower soil pH reduces and/or impedes nutrient uptake resulting in thin walled, low grade, off-type fruit.

Soil Adaptability -Sandy, silt, and clay loams are all used for successful tomato production, with sandy soils best for early plantings as they warm earlier in the spring. A deep loam with excellent interior soil drainage and a site with good air drainage will improve total yields of summer and fall tomatoes.

Time of Transplanting

Transplant as early as May 1 in Southside Virginia to May 25 in Southwest Virginia mountains. Tomatoes are tropical by nature and tender, not tolerant of cold soil under 60 degrees F and/or cold air temperatures. *Fall crops* may be direct field seeded around May 15 in Southside, Southwest, or Northern Virginia, or transplanted June 10-20, to provide a fall crop maturing first harvests by early September and continuing until frost.

NOTE: Hot summer temperatures can *reduce* pollination and fruit set, especially on black plastic mulches. Use white bonded over black plastic mulch or straw mulch or no-till culture on fall tomatoes.

Method of Planting

Transplants may be field set with tobacco transplanters or hand planted or may be set with water wheel mulch planters through black plastic mulch (for earliest summer yields). Black plastic mulch is not recommended with fall crops. Use white bonded over black plastic mulch film or straw mulch on fall crops, at least 100 bales/acre. *Use of no-till culture is highly recommended for fall tomatoes.* To reduce heat and transplant shock, consider spraying a 12-18 inch wide white strip on black plastic mulch before transplanting fall tomatoes. Center the strip where plants will be set and use a dilute 3:1 mixture of water and white latex paint (indoor or outdoor). Also, use this spray when recycling black plastic mulch and drip irrigation inputs after spring harvest of annual fall-planted Chandler strawberries before planting to fall tomatoes.

Spacing

For summer crops, single rows are spaced 24 inches apart on 5-foot row centers. Use the Florida string-weave plant support system for highest quality fruit, for ease of harvest, and for best air movement through plants. Less disease occurs when a protective fungicide spray program is carried out on a regular weekly basis. For fall crops, space 2 to 3 feet apart in-row on 5-foot row centers with minimum pruning for better foliage protection against sun scald. Prune fall tomato plants only once when about 1 foot tall, removing all ground suckers and all internode suckers up to first blossom cluster.

Plants Needed Per acre

24" x 5' = 4,356. 30" x 5' = 3,485. 36" x 5' = 2,904.

Use larger cell sizes for highest early yields (see Table 1, p. 6) and order extra plants for replacements.

Pruning

See page 1 of this publication under string trellising discussion.

*Herbicides

Choices include Devrinol, Treflan, Sencor, and Tillam, as per VCE Publication 456-420. *Do not apply herbicides under plastic mulch!* Volatilization can create injury due to high temperatures and gas exchange under plastic film mulch.

*Insecticides

For early season Colorado potato beetles, flea beetles, and aphids, Thiodan or other labeled insecticides as per VCE Publication 456-420. For cutworms at planting, Diazinon as per VCE Publication 456-420. For later season stinkbug injury on fruit and for fruit worms, be prepared to scout fields frequently and begin pest management controls as per VCE Publication 456-420.

*Fungicides

For damping-off in field beds, transplants or for precision direct field seeding for fall tomatoes, apply Ridomil as per VCE Publication 456-420. For later season bacterial diseases, foliar and fruit fungus pathogens, see materials and rates in VCE Publication 456-420. **Note:** Be prepared to apply Bravo or other labeled fungicides *on a weekly protective basis* against Early and Late Blight Diseases using high pressure piston pump-modified sprayers and drop nozzles. A tobacco sprayer may be so modified for about \$1,000. Air-blast

sprayers with row crop heads also are successfully used, spraying around both sides of every 5 rows of tomatoes.

**Pesticides and rates are as found in VCE Publication 456-420, Commercial Vegetable Production Guide for Virginia, revised annually as required by law for publications containing recommended pesticides with rates of application.*

Irrigation Requirements

Regular rainfall or irrigation is needed for rapid, unstressed vegetative or juvenile plant growth, for flowering and fruit set of a well-developed juvenile plant, and for fruit sizing. A ton of tomato fruit contains over 1,700 pounds of water, not to mention thousands of gallons of water used per acre each week in growth and transpiration of the plants.

In dry weather, *always* irrigate early in the morning (if using overhead irrigation) to allow plants to thoroughly dry before nightfall as a further precaution against rapid spread of bacterial and fungal diseases.

Frequency and length of duration for each trickle irrigation cycle depends on several factors including size and age of plants, temperature, wind, cloud cover, fruit load, soil type, and growth rate or vigor of plants. Maximum water use by tomato plants will occur from fruit set through harvest. We recommend that growers check newly set transplants daily by examining soil in the root zone. Irrigate whenever soil particles will not ball together with the hand and when the soil feels dry. Trickle irrigate for 1/2 to 1 hour every other day will usually suffice in dry weather at this early stage. Be careful *not* to over water which will cause root oxygen starvation and root rot, resulting in stunting, poor plant growth or plant death.

As plants increase in size and as summer temperatures rise, 1 to 2 hours of trickle irrigation may be required every other day in dry weather, depending on how much moisture is found in the root zone when hand checked, and how much rain has fallen to slow the loss of transpiration from leaves. As plants reach full vegetative growth and as fruit sizes, especially with sunny, high temperatures causing high water loss through respiration, daily trickle irrigation may be required for 1 to 2 hours or longer for optimum yields and best fruit quality. Always strive to keep soil moisture near field capacity, never further than 70 percent of field capacity (when you can squeeze moisture at surface of hand-squeezed soil ball).

Drip Irrigation Component Recommendations

1. If using surface-applied water, must have dual sand filters.
2. For a minimum leak system, use tube-type connectors from lay flat to drip tape and use either 8 ml thick drip tape or drip tubing with in-line emitters.
3. If possible, use electric pumps as opposed to gasoline driven pumps for reliability, labor and operating cost reduction and maintenance-free operation. A gasoline motor driven pump often will consume \$5 worth of gasoline per 4 hour drip irrigation cycle.
4. Use completely soluble fertilizer for injection through the fertigator.
5. Use chlorine tablets in fertilizer feeder tank to keep drip tape clean of algae build-up and clogging.
6. Operate 10 lbs. PSI on lateral lines and 6-8 lbs. PSI at drip tape.
7. Wait till water has filled all drip tape lines before injecting fertilizer.
8. Backflush sand filters on a regular basis at least *every 5 hours of operation*.

Harvesting, Handling, and Packaging

Fresh market tomatoes are commonly harvested in field containers, placed in bins, and transported to

packing house facilities for washing and grading to size and color ordered by buyers. Buyers may place orders for fruit ranging from mature green stage, for “breakers” (showing white streaks to first pinking the size of a dime on lower or blossom end of fruit), to early pink stage (for nearby markets only). Ripes are of no value in the shipping market as they have little shelf life remaining.

Most area buyers prefer breakers, an excellent compromise for attaining full-vine ripened flavor, yet with good remaining shelf life while ripening continues. The 25 lb. tomato box with lid has become the standard in food distribution channels. Never store tomatoes below 55°F for maximum shelf life and quality. Likewise, chilling injury can occur if tomatoes are cooled or held in cooler or refrigerated truck at temperatures below 55°F. To prevent fruit rots in market channels, wash water at packing plant should never be colder than the internal temperature of the fruit coming from the field. Also use chlorinated (200 ppm) water in the washer.

Ethylene Gassing of Mature Green Fruit to Speed Post-Harvest Ripening

With production of fall tomatoes, the possibility always exists of a fruit-damaging early frost or freeze occurring before harvests are complete. Mature green fruit can be saved and ripened to high quality marketable condition if harvested before temperatures fall into the lower 30's F. Ideally, fruit is washed, size-graded and packed into shipping boxes with stackable lids, then loaded into a room or truck for gassing. Structures that will hold a room temperature above 60°F during the 24-hour gassing period, such as a tobacco barn lined with plastic sheeting on the inside to help hold temperature and the gas concentration, an enclosed truck cargo area similarly prepared, storage buildings or even vacant greenhouses, all have been successfully used to ripen mature green fruit with acceptable flavor and shelf life.

Only mature green fruit should be ethylene ripened, i.e., those fruit that have attained marketable size *that also show* a white color, streak or patch of skin at the blossom-end of each tomato *and also have* jelled locules and hard seeds. Such fruit also must be sound and free of defects.

The following conditions must be met for high quality fruit that is buyer and consumer-acceptable in marketing channels: (1) Harvest only mature greens while interior fruit pulp temperature is still as close to 60°F as possible. If fruit temperature has dropped below 60°F, hold in heated building below 70°F until pulp (not air) temperatures have reached 62°F, *before* beginning the 24-hour-gas release period; (2) The ripening room air must be constantly circulated with fans; otherwise, since ethylene gas is lighter than air, it will rise to the ceiling and cause poor or uneven ripening; (3) Maintain relative humidity between 85-96 percent by wetting down walls and floor before loading room with fruit *and again* at the beginning of the 12-hour ventilation following gas generation-circulation; (4) One small ethylene catalytic generator (also used in curing tobacco) is sufficient for ripening up to a tractor-trailer-size load of 900-1, 200 25-lb. boxes of tomatoes. Operate the generator continuously for 24 hours, holding fruit pulp temperatures between 62-70°F, with continuous internal room air circulation. Two fans, one at floor level and one at ceiling level, pushing air in the same flow direction, will maintain needed air circulation; (5) After gassing, ventilate for 12 hours and then hold or ship fruit at 55°F, the optimum for maintaining highest quality and flavor. Colder or higher temperatures after ethylene ripening can cause softening, watery, poor flavored fruit (winter shipping tomato syndrome often experienced by consumers).

Remember, *immature greens will not attain good flavor or may not color after gassing*. The ethylene generator used on mature green fruit accelerates ripening above normal or natural ethylene production that is already beginning to be produced only in such mature fruit. Gassing *will not* provide marketable fruit unless they are mature green, ready for natural ripening. Such generators are available in Virginia and may be leased by the manufacturer to growers. Your marketing organization may be able to assist with generator leasing or even possibly provide custom gassing of fruit after grading and packing.

Production Costs and Expected Returns Budgets, Spring and Fall Tomatoes

(See pages 6 through 12)

Note: For increasing earliness of spring tomatoes, research in Virginia, Tennessee, Kentucky and other surrounding areas confirms that the size of the root cell in which transplants are grown has a very definite ef-

fect. The smaller the cell size, the lower are early season yields. By late season, yields from various cell sizes will generally even out so that final total season yields are very similar. Table 1 provides such early season yield data from Virginia research conducted by Dr. Herman Hohlt at the Eastern Shore Agricultural Research Extension Center at Painter, Virginia, in 1985.

Table 1. Effect of Transplant Root Size on Early Yields of Tomato, cv. Pik Red, String Trellised, Irrigated.

Cell Size	Early Season Marketable Boxes/A, 1st & 2nd Picks	Gross \$ Value/Acre @ \$12/Box
2" Diameter x 3" Deep Todd Cell	920	\$11,040
1" Diameter x 3" Deep Todd Cell	863	\$10,356
1" Diameter x 3" Deep Todd Cell	860	\$10,320
1" Diameter x 1" Deep Plug (#200 Tray)	451	\$5,412

Table 2. Stringweave Market Tomatoes (Spring): Plastic Mulched, Drip Irrigated

A-Land 1 Acre

**** MANAGEMENT AND PRODUCTION ASSUMPTIONS ****

- Soil pH limed to 6.5 or higher with Ca levels at H+ or higher, hence no lime input.
- Rows 5' with plants 2' in row, every 6th row must be used as a spray row because of requirement for drop nozzles.
- 50 lbs/A N, P, and K preplant fertilizer strip incorporated into the 4' wide row at bedding. **Caution**, fertilizer must be thoroughly mixed in soil to prevent salt injury. First fertigation with drip system applied 1 week post-transplanting (liquid 20-20-20 to supply 40 lbs. actual N, 40 lb K20 and 40 lb P205/acre.) Always use only high grade 100% soluble nutrients or trickle system will be clogged.
- Use 1 stake per 2 plants and use only heavy (1" x 2") sticks. Between crops disinfect with solution of 1 part chlorine bleach mixed with 10 parts of water for assisting control of bacterial, viral and fungal disease. Spray weekly from 1st bloom-set through harvest for early blight and other diseases with 2 pts. Bravo with adequate water to cover an acre at 200 PSI. Estimated 10 sprays. Add insecticides as needed depending on pest. Learn to scout fields and recognize pests.
- Second fertigation (liquid 20-20-20) applied when the fruit is 1 inch in diameter and third fertigation when first fruit starts to color, each supplying 40 lbs/A N, P, and K.
- Drip irrigation tubing and plastic mulch laid together with rented mulch applicator.
- Production labor costs based on observed time on tasks. Harvest labor estimated as 2 times weekly during the entire harvest period, estimated 7 week period. Hauling estimated at less than 15 miles to market.
- See drip irrigation components recommendations on page 4.

Variable Costs:		Units	Quantity	Price	Costs/A/YR
Preplant Fertilizer	N	Lb.	40	.34	\$13.60
	P	Lb.	50	.32	16.00
	K	Lb.	50	.18	9.00
	Boron	Lb.	2	2.10	4.20

PPI Herbicides					
Devrinol 50 W	lb.	2.4	7.50	18.00	
Lexone 75 DF	oz.	3.2	1.44	4.61	
Plastic Mulch (4000')	Rolls	2	85.00	170.00	
Drip Irrigation Tube (8 Mil "T" Tape)	Ft.	8000	.027	216.00	
Mulch Applicator Rental				20.00	
Plants (128 Cell Flats)	Ea.	5000	.045	225.00	
Water Wheel Planter Rental				15.00	
Stake Sanitizer, Chlorox	Gal.	2	1.34	2.68	
Stakes, 1" x 2" x 6', Hardwood	Ea.	1750	0.20 (5-Yr. Life)	70.00	
Dilute Through Drip Irrigation Fertilizer Liquid 20-20-20	(Lbs. Nutrients)	200 to = 40 lbs. NPK/A.	1.10	220.00	
Post Emergence Herbicides Lexone 75 DF	Oz.	3.0	1.44	4.32	
Nylon Twine	Rolls	14	4.95	69.30	
Fungicides/Insecticides					
Thiodan 2 E	Qts.	10	6.63	66.30	
Bravo 720	Pts.	25	4.69	117.25	
Asana 2.4 Ec	Oz.	80	.876	70.08	
Production Interest	Mo.	4	12%	26.45	
TOTAL VARIABLE COSTS =				\$1357.79	

STRINGWEAVE TOMATOES (SPRING)

STRINGWEAVE TOMATOES (SPRING)

Production Labor:

Tillage and Herbicide Incorporation	HR.	5	4.50	\$ 22.50
Fertilizing/Bedding	HR.	4	4.50	\$ 18.00
Laying Plastic Mulch	HR.	4	4.50	\$ 18.00
Planting	HR.	12	4.50	\$ 54.00
Driving Stakes	HR.	40	4.50	\$180.00
Stringing	HR.	40	4.50	\$180.00
Suckering	HR.	40	4.50	\$180.00
Spraying	HR.	20	4.50	\$ 90.00
Irrigation Labor	HR.	20	4.50	\$ 90.00

TOTAL PREHARVEST LABOR = \$832.50

TOTAL PREHARVEST EXPENSES = \$2190.29

TOTAL PREHARVEST BREAK EVEN COSTS PER 25 LB BOX AT VARIOUS PRODUCTION LEVELS:

1400 BX = \$1.56	1800 BX = \$1.22	2200 BX = \$1.00
1600 BX = \$1.37	2000 BX = \$1.10	2400 BX = \$0.91

HARVEST LABOR/EXPENSES:

Field Harvesting = 7 weeks x 2.5 Passes x 30 hr. per pass =	HR.	525	4.50	\$2362.50
Hauling and Unloading =	HR.	36	4.50	\$ 162.00
Purchased Field Boxes		120	1.00	\$ 120.00

*Expected Packing/Marketing Charges = 2.45/Box Marketed

TOTAL PRODUCTION COSTS = \$4834.79

BREAK EVEN COSTS PER 25 LB BOX AT VARIOUS PRODUCTION LEVELS INCLUDING
EXPECTED PACKING/MARKETING CHARGES*
(2.45/box added)

1400 Bx = \$5.90	1800 Bx = \$5.15	2200 Bx = \$4.65
1600 Bx = \$5.48	2000 Bx = \$4.88	2400 Bx = \$4.46

Table 3. Stringweave Market Tomatoes (Fall): Sprinkler Irrigation

A-Land 1 Acre

**** MANAGEMENT AND PRODUCTION ASSUMPTIONS ****

- Soil pH limed to 6.5 or higher with Ca levels at H+ or higher, hence no lime input.
- Rows 5' with plants 2-' in-row, every 6th row must be used as a spray row. 4000 plants required per acre. Mulch with 100 bales straw/A.
- Preplant fertilizer incorporated into the row at bedding. Caution, fertilizer must be thoroughly mixed in soil to prevent salt injury.
- Use 1 stake per 2 plants and use only heavy (1" x 2") sticks. Between crops disinfect stakes with solution of 1 gal. of Chlorox mixed with 10 gal. of water to assist bacterial, viral and fungal disease control.
- Spray weekly from 1st bloom-set through harvest for protection against early and late blight and other diseases with 2 pts Bravo with adequate water to cover an acre at 200 psi. Estimated 10 sprays. Add insecticides based on need from pest pressure. Learn to scout fields and recognize insect pests.
- First sidedress fertilizer applied when the fruit is 1 inch in diameter and second sidedress when first fruit starts to color.
- Irrigate to furnish 1 acre inch of water per irrigation whenever free moisture cannot be produced on surface of squeezed soil ball from root zones (less than 70% of field capacity) in the absence of rainfall. Caution, to prevent fruit cracking, irrigation must be programmed to prevent fruit skin from becoming hard. Estimated 10-14 irrigations.
- Production labor costs based on observed time on tasks. Harvest labor estimated as 2 times weekly during entire harvest period, estimated 7 week period. Hauling estimated at less than 15 miles to market.
- First acre sprinkler system, new equipment = \$680/A annual costs.

Variable Costs:	Units	Quantity	Price	Costs/A/YR
-----------------	-------	----------	-------	------------

Preplant Fertilizer	N	Lb.	50	.34	\$17.00
	P	Lb.	200	.32	64.00
	K	Lb.	200	.18	36.00
	BORON	LB.	2	2.10	4.20
PPI Herbicides					
Devrinol 50 W		Lb.	4	7.50	30.00
Lexone 75 DF		oz.	5.3	1.44	7.64
Plants (128 Cell Flats)		Ea.	4000	0.45	180.00
Wheat Straw		Bales	100	1.50	150.00
Stakes, 1" x 2" x 5', Hardwood		Ea.	1750	0.20 (5-Yr Life)	70.00
Stake Sanitizer, Chlorox			Gal.	2	1.34
2.68					
Post Emergence Herbicides					
Lexone 75 DF		Oz.	5.3	1.44	7.64
Nylon Twine		Rolls	14	4.95	69.30
Fungicides/Insecticides					
Thiodan 2 E		Qts.	10	6.63	66.30
Bravo 720		Pts. 25	4.69	117.25	
Pydrin 2.4 Ec		Oz.	80	.876	70.08
Sidedress Fertilizer N		Lb.	50	.34	17.00
Production Interest		Mo.	4	12%	26.45
Sprinkler Irrigation Equipment			1 Acre	Annual Cost	\$680.00
TOTAL VARIABLE COSTS =					\$942.65

STRINGWEAVE TOMATOES (FALL)			STRINGWEAVE TOMATOES (FALL)		
Production Labor:					
Tillage and Herbicide Incorporation	Hr.	5	4.50		\$ 22.50
Fertilizing/Bedding	Hr.	4	4.50		18.00
Planting	Hr.	12	4.50		54.00
Driving Stakes	Hr.	40	4.50		180.00
Stringing	Hr.	40	4.50		180.00
Spreading Straw	Hr.	16	4.50		72.00
Suckering	Hr.	40	4.50		180.00
Irrigation Labor	Hr.	20	4.50		90.00
TOTAL PREHARVEST LABOR = 197 Hrs.					\$886.50
TOTAL PREHARVEST EXPENSES =					\$1829.15

Total Preharvest Break Even Costs Per 25 Lb. Box at Various Production Levels:

600 Bx = \$3.05
800 Bx = \$2.29

1200 Bx = \$1.52
1400 Bx = \$1.31

1800 Bx = \$1.02
2000 Bx = \$0.91

1000 Bx = \$1.83

1600 Bx = \$1.15

HARVEST LABOR/EXPENSES:

Field Harvesting = 7 weeks x 2.5

Passes x 24 hr. per pass =	Hr.	420	4.50	\$1890.00
Hauling and Unloading =	Hr.	36	4.50	\$162.00
Purchased Field Boxes		100	1.00	\$100.00

**Expected Packing/Marketing Charges = 2.45/Box Marketed*

TOTAL PRODUCTION COSTS = \$3,981.15

BREAK EVEN COSTS PER 25 LB BOX AT VARIOUS PRODUCTION LEVELS INCLUDING EXPECTED PACK/MARKETING CHARGES* (plus \$2.45 box sold)

600 Bx = \$9.09	1200 Bx = \$5.78	1800 Bx = \$4.66
800 Bx = \$7.44	1400 Bx = \$5.30	2000 Bx = \$4.44
1000 Bx = \$6.43	1600 Bx = \$4.94	2400 Bx = \$4.11

Table 4. Drip Irrigation System: Pre-Punched Tubing, 3 Acre Pump and Sand Filters

Assumptions:

- Designed for vegetable production.
- Limited amount of water needed compared to sprinkler irrigation. - Assumes water and electricity are at planting site.
- 95% water efficiency, provides 1.25" water/week at plant roots only.
- 38 GPM - Operate 15 hrs. per week.
- Use electric motor to reduce maintenance and labor where possible. 3 HP electric motor, single phase, will service 3 acres.
- Will need sand filters except for operation from deep wells. • Sand filters cost is average of \$1200, capable of servicing 3 acres.
- If using high quality well water, only a screen filter may be needed.
- The screen filter cost is \$100.
- If filters are not used, the pre-punched holes clog quickly and ruin efficiency.
- Total irrigation costs exclude labor and maintenance! Use heaviest tubing to reduce maintenance.

Items	Units	Costs	Total Costs/Acre
8-10 Mil Biwall Prepunched Tubing	7500 ft.	\$0.03	\$225.00
2" Header Pipe, Vinyl Lay-Flat	147 ft.	\$0.68	\$100.00
Fittings, Connections, Etc.	1 ea.	\$50.00	\$50.00
2" PVC Mainline	200 ft.	\$0.38	\$76.00
3 H.P. Electric Moter and Pump	1 ea.	\$495.00	\$495.00
Suction Line	1 ea.	\$75.00	\$75.00

Gauges	1 ea.	\$50.00	\$50.00
2 Sand Filters	1 unit	\$1,200.00	\$1,200.00
TOTAL MATERIALS COSTS:			\$2,271.00

	Costs By Life	Annual Costs Plus 13% Int.
Estimated Annual Costs:		
Main Line, Pump, Electric Motor and Filter System - 10 Year Life	\$1,845.00	\$209.00
Header Pipe, Fittings, Gauges - 5 Year Life	\$174.96	\$53.00
Biwall Pre-Punched Emitter Tubing - 1 Year Life	\$225.00	\$225 x .13
Motor Operating Cost: (per growing season)		\$10.00
TOTAL ANNUAL COSTS		\$484.00

Table 5. Solid Set Sprinkler System, 1 Acre

Assumptions:

- Designed for vegetable production - 60 x 60 triangular spacing.
- Abundant water supply necessary - Will aid in frost protection.
- Assumes water is at planting site.
- Add extra cost of mainline if water is not at planting site.
- Try to find used mainline to reduce start-up costs.
- 75% water efficiency, provides 1.50" water/week - Leave equipment in place.
- 68 GPM - Operation 10 hrs. per week.
- Ten gallons gasoline consumption per week (gas \$1.00/gallon).
- Total irrigation costs exclude labor and maintenance!

Items	Units	Costs	Total Costs/Acre
In field costs (3" Laterals, #30 Rainbirds)	1 acre	\$1,100.00	\$1,100.00
4" Aluminum Mainline (7 30-ft. sections)	210	\$2.00	\$449.00
10 H.P. Gasoline Motor and Pump	1 each	\$1,650.00	\$1,650.00
Suction Line	1 each	\$75.00	\$75.00
Gauges and Miscellaneous	1 each	\$50.00	\$50.00
TOTAL MATERIALS COSTS:			\$3,324.00

	Costs By Life	Annual Costs Plus 10% Int.
Estimated Annual Costs:		

In Field Costs, Motor and Pump - 7 Year Life	\$2,750.00	\$565.00
Mainline, Suction Line, Gauges - 15 Year Life	\$574.00	\$76.00
Motor Operating Costs (8 wk. growing season)		\$40.00
TOTAL MATERIALS COSTS:		\$3,324.00
TOTAL ANNUAL IRRIGATION COSTS:		\$680.00

Disclaimer

Trade and brand names are used for information purposes only. Virginia Cooperative Extension does not guarantee nor warrant the standards of these products, nor does it imply approval of these products to the exclusion of other products which also may be suitable.

www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences,
Virginia Polytechnic Institute and State University, 2009

Virginia Cooperative Extension programs and employment are open to all, regardless of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. An equal opportunity/affirmative action employer. Issued in furtherance of Cooperative Extension work, Virginia Polytechnic Institute and State University, Virginia State University, and the U.S. Department of Agriculture cooperating. Rick D. Rudd, Interim Director, Virginia Cooperative Extension, Virginia Tech, Blacksburg; Alma C. Hobbs, Administrator, 1890 Extension Program, Virginia State, Petersburg.