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GROWER

NEW ENGLAND VEGETABLE AND SMALL FRUIT NEWSLETTER

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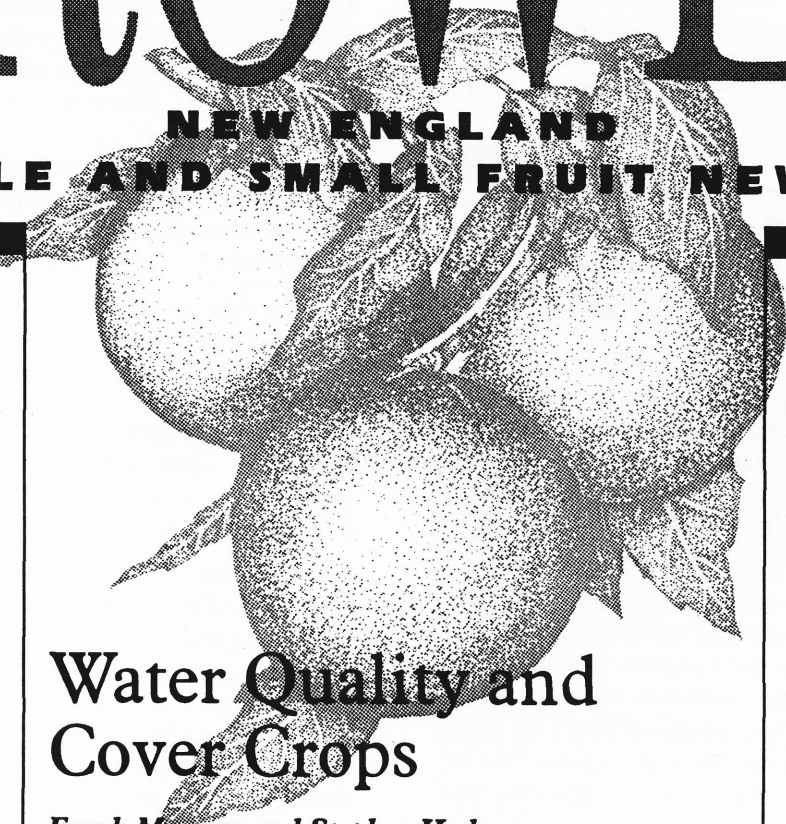

Water Quality and Cover Crops

Frank Mangan and Stephen Herbert
University of Massachusetts

It is important that growers realize that agricultural practices have the potential to severely impact the quality of our drinking water. There have been several studies in other states that have linked the contamination of surface and ground water to agricultural practices.

What is Groundwater?

Groundwater is water below the earth's surface. It represents water in one stage of nature's water cycle. Water descends from storm clouds to earth as rain or snow, then moves through and across the earth to water bodies where it evaporates into the atmosphere to form more clouds.

Groundwater is by far the world's largest freshwater supply. Scientists estimate that the amount of groundwater is more than 400 times greater than all the water in the world's lakes,

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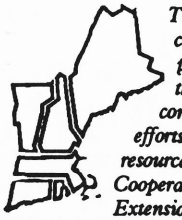

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Water Quality

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reservoirs and rivers. Ground- water supplies about 35% of the drinking water in Massachusetts and 50% for the United States.

Once polluted, groundwater supplies are extremely difficult and expensive to clean. Some will not recover for hundreds of years.

Because groundwater is below the earth's surface and out of sight, many misconceptions exist about it. For example, many people believe that groundwater occurs in vast underground lakes and rivers or veins. In truth, groundwater is found in tiny pores and cracks in sediment and bedrock. While water in some surface streams may move several inches or feet per second, groundwater generally moves several inches or feet per *month*.

How Can Agricultural Chemicals Contaminate Water Supplies?

Runoff is the movement of water across the soil surface. This occurs when the amount of rain or irrigation water contacting the soil surface exceeds the ability of the soil to absorb water. Pesticides and fertilizers move from fields while dissolved in runoff water or adsorbed (chemically attached) to eroded sediment.

Leaching is the movement of pollutants through the soil by rain or irrigation water as water moves downward through the soil. Soil organic matter content, clay content and permeability all affect the potential for nutrients and pesticides to leach in soils. In general, soils with moderate to high organic matter and clay content are less likely to leach pesticides into groundwater.

Point source contamination occurs when a pollutant enters a body of water from a well-defined point of entry. Perhaps the most common example of point source contamination in farming involves the mixing and loading of pesticides near wells. There have been documented instances where significant amounts of a pesticide have accidentally entered a water supply due to spillage.

Why the Concern About Nitrates in Drinking Water?

The biggest concern is for infants younger than six months. These children are extremely susceptible to acute nitrate poisoning because of certain bacteria that may live in their digestive system during the first few months of life. These bacteria change nitrate to toxic nitrite, transforming hemoglobin (which carries oxygen to all parts of the body) to methemoglobin which does not carry oxygen. As the oxygen carried by the blood decreases, the body is suffocated. At three to six months of age, these bacteria are killed so the nitrate is not converted to nitrite.

How Do the Seasons Affect the Potential for Leaching of Agricultural Chemicals?

Spring

The spring season in Massachusetts is the period with perhaps the greatest potential for leaching. Soils coming out of winter have high water content from rain and snow melt. Plants are not yet growing vigorously enough to "pump" significant amounts of water out of the soil. Evaporation rates are also low due to the relatively cool temperatures and low solar intensity. The combination of these factors translates to a high potential for water to percolate down through the soil.

This time of the year is also when most of the herbicides and fertilizers for many crops are applied.

Summer

The potential for leaching in the summer in Massachusetts is very low. This is due to the large demand for water by growing crops. Evaporation rates are high due to the warm temperatures and high solar intensity.

The demand for water by crops during the summer is often much greater than the amount of water that enters the soil.

Fall

Agricultural chemicals can leach during this time of the year for the same reasons as in the spring—decreased crop growth and evaporation. However, the potential for pesticides leaching may be less this time of year since less pesticides are applied to the soil in the fall.

There is usually less fertilizer applied in the fall than in the spring. However researchers in Massachusetts have found higher concentrations of nitrates in water samples taken in the fall than any other time of the year. One of the important functions of cover crops seeded in the fall is to take up this nitrate so that it will not leach below the root zone.

Winter

There is normally little leaching in the winter months due to frozen soil. (However, manure applied to frozen soil can easily run off into area waters.)

The conclusion of this article will be in next month's *Grower*. Cover crops will be discussed—what they do, how they do it and the different types.

Finally! A Nitrogen Test for Sweet Corn

Tom Morris
Soil Fertility Specialist
University of Connecticut

There is a new soil test for nitrogen availability for sweet corn that enables site-specific nitrogen (N) fertilizer recommendations. The test, called the Presidedress Soil Nitrate Test (PSNT), originally was developed for field corn in the mid-1980s by Dr. Fred Magdoff at Vermont. Use of the test has resulted in substantial reductions in N fertilizer applications to field corn. Recent research in New Jersey, New Hampshire and Connecticut indicates that the PSNT is a reliable tool for managing N for sweet corn.

The time of sampling and the depth of sampling for the PSNT are different from other soil tests. Soil samples for the PSNT are collected from the surface foot of soil when corn is six to 12 inches tall (measured from the ground surface to the center of the whorl). The test is based on concentrations of nitrate-N (NO^-3-N) in the soil sample. Concentrations of nitrate-N between 25 and 30 ppm indicate that application of N fertilizer likely will not increase yields. Concentrations below this range indicate that application of N fertilizer likely will increase yields.

The PSNT should be used to optimize your nitrogen management for corn. Optimization denotes a process of using the test for several years in the same field to gradually improve your N management. This will save you money on fertilizer and will decrease the potential for nitrate contamination of ground and surface waters.

The best method to optimize your N management for sweet corn is to apply the recommended broadcast rate of N (60 lb/acre) before planting and the recommended banded rate of N at planting (40 lb/acre), and then use the test. You will probably find that some fields test consistently in excess (greater than 30 ppm). If so, gradually reduce the amount of broadcast fertilizer applied before planting to these fields so that they test between 10 and 30 ppm in the future. Fields that consistently test extremely deficient (less than 10 ppm) should receive more N fertilizer before planting so that these fields test between 10 and 30 ppm in the future.

After several years, you probably will find that the amount of N fertilizer recommended by using the test varies depending on the amount of rainfall received in the spring. That is because soil nitrate concentrations are greatly affected by rainfall. In years with unusually dry spring weather, soil nitrate concentrations typically will be higher than normal; in years with unusually wet spring weather, soil nitrate concentrations typically will be much lower than normal. The only way to know what constitutes the normal range of soil nitrate concentrations for your soils and N management is to test your fields for a few years in a row and maintain records of the results.

The PSNT is recommended for use with mid- and late-season sweet corn varieties. Because research data for early-season varieties are unavailable, the test should be used with caution for these conditions.

The PSNT is a new technology, and growers are advised to adopt it gradually. Initial use of the test requires minimal investments of time and money when used on a few test areas on each farm each year. There is no need for larger investments in situations where the test shows that current practices are appropriate. Larger investments in the test should be cost effective in fields where problems (e.g., where soil nitrate concentrations are consistently too high) are detected.

DO NOT send soil samples for the PSNT to your state soil testing laboratory without first checking with your local Extension office. Some state laboratories do not accept samples for the PSNT. The laboratories that do accept samples require that the soil samples be collected, handled and shipped according to specific procedures.

Highmoor Farm Strawberry Variety Trial 1994

David T. Handley
University of Maine

The results are in! Twelve strawberry varieties are being evaluated at Highmoor Farm in Monmouth. The plots were planted in 1993 and established as narrow matted rows. 1994 was the first harvest season. The table below shows the yield, average fruit size and characteristics observed for each variety. It should be noted that yield in pounds per acre are extrapolated from small plots and may not exactly represent what may occur on any particular site. 'Settler' and 'Governor Simcoe' suffered from poor quality planting stock and, therefore, may not be truly representa- tive of these varieties. Fruit size is averaged over the entire season and does not account for the typical reduction in size on later ripening fruit. ▶ *page 4*

Strawberry

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The yield and fruit size of 'Cavendish' make this a very promising variety, but its uneven ripening habit, which is worsened by warm temperatures, may limit its market appeal. Cooling plants through light irrigation on hot days during the fruiting season may relieve this problem somewhat. 'Jewel' may become a good replacement for 'Blomindon' in the mid- to late ripening season. Other varieties which have performed well under New England conditions but were not included in this trial are described in the table above.

Descriptions of strawberry varieties for Maine not tested in 1994 include:

Early Season

Earliglow: An early berry of high quality. Fruit is firm with excellent flavor and color. Yields may be low in the Northeast. Fruit size tends to decrease as season progresses. Plants are vigorous runner producers and are resistant to red stele and *Verticillium* wilt.

Veestar: A popular Canadian introduction. Very productive, good flavor, but fruit tends to be soft. Plants are vigorous but have no known resistance to red stele or *Verticillium*.

Early Mid-season

Annapolis: From Nova Scotia. Large fruit with good flavor and color, but somewhat soft. Very vigorous, free-running plants. Resistant to red stele.

Cornwallis: From Nova Scotia (Earliglow x Kent). Very productive. Medium-sized fruit with good flavor and color. Plants are vigorous and produce runners freely. Resistant to red stele.

Mid-season

Redchief: Glossy, attractive, medium-sized fruit with firm texture and good flavor. Good production. Plants are vigorous but prefer heavier soils. Resistant to red stele and *Verticillium*.

Mid-late Season

Allstar: From the United States Department of Agriculture. Berries are large, conical and light red to orange with mild, sweet flavor. The plants are vigorous and make runners freely. Resistant to red stele and *Verticillium*.

Sparkle: Excellent flavored fruit, but dark red and somewhat soft. Fruit size tends to decrease as season progresses. Plants are vigorous, copious runner producers with some resistance to red stele.

Glooscap: From Nova Scotia. Medium to large fruit, firm and dark red. Good flavor. Susceptible to green petal disease, red stele and *Verticillium*. May be infected with "yellows", similar to 'Blomidon'.

Late Season

Bounty: Uniform fruit with good flavor. Plants show fair vigor and runner production. No resistance to red stele or *Verticillium*.

Startyme: New from Ontario, for trial in Maine. Large fruit, pale red, easy to hull, somewhat soft with good flavor. Large, vigorous plants. No known resistance to red stele or *Verticillium*.

Plant and Fruit Characteristics of Strawberry Varieties in Monmouth, Maine, 1994

Variety	*Lbs/Acre*	*Grams/Fruit*	*Characteristics*
Cavendish	17,243	14	Good plant vigor; midseason; fruit firm with tender skin, large juicy, sweet, uneven ripening habit.
Honeoye	15,198	12	Good plant vigor; early-mid-late season; fruit firm, glossy, large, acid, "flat" flavor.
Jewel	12,161	11	Uneven plant vigor; mid-late season; fruit dark red, firm, medium-large, mildly acid flavor.
Oka	11,701	10	Good plant vigor; mildew; early-midseason; fruit dark red, medium size, soft, sweet.
Kent	11,144	10	Vigorous but uneven plants; midseason; large primary fruit with some odd shapes, firm, sweet.
Chambly	10,575	10	Good plant vigor; mildew; midseason; fruit medium size, dark red, soft with tough skin, acid, juicy.
Lateglow	4,961	10	Weak plants; mildew problems; late; fruit medium size, bright red, firm, tough, sweet.
Bloomidon	4,937	10	Plants vigorous, but show "yellows"; mid-late season; fruit medium-large, bright red, firm, mildly acid.
Seneca	4,380	8	Plants vigorous but uneven; mid-late season; fruit medium-large size, bright red, firm, tough, very mild, acid.
NY1424	3,981	8	Plants vigorous but uneven; late; fruit medium-large, bright red, soft, hollow, hard to pick, juicy, aromatic.
Settler	3,315	8	Plants weak and uneven; midseason; fruit medium-size, red-orange, firm, tough, sweet.
Governor Simcoe	2,747	7	Plants weak, uneven; mildew; midseason; fruit medium size, orange-red, firm with tough skin, acid, tangy.

High Tunnels for Early Spring or Late Fall Production of Tomatoes and Other Crops

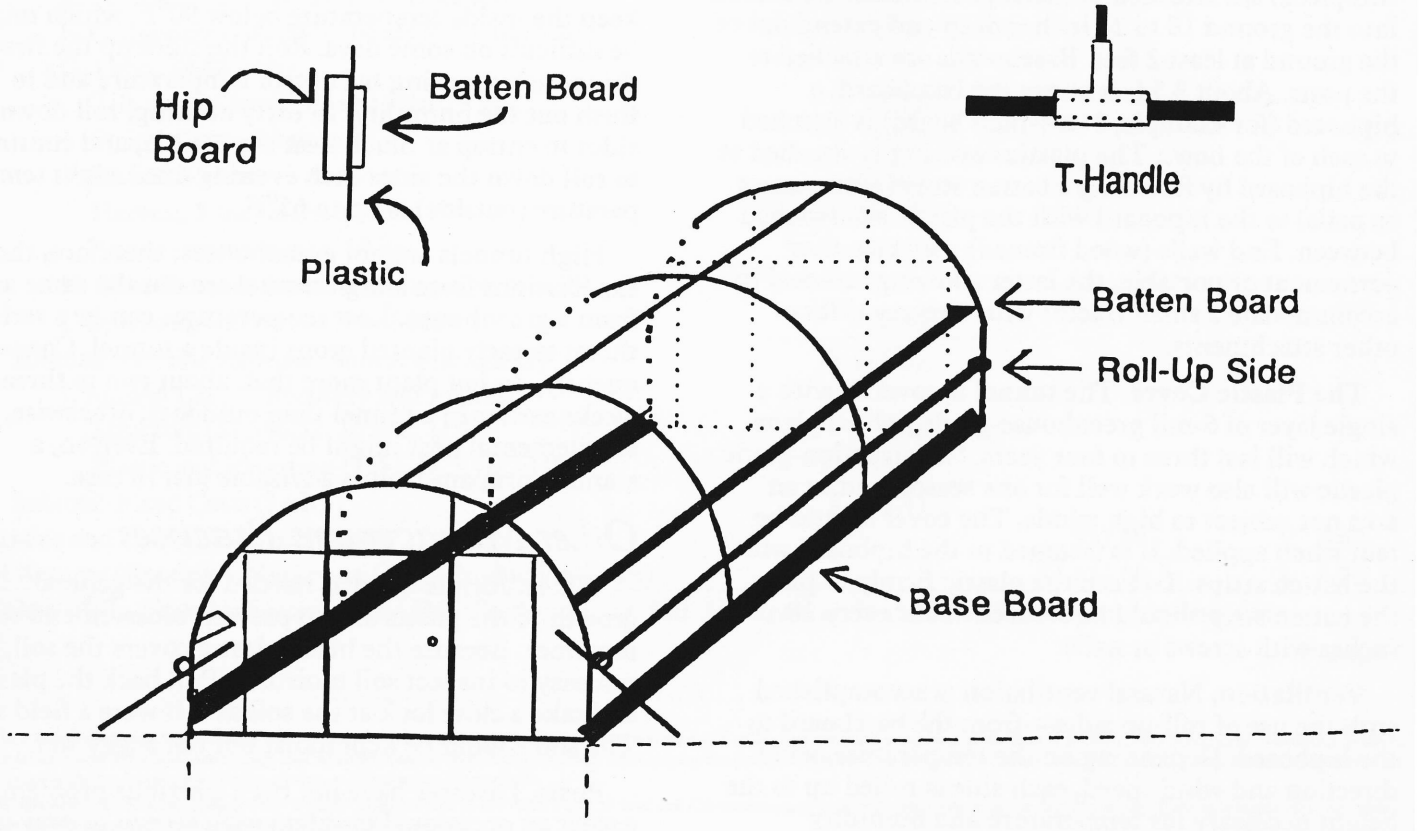
Otho S. Wells
University of New Hampshire

Plant growers worldwide strive to control the environment in which plants grow. Temperature is generally the predominant concern, followed by humidity, light, water, nutrients and pests. Methods range from an inexpensive plastic milk jug placed over a tomato transplant in a home garden to the ultramodern greenhouse controlled by sophisticated computer technology. The vast majority of vegetable growers in the United States utilize systems that fall somewhere between these two extremes. Hot caps, plastic mulches and row covers (low plastic tunnels and floating covers) are intermediate systems of environmental control. More recently, high tunnels have begun to take on an expanded use for the production of tomatoes and other crops.

From the outset, it should be noted that high tunnels are not something "hot off the press." For many years they have been used extensively in Europe, Asia and the Mideast for early production of vegetables, fruit and flowers. To some extent, they have been used as overwintering structures (hoop houses) for ornamentals here in the United States. For all practical purposes, however, very few high tunnels are used in this country for the production of vegetables. I believe we will see a dramatic increase in the next few years.

What is a High Tunnel?

A high tunnel is not a greenhouse, except in concept. A high tunnel is a quonset-shaped, plastic-covered greenhouse-like structure which has neither an electric-powered ventilation system nor a permanent heating system. The only external connection is water. Solar heat and ventilation are utilized for temperature and humidity control. In contrast to a greenhouse which has a double layer of plastic (or glass), a permanent heating and ventilation system and other amenities like thermostats, lights and multiple electrical outlets, a high tunnel is "sparsely" out- ▶ *page 6*



High Tunnel for Tomatoes

High Tunnels

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fitted. It is like a protective shell sitting in a field providing seasonal extension in the spring and fall.

The Structure

A high tunnel is not complicated to build. On the other hand, many growers in New England have found it easier to purchase a unit than to bother with do-it-yourself construction, unless several units are to be erected. The basic system includes a metal frame covered with plastic that can be rolled up at the sides, a trickle irrigation system and a piece of black plastic on the ground.

Size. Length is not critical, but width is. The width should not exceed the capacity for natural ventilation. A reasonable width seems to be 14 to 20 feet. However, if a tunnel is located on a site where the wind comes sweeping through, a greater width is feasible. In New England, a standard size is 14 x 96 feet. Size is partially dictated by the availability of various sizes of plastic.

The Frame. Framing materials include wood, PVC and galvanized metal. The latter being the most popular and the most durable. Metal bows (one- or two-piece) are attached to metal posts which are driven into the ground 18 to 24 inches deep and extend out of the ground at least 2 feet. Baseboards are attached to the posts. About 3.5 feet above the baseboard, a hipboard (for example, 1- x 4-inch board) is attached to each of the bows. The plastic covering is attached to the hipboard by fastening a batten strap (with screws or nails) to the hipboard with the plastic sandwiched between. End walls (wood framed) may be either permanent or portable, the latter allowing removal to accommodate a small tractor with a rotary tiller or other attachments.

The Plastic Cover. The tunnel is covered with a single layer of 6-mil greenhouse-grade polyethylene which will last three to four years. Construction-grade plastic will also work well for one season and in an area not subject to high winds. The cover should be taut when applied. It is fastened to the hipboard with the batten strips. To keep the plastic firmly in place, the batten strip should be secured about every 18 inches with screws or nails.

Ventilation. Natural ventilation is accomplished with the use of roll-up sides—from the baseboard to the hipboard. Depending on the temperature, wind direction and wind speed, each side is rolled up to the height necessary for temperature and humidity control. The two sides may be opened at different heights. A simple roll-up method is to tape the edge of the plastic cover to a one-inch pipe running the length of the tunnel and attach a sliding "T" handle to one end of the pipe (see diagram on page 5).

Trickle Irrigation. Trickle irrigation is essential for adequate and timely watering and/or feeding. One line per row (or per double row) is sufficient. The trickle lines are laid out and anchored before the ground cover is applied.

Ground Cover (Mulch). For best results with most crops, the total soil surface is covered with a single sheet of 6-mil black plastic. This serves to warm the soil, control weeds, reduce soil moisture evaporation and to serve as a barrier against disease that might be in the soil. Be sure that the cover is well secured along the edges to prevent wind from billowing the plastic over young plants.

Location of the Tunnel. A high tunnel should be located on good soil that is well fortified nutritionally and that is well drained. Full sun is important, even though high temperatures will have to be managed. To aid in natural ventilation, orient the tunnel so that prevailing breezes will blow through the tunnel from side to side.

Temperature Management

Excessively high temperatures can be very detrimental to tomatoes when they are in blossom. Attempt to keep the inside temperature below 90°F, which might be difficult on some days. Roll the sides up the first thing each morning to control temperature and to flush out the humidity. In early evening, roll down the sides to entrap as much heat as possible, and continue to roll down the sides each evening until night temperature (outside) is up to 65°F.

High tunnels are not greenhouses; therefore, the expectations from a high tunnel are not the same as from a greenhouse. Low temperatures can be a serious threat to early planted crops inside a tunnel. Consequently, do not plant more than about two to three weeks earlier in a tunnel than outdoors, otherwise, supplemental heat might be required. Even so, a standby propane unit is advisable just in case.

Other Management Practices

Water. Ample water is needed for the general growth of the plants and to prevent blossom-end rot in tomatoes. Because the black plastic covers the soil, it is not easy to inspect soil moisture. Pull back the plastic and take a close look at the soil as if it were a field soil. The soil should be kept moist but not soggy wet.

Pests. Diseases have not been a serious problem, except an occasional problem with *botrytis* or gray mold when humidity was too high. To control early blight, do not plant field tomatoes close to the tunnel. White

Economic Feasibility of High Tunnel Tomato Production (one tunnel @ 14' x 96' = 1,344 sq. ft.)

I. Structure Costs			
A. Frame (posts and bows)	$ 800.00		
B. Side Boards			
1" x 6" x 96' x 2 @ $ .50/LF	96.00		
1" x 4" x 96' x 2 @ $ .18/LF	34.56		
C. Pipe and T Handles (roll-up)	137.50		
D. End Walls			
2" x 4" x 47' x 2 @ $ .24/LF	22.56		
E. Construction Labor (32 hrs. @ $8.00/hr.)	256.00		
		$1,346.62	
II. Plastic and Trickle Irrigation			
A. Cover (1 layer 703, 6 mil 24' x 100')	$ 203.79		
B. Black poly sheeting (6 mil 16' x 100')	63.10		
C. Trickle irrigation	85.00		
		$351.89	
III. "Annual" Expenses and Returns		Per Tunnel	Per Pound
Receipts(2,000 pounds @ $1.60/lb.)		$3,200.00	$ 1.60
Marketing Costs (25% of receipts)		800.00	0.40
Production Expenses			
A. Plants (7 sq. ft./plant, 192 plants @ $.15	$ 28.80		
B. Stakes (192 @ $.25 each)	48.00		
C. String (2,500 ft.)	15.00		
D. Fertilizer (starter, 10-20-20 and lime)	5.00		
E. Fertilizer through Trickle Irrigation	20.00		
F. Containers (100 20-lb. boxes @ $1.10 each)	110.00		
G. Labor @ $8.00/hr.			
Till, spread fertilizer and plant, 3 hrs.	24.00		
String plants, 3 hrs.	24.00		
Prune, 2.5 hrs.	20.00		
Harvest, 8 harvesters x 4 hrs.	256.00		
Annual maintenance, 10 hrs.	80.00		
H. Miscellaneous (small tools, repairs, rototill)	25.00		
I. Operating Interest @ 5% of $656	32.79		
Subtotal Variable Expense (Sum A through H)	$ 688.59		
J. Annual Capital Recovery and Interest			
Structure ($1,346.52, 10 yrs., 11%)	228.66		
Plastic and irrigation ($351.89, 5 yrs., 11%)	59.75		
Subtotal Fixed Costs (J+K)	$ 288.41		
Variable and Fixed Production Costs		977.00	$ 0.49
Net Returns (Receipts - Marketing Cost - Production Costs)		$1,423.00	$ 0.71

By Otho Wells, Vegetable Specialist, and Mike Sciabarrasi, Ag. Bus. Management Specialist, UNH Cooperative Extension

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High Tunnels

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flies can become a real nuisance if not checked early. Do not allow them to build up. Soap insecticides are effective for small populations of white flies.

Growing System. In a 14-foot-wide tunnel, we have found that four rows of tomatoes grown with the basketweave trellis is the most efficient way to manage the plants. The rows are 3.5 feet apart and the plants are 18 inches apart in the row. Either determinate or indeterminate varieties may be used since they are tipped out at about three to four feet high.

The economics of high tunnel crops will vary. High tunnels produce tomatoes a month earlier than field grown. When coupled with good retail prices, this results in the tunnel paying for itself the first year. See the table on page 7 on economics.

Summary

High tunnels are a protected growing system that will provide tomatoes one month earlier in the spring. They are not high-cost structures, thus allowing for low-capital entry into crop production. Generally, high tunnels are part of a diversified operation, contributing to the early phase of overall production and marketing. While production in high tunnels continues throughout the season, it is the early market that is most important .

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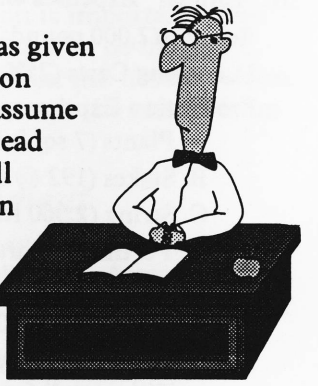
Fungus Gnat Update

In the January issue of the *Grower*, the article on fungus gnats and shore flies discussed the use of beneficial nematodes. Two of the controls mentioned are no longer available. As of December 1, 1994, *Steinernema carpscapsae* is no longer sold by CIBA Geigy under the trade name Exhibit. However, *S. carpscapsae* is now available from the Lesco company as Vector-TL.

Another species of beneficial nematode, *S. feltiae* is now available under the trade name X-Gnat.

Change of Duties

Dr. Richard A. Ashley has given up some of his Extension duties to temporarily assume the position of Department Head of Plant Science. While he will continue to do some Extension work, Rose Hiskes has been hired to assist him. She can be reached at 203-486-3438.



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