COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF KENTUCKY
College of Agriculture

West Kentucky Vegetable Growers Newsletter

VOLUME 1, ISSUE 1 JULY 2007

Courtney Flood, Fruit & Vegetable Extension Associate. Editor
Dr. Joe Masabni, Fruit & Vegetable Extension Specialist, Editor

Special Topics of Interest:

Plant and Soil Water Relations 101

John Strang, Fruit & Vegetable Extension Specialist

Water makes up about 80 to 90% of the composition of all actively growing plants. It is a solvent in the plant, active in many chemical reactions and it is responsible for keeping plants turgid. Water moves into the roots up through the plant and exits through the leaves in a process termed transpiration. This process is responsible for moving nutrients from the roots up into the leaves, cooling the plant through evaporation and getting rid of water used in nutrient uptake. The transpiration process also helps to pull water up to the leaves.

Plants vary in their transpiration rate. Those with a thin cuticle or wax layer on the leaves loose water at a more rapid rate than those with thicker cuticles. Cuticle thickness is affected by the environment in which the leaf develops. A leaf grown in a dry hot sunny environment will have a thicker cuticle. Plants with sunken stomata or pores in the leaves responsible for gas exchange, loose water slower than those that have them on the leaf surfaces. If leaves are oriented at right angles to the sun transpiration is maximized. While plants that have rolled their leaves when they are drought stressed lose less water. Plants with larger leaf areas lose more water through transpiration. Land that is covered with vegetation loses water at a much greater rate than bare soil.

Soils differ in the amount of water that they can hold. This is largely affected by soil particle size. Clay soils, which have a small particle size hold more water per foot of depth than silt soils, which are made up of larger particles. Sandy soils, which are made up of still larger particles are able to hold the least amount of water per foot of depth. Organic matter increases the water holding capacity of soils. Thus, the deeper the soil the more water holding capacity the soil has in the rooting area of the crop plant.

Plants won't grow if there is too much water in the soil or if the water table is too high. This is because the roots need to be able to remove oxygen from the soil to take up nutrients. If the soil is saturated with water the soil air spaces are full of water and oxygen is not available to the plants. Thus, excessive irrigation can be detrimental.

A plants water requirement is affected by a number of factors. The water requirement is increased by nutrient deficiencies, soil compaction, drought, and restriction of the crop root system. Water requirement are decreased by cultivation, which reduces weed competition, promotes water infiltration, and allows more oxygen into the soil.

Water in the soil is classified as chemically combined water, which is not available to the plants, capillary water, which is the major source of water to the plants and gravitational water, which soils can not hold against the force of gravity. Following a heavy rain or irrigation the gravitational water runs off or through the soil in 24 to 48 hours. At this point the soil is at field capacity, or holding its maximum amount of water. As capillary water is removed by plants or evaporates, the soil water level drops and plants begin to wilt. Wilting is the point at which plants can not take in enough water and move it to the leaf surfaces to keep them turgid. Wilting is a

A tape measure is used for scale to show the size of a soil crack due to severe drought in Eastern Kentucky.

"A mulch on the soil surface insulates the soil from air movement, moderates soil temperature and lengthens the distance between the soil and the atmosphere all of which reduce evaporation and water loss."

function of how much moisture the roots can absorb and the temperature and humidity that the plant is exposed to. High temperatures, low humidity and wind maximizes evaporation and the loss of water from the plant. Initially, the plant overcomes incipient wilting, which is greatest at mid-day and rehydrates during the evening and night when water loss is not as great. As time and drought progress the plant reaches the permanent wilting point, the soil moisture level that will not support plant growth and from which the plant can not recover unless water is supplied. This point is evident when the plants are wilted at sunrise.

The movement of water into the soil is termed infiltration. The infiltration rate determines how much water is retained and how much is lost. Water easily runs off of bare ground and a considerable amount can be lost. Litter, grass or an organic mulch on the soil surface greatly increased the infiltration rate and the amount of moisture retained. Slope strongly affects infiltration and the steeper the slope, the faster water runs off. Soil type also affects infiltration and water moves into a fine soil slower than a sandy soil. If the soil is dry infiltration is greatly slowed in comparison with a wet soil.

Once water gains entry into a soil its percolation downward is as gravitational water. In other words the soil has to be saturated at each level before it moves downward. Thus, frequent shallow watering does not get water down to the plant root system. The percolation rate is influenced by the number, size and continuity of air spaces. Organic matter tends to increase the percolation rate. The hydration of gels, which plug air spaces, slows percolation in clay soils. Percolation downwards always exceeds lateral movement.

As plants remove water from the soil they tend to remove it first from the upper layers of the soil. As the upper layers of soil are depleted of water roots remove it from progressively lower levels. When plants are growing actively their roots and root hairs grow into new areas where more soil water is available. Once the wilting point is reached, the roots are no longer growing and finally a band of dry soil develops over the root hair tips. At low soil moisture levels, water is found in the soil as thin films on soil particles. These thin films slowly move from areas of higher moisture to lower moisture. The movement of these films can keep a plant just barely alive once it reaches the permanent wilting point.

Evaporation of water from the soil is affected by the scope, air movement, soil type and soil temperature. Evaporation is a major factor in moisture loss from the first four inches of soil, not much of a factor in the second four inches and not a factor below eight inches. A mulch on the soil surface insulates the soil from air movement, moderates soil temperature and lengthens the distance between the soil and the atmosphere all of which reduce evaporation and water loss.

When a plant wilts the stomates close. When this happens photosynthesis is mostly shut down. Plant growth is a constant battle between photosynthesis, which is responsible for carbohydrate accumulation and growth and respiration, which involved the breakdown of plant reserves to produce energy and keep the plant functioning. The respiration rate in plants increases with increasing temperature. Once temperatures reach about 93F the rate of photosynthesis and respiration are essentially equal. Above this temperature respiration dominates and the plant undergoes a net loss of its reserves.

When water is limiting plant growth is reduced, fruit size is smaller and the fruit color is dull and lifeless. Often bitter or off-flavors develop in drought stressed

fruits and vegetables. This is readily apparent if lettuce is grown where water is limited. Lack of water also serves to concentrate sugars and make fruit sweeter. For example irrigation water is usually limited prior to and during harvest to make watermelons and cantaloupes sweeter.

Astute growers monitor plant water availability in the soil. The use of tensiometers or other devices to measure plant water availability is critical to irrigate at the right time with the right amount of water. By placing a tensiometer at a shallow depth and another at a deeper depth in the lower part of the crops root system, excellent moisture control can be obtained. The irrigation is turned on after the shallow tensiometer shows low water availability and the lower tensiometer is starting to dry out. The irrigation is then shut off when the lower tensiometer is completely hydrated. This keeps the plants from becoming excessively stressed and also avoids over irrigation and wasting water.

Downy Mildew of Cucurbits Found in Canada, Ohio, Michigan, New York and North Carolina

Kenny Seebold, Vegetable Pathologist

Downy mildew has been reported on cucurbit crops in Canada, Ohio, Michigan, New York, and North Carolina in recent weeks. It does not appear that the disease has reached KY; however, the early appearance of downy mildew in northern states could signal an earlier-than-normal outbreak in the Commonwealth. Downy mildew on cucurbits is an aggressive, fast-moving disease and can be really hard to stop when it gets started. Under the right conditions, infection levels can go from 10% of leaf area infected to 90-100% in less than a week!

Identifying downy mildew on cucurbits can be a little tricky, because symptoms on each species vary to some degree. What's more, downy mildew can be confused with powdery mildew. Both of these diseases are similar in that they are caused by obligate pathogens, meaning that the pathogen must be associated with a host plant to survive. The downy mildew pathogen, *Pseudoperonospora cubensis*, is not a true fungus. It belongs to the Oomycetes and is related to the pathogen that causes blue mold of tobacco; however, powdery mildew is caused by *Podosphaera xanthii* and belongs to the Ascomycete group of "true" fungi. Although downy mildew is more common in wet weather, fogs and heavy dews can contribute enough moisture to allow infection during "dry" weather. Powdery mildew is more likely to be a problem when conditions are hot and dry, and it tends to develop gradually over the course of several weeks. In terms of symptoms, the two diseases can be confused. Early on, both can cause yellow spots on the upper surface of a leaf. In the case of downy mildew, leaf spots tend to be small, blocky, and are limited by leaf veins, while spots associated with powdery mildew are round and somewhat diffuse. On the underside of a leaf with downy mildew, lesions will initially appear sunken and slightly water-soaked. As downy mildew progresses, infected leaves will take on a scorched appearance. Leaf yellowing (chlorosis) is more common with powdery mildew, and infected leaves will be covered with a white, talc-like, superficial growth (from which powdery mildew takes its name) that tends to favor the upper leaf surface; however, it is not uncommon to find colonies of the powdery mildew fungus on lower leaf surfaces, stems, or vines if disease is severe. The powdery growth consists of mycelium and conidia (spores). One of the key features of downy mildew is the pattern of sporulation, which occurs only on the underside of an infected leaf and has a faint, fuzzy or "downy" appearance. It is generally easier to observe sporulation with downy mildew in the morning when there's plenty of leaf wetness. It's very easy to distinguish the downy and powdery mildew pathogens at the microscopic level; sporangia of downy mildew are formed on sporangiophores that have a distinctive branching pattern that gives them the appearance of "deer antlers". Conidia of powdery mildew are formed in chains on relatively simple structures. If downy mildew is suspected, send a sample in to the Plant Disease Diagnostic Lab in Lexington or Princeton for examination.

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Magnesium Deficiency in Tomato

Nathan Howard,
Extension Associate for
Vegetable Crops
Green River Area

This season tomato fruit loads are extremely heavy around the region. This type of fruit load combined with frequent fertigations of potassium or calcium nitrate can cause magnesium deficiencies to appear on lower leaves of tomato plants. Most seasons we see a few mild symptoms in tomato grower's fields, but this season more widespread and often severe cases have occurred. Magnesium deficiency symptoms appear on the lower leaves of the plant with yellowing between the veins (veins remain green). In these cases growers are taking corrective measures to try to contain the problem to the lower part of the plant. In general, we recommend having at least 200 lb/ acre of magnesium on soil tests for staked tomatoes prior to planting.

Although even with high levels in the soil the tomato plant can still have problems up taking magnesium, as well as other nutrients. A plant tissue sample is a good way to determine what levels of nutrients are being taken up in the plant. UK does not provide tissue testing but many private labs in the area do. Magnesium sources include dolomitic lime (11-12% Mg), Epsom salts (=magnesium sulfate, 10-16% Mg), magnesium nitrate (6.3% Mg) and magnesium oxide (45-55% Mg). Epsom salts and magnesium oxide can be fertigated through the drip system: make weekly applications of 1 to 2 pounds actual magnesium/acre (10-20 lb/A epsom salts or 2-4 lb/A mag oxide). Application rates may vary with solubility of material (check with the manufacturer). These are corrective measures that will work well if you are already seeing symptoms. For future tomato crops make sure to raise soil test magnesium levels with dolomitic lime prior to planting.

The picture above shows a tomato plant with a severe magnesium deficiency.

Preliminary Results of the 2006 Produce Planting & Marketing Intensions Survey

Timothy Woods and Jim Mansfield, Agricultural Economics

Preliminary results from the 2006 Produce Planting & Marketing Intensions Survey have been tallied. The survey is an attempt to measure produce crop acreage, planting trends, markets in use and the demographics of produce farmers in Kentucky. In March of 2007 thirteen hundred and twelve surveys were mailed to all known Kentucky produce farms. Three hundred and eighteen useable surveys were returned resulting in a 24% return rate.

Preliminary results indicate an expected acreage increase for produce crops of 8% over all and a total of 11,514 acres. This is the same acreage growth rate as the 2006 estimate. Fruit crop acreage will essentially remain the same at an estimated 2,496 acres. While vegetable crop acres estimated at 9,018 are predicted to be up 11% from the 2006 level.

Produce crop expansions appear to include a wide variety of crops. Looking at the diversity of planting sizes for these crops one can conclude that crops for direct marketing (from smaller acreage plantings) and crops for wholesale sales (planted in larger acreage) are included in Kentucky produce farmers plans. Of the 39 fruits and vegetables that where asked about in the survey, only eight of them had a reduction in planting intensions. The other thirty-one crops all showed an increase in acres. (See Table 1)

Taking a closer look at vegetable crops, the largest acre-

Preliminary Results of the 2006 Produce Planting & Marketing Intensions Survey

age change comes with a 225 acre estimated increase in cabbage production. Undoubtedly this is a reflection of Cabbage Inc, a produce wholesaler that has begun contracting for fresh and processing cabbage within the state. Another probable wholesale market effect is the 31% decline in jalapeno pepper acreage (from 125 in 2006 to 86 in 2007); this is probably a result of decreased contracting in Western KY for jalapenos. The other possible wholesale market driven acreage change is reflected in a 184% increase in field grown lettuce acres (from 18 acres increased to 51 in 2007). This is probably due to contract trial production of romaine lettuce on several Central Kentucky farms. More intensive production techniques for lettuce in greenhouses were also estimated to make a large increase of 226% (from 5 acres increased to 16 acres). This could be in response to more high tunnel production techniques being used by KY growers as well as a reflection of the increased demand for fresh produce for direct markets such as farmers markets and CSA's. Other intensive production methods appear to be gaining in popularity with KY farmers in the form of greenhouse tomato production showing a 50% increase over 2006 (increased to 23 acres).

Fruit acreage of 2,498 acres over all is predicted to remain essentially unchanged from the 2006 estimate. There is an estimated small decline in apple acreage (1%) and a possible 11% decline in grape acreage indicated by survey respondents Bramble crops on the other hand, show continued expansion of 12% each for blueberries and blackberries to 134 acres and 146 acres respectively. Raspberries appear to be gaining in popularity, possible from new and improved varieties being available. Raspberries acres are predicted to increase from 30 acres in 2006 to 38 acres in 2007. Most of the responses were provided before the late Spring freeze. It's likely that actual harvested acreage, especially for fruit, will actually be lower, especially for tree fruit.

Producers were asked to provide some perspective on the changes in their fruit & vegetable operations in recent years, identifying changes in their acreage in 2006 from 2003. The majority of growers indicated they had actually seen sales for 2006 increased during this period - slightly (18%) or substantially (35%). Produce sales projected over the next 3 years was expected to increase somewhat (35%) or substantially (16%), while only 15% expected any sort of decrease.

Many producers continue to be relatively small (56% had less than $10,000 in sales) and emphasized selling through direct market channels. Marketing through farmers markets, direct to restaurants, on-farm retailing, auctions, and CSA's all increased in the number of farmers selling at least 10% of their produce through these channels. State-wide marketing programs, such as Restaurant Rewards (7% involvement) and MarketMaker (13% involvement), remain underutilized. There remains a strong need to raise awareness of these tools.

Additional information particularly concerning marketing channels and the demographics of Kentucky produce farmers will be released in a more comprehensive report on the survey in coming months.
For additional information contact: Dr. Timothy Woods at tawoods@uky.edu.

KENTUCKY MARKET MAKER™

MarketMaker – A Great Tool for Direct Selling Produce (and Any Other Food Products)

Be sure you take a minute to register your farm on www.Marketmakerky.com. Buyers from Kentucky and neighboring states are using this free directory to find farm products of all kinds. Registration of your business is very simple and you don't need to be a computer whiz to be included. Your county extension office can help you with any questions or contact Bob Perry at UK (859-257-8890) for specific help.

TABLE 1

	2002 USDA Estimated Acreage (Ag Census)	*2006 Acreage Estimate*		***2007 Acreage Forecast***	***2006-07 Percent Change***
Asparagus	44	**45**		**42**	**-6%**
Beans, Snap	541	**405**		**401**	**-1%**
Beets	8	**45**		45	**0%**
Broccoli	49	**260**		**320**	**23%**
Cabbage*	262	**225**		**450**	**100%**
Chinese Cabbage	25	N/A		N/A	N/A
Cantaloupes	575	**460**		**552**	**20%**
Corn, Sweet	2010	**2664**		**2797**	**5%**
Corn, Ornamental	N/A	**159**		**170**	**7%**
Cucumbers, Fresh	146	**142**		**156**	**10%**
Eggplant	2	**25**		**25**	**0%**
Garlic	8	**27**		**46**	**70%**
Greens (Collards, Kale, Mustard, Turnip)	81	**66**		**66**	**0%**
Lettuce - Leaf, Head, & Romaine	14	**18**		**51**	**184%**
Lettuce (Greenhouse)	N/A	**5**		**16**	**226%**
Okra	12	**20**		**29**	**43%**
Onions (Dry & Green)	13	**30**		**36**	**21%**
Ornamental Vegs.	N/A	**45**		**51**	**13%**
Peas	6	**45**		**51**	**14%**
Peppers, Bell	348	**435**		**505**	**16%**
Peppers, Jalepeno	52	**125**		**86**	**-31%**
Peppers, Other	N/A	**85**		**92**	**8%**
Potatoes, Red	N/A	**60**		**77**	**28%**
Potatoes, White	N/A	**75**		**89**	**19%**
Pumpkins	1524	**1260**		**1310**	**4%**
Squash, Summer	136	**145**		**131**	**-10%**
Squash, Winter	N/A	**40**		**50**	**24%**
Sweet Potatoes	N/A	**60**		**83**	**38%**
Tomatoes, Field	911	**615**		**578**	**-6%**
Tomatoes, Greenhouse	N/A	**15**		**23**	**50%**
Watermelons	450	**435**		**574**	**32%**
Herbs	12	**20**		**19**	**-4%**
Other Vegetables	69	**60**		**97**	**62%**
Apples	1920	**980**		**970**	**-1%**
Blackberries	86	**130**		**146**	**12%**
Blueberries	61	**120**		**134**	**12%**
Grapes**	489	**410**	Bearing	**365**	**-11%**
Peaches	408	**600**		**606**	**1%**
Pears	74	**50**		**50**	**0%**
Raspberries	20	**30**		**38**	**25%**
Strawberries	216	**175**		**182**	**4%**
Other Fruits	26	**5**		**5**	**4%**
Total Produce Acres	**10,598**	**10,616**		**11,514**	**8%**
Total Fruit Acres	3,300	2,500		2,496	**0%**
Total Vegetable Acres	7,298	8,116		9,018	**11%**

* Adjusted with information from UK Extension Personnel

** 505 Acres of grapes planted

Downy Mildew of Cucurbits Found in Canada, Ohio, Michigan, New York, and North Carolina Continued from page 3

We need to keep an eye on all cucurbit crops and act as quickly as possible if downy mildew is found. The good news is that downy mildew can be controlled with preventive applications of several fungicides, many of which may already be in use as part of a regular disease management program. The following list was adapted from ID-36 (2006-07 Vegetable Production Guide for Commercial Growers):

Chlorothalonil (Bravo, Equus, etc.) 720SC: 1.5-2 pt/A; Dry flowable formulations are available - see label for rates.
Mancozeb (Dithane, Manzate, Penncozeb, etc): 2-3 lb/A [cannot be used on pumpkins].
Maneb 75: 1.5-2 lb/A, 7-10 day spray interval [pumpkins, cucumbers, winter squash, summer squash].
Maneb 80: 1.5-2 lb/A, 7-10 day spray interval [pumpkins, cucumbers, winter squash, summer squash].
Manex: 1.2-1.6 qt/A, 7-10 day spray interval [pumpkins, cucumbers, winter squash, summer squash].
Quadris: 11-15.4 fl oz/A, 5-7 day spray interval.
Cabrio: 8-12 oz/A, 7-14 day spray interval.
Flint: 4 oz/A, 7-14 day spray interval.
Pristine: 12.5-18.5 oz/A, 7-day spray interval.
Acrobat: 6.4 oz/A, 5-10 day spray interval.
Forum: 6.0 fl oz/A, 5-10 day spray interval.
Reason: 5.5 fl oz/A, 5-10 day spray interval.
Previcur Flex: 1.2 pt/A, 7-14 day spray interval.
Ridomil Gold Copper: 2 lb/A, 14-day spray interval.
Ridomil Gold Bravo: 2 lb/A, 14-day spray interval.
Fixed copper (Kocide, Cuprofix, etc.) - see label for rates.

Please note that products containing mancozeb (Dithane, Manzate, Penncozeb, Gavel, etc) cannot be applied to pumpkins. Maneb or Manex, an EBDC fungicide similar to mancozeb can be used on pumpkins. Each product has a limit on the number of applications that can be applied - consult the label for specific information. Resistance management practices should be followed with products such as Quadris, Cabrio, Amistar, Pristine, Reason, Acrobat/Forum, and Flint - do not make back-to-back applications of these products; rotate with products containing different modes of action. Please be aware that strobilurin-insensitive strains of the downy mildew pathogen or common, and will limit the effectiveness of these materials (Amistar, Cabrio, Quadris, Pristine, Reason) should we encounter insensitive strains. In general, excellent protection against downy mildew can be achieved with EBDC's (mancozeb and maneb) or chorothalonil. To be effective, these products should be applied before disease is observed. If downy is observed before fungicides have been applied, use a product such as Gavel or Ridomil Gold Bravo. If your growers are not using fungicides at the moment, encourage them to put out an application soon to prevent problems and urge them to stay on a regular schedule. Given the hot and dry weather, a longer spray interval can be used to save on fungicide costs and still provide good protection against downy mildew and other diseases.

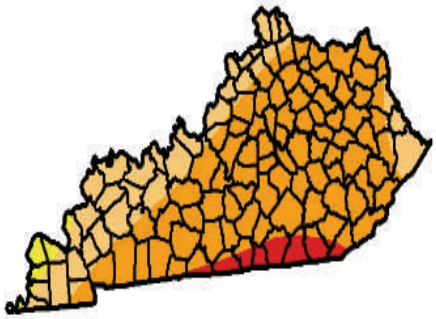
The pictures above are a top and underside look at cantaloupe diagnosed with downy mildew.

U.S. Drought Monitor
Kentucky

June 19, 2007
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	98.0	71.8	5.1	0.0
Last Week (06/12/2007 map)	0.0	100.0	95.1	46.8	0.0	0.0
3 Months Ago (03/27/2007 map)	53.7	46.3	11.0	0.0	0.0	0.0
Start of Calendar Year (01/02/2007 map)	51.5	48.5	0.0	0.0	0.0	0.0
Start of Water Year (10/03/2006 map)	100.0	0.0	0.0	0.0	0.0	0.0
One Year Ago (06/20/2006 map)	81.0	19.0	0.0	0.0	0.0	0.0



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

Released Thursday, June 21, 2007
Author: Rich Tinker, Climate Prediction Center, NCEP/NWS/NOAA

Editor Tidbits

Tomato N & K Testing Service

The University of Kentucky Research and Education Center at Princeton now offers a Tomato Plant Testing Service open Monday– Friday 8-5pm. Bring in your fresh or dried samples to be tested for Nitrogen and Potassium and the results will be given to you in a timely manner. Samples should be taken from the first fully developed leaf with the petiole (where the whole leaf attaches to the main stem) and leaves intact. Please only 3-4 samples per grower per week. The sample will act as a representation of the field as a whole.

Organic Insect Control

I was contacted about an organic insect control question and would like to pass along the information I found. The Beneficial Insect Company out of North Carolina sells beneficial bugs at reasonable prices. The phone number is 336-973-8490 and the website address is www.thebeneficialinsectco.com. Please take a look at the website. Most of the common vegetable insects have a beneficial bug listed to control them.

Chemical Suppliers List

KY Counties	Supplier Names		
Caldwell	Agri-Chem (270) 365-7232	Akridge Farm Supply 55 Wyatt St Fredonia, KY 42411 (270) 545-3332	Thomas Casey Farm Supply (270) 365– 6920
Carlisle	Agri-Chem (270) 628-3311		
Christian	Southern States	Ag Chem	Security Seeds
Fulton	Speed Ag Service, LLC 345 St Rt 166W Hickman, KY 42050	Helena Chemical Co 3500 St Rt 1099 Hickman, KY 42050	
Hancock	Hancock Co. Farm Supply (Southern States) 740 Madison St, PO Box 95 Hawesville, KY 42348 (270) 927-8024		
Lyon	Akridge Farm Supply 55 Wyatt St Fredonia, KY 42411 (270) 545-3332	Akridge Farm Supply 724 Fairview St Eddyville, KY 42038 (270) 388-2910	
Mason	Maysville Southern States 1325 Clyde T Barbour Pky Maysville, KY 41056 (606) 759-0330	May's Lick Mill 6538 US 68 May's Lick, KY 41055 (606) 763-6602	Other: Tractor Supply Co Lowe's Wal-Mart
Meade	Miles Farm Center Ekron, KY (270) 828-2822		
Todd	Deerfield Supplies Elkton, KY (270) 265-2425		

University of Kentucky does not endorse any of the specific businesses or companies listed. This a partial list of chemical and organic control suppliers for Kentucky growers, to be expanded in future issues.

Corn Earworm Management in Sweet Corn

Ric Bessin, Extension Entomologist

Corn earworm is potentially the greatest threat to sweet corn production in Kentucky. Because it feeds directly on the market product, is difficult to control, and is common in high numbers at the end of the season, most insecticides used on sweet corn target this pest. Once earworm has become established within the ear, control is impossible. Earworms spend a relatively short period of their life feeding in a site that can receive an adequate insecticide application. A effective program, especially on late season corn, is necessary to ensure that damaged ears are kept to a minimum.

Currently, the primary insecticides used for corn earworm control in sweet corn belong to the pyrethroid class. There is growing concern that corn earworm in some regions of the Midwest has developed resistance to this class of insecticides. Some field failures have been reported.

Earworms are variable in color, but they have a brown head without markings and numerous microscopic spines covering their body. Corn earworms are moderately hairy larvae that vary from yellow, to green, to red to brownish black. They may be found feeding in the ear tips following silking. The larvae are cannibalistic, rarely is their more than one per ear or whorl.

The moth has a wing span of 1 to 1-1/2 inches. The front wings of the male are usually a light yellowish olive; those of the female are yellowish brown to pinkish brown. Each forewing has a dark spot in the center. The dome-shaped-egg is usually white when first laid but develops a reddish-brown band before hatching.

BIOLOGY

Corn earworms overwinter as pupae in underground cells. Some adults from these pupae begin to emerge as early as late March, others may not appear until August. There are generally four generations each year, however, overlap is great and adult moths that can lay eggs may be present in significant numbers throughout most of the growing season.

Female moths search out fresh silks on which to lay single eggs. Following hatch, the small larvae often eat the egg shell before beginning to feed on the silk. Within a day or so they move down the silks to the tip of the ear. Corn earworms generally complete their development in 14 to 16 days. Full grown worms leave the ear and pupate in the soil. The new adult will be active in another 10 to 14 days. Damage to the kernels in the tip make the ear more attractive to sap beetles.

CULTURAL CONTROLS

There are a number of approaches that growers can implement to control corn earworm besides just spraying insecticides. This includes selecting the best varieties and planting dates. Varietal selection is very important. Corn hybrids having a long, tight fitting shuck appear to suffer less damage than those with loose shucks. The key factor determining the relative risk of corn earworm attack is planting date. Early and midseason we typically have fewer corn earworm moths to lay eggs on the silks. But late-planted corn will be late-silking corn, and many more moths are searching for egg-laying sites at this time. In addition, late in the season, the field corn crop is producing high numbers of corn earworm moths and is not attractive to the moths for egg laying.

SPRAY COVERAGE

Spray solution should be driven deep into the silks to be of maximum benefit. The center third of the plant is the only zone that needs to be protected. Ground application has always been shown to be superior to aerial application, particularly when using drop nozzles on each side of the row directed towards the ears. A spray pressure of 30 psi or higher is recommended.

PREVENTIVE MANAGEMENT

A preventive program against corn earworms may begin when 10% of the ears are silked. Repeated sprays at three to five day intervals until 90% of the silks have wilted should give a high percentage of worm free ears during early and midseason. Control is more difficult late in the season. Even shortening spray intervals may produce only 90% clean ears.

AN IPM APPROACH

Since moth intensity varies considerably during the season, it makes good sense to monitor adult activity and adjust the need for sprays accordingly. Pheromone traps need to be examined twice a week for corn earworms beginning in early June to determine moth activity and the need to spray. Special attention should be given to late planted fields and fields with green silks. Moths should be removed from traps, counted, destroyed, and removed from the field during each visit.

Photo courtesy of Ric Bessin, University of Kentucky Entomology

Weekly Trap Catch	Treatment Frequency
350 or more	Every 3 days
11 to 349	Every 4 days
5 to 10	Every 5 days
When corn earworm weekly counts are less than 5, there is no need to spray for corn earworm.	

Economic Threshold: When tassels emerge and silks are still green, numbers of corn earworm moths captured in pheromone traps will determine the frequency of insecticide applications.

Corn Earworm Management in Sweet Corn

BT SWEET CORN

Similar to Bt field corn, Bt sweet corn has been genetically engineered with a protein that kills certain caterpillars. It is very selective, safe to beneficial insects, and has been approved for commercial production. However, it is not "bullet proof" when planted late there can be considerable earworm damage to Bt sweet corn. Bt sweet corn still needs to be monitored and in some situations may need to be sprayed to prevent infestation with corn earworm

CAUTION! Pesticide recommendations in this publication are registered for use in Kentucky, USA ONLY! The use of some products may not be legal in your state or country. Please check with your local county agent or regulatory official before using any pesticide mentioned in this publication.

Of course, **ALWAYS READ AND FOLLOW LABEL DIRECTIONS FOR SAFE USE OF ANY PESTICIDE!**

Irrigation Provides a Critical Step in Producing Quality Vegetables

Terry Jones, Fruit & Vegetable Extension Specialist

Horticulture, vegetable production in particular, is often viewed by non growers as a cure-all for their financial ills. When the profit or future of other farm crops declines, interest in horticultural crops rises. History repeats itself as the farm economy cycles. To the retired person, horticulture is seen as an ideal way to provide supplemental income. To the person sick of the "rat race" it is seen as a means to change their lifestyle and earn a much "easier" living. To the hobby farmer it is seen as the ideal way of life. To the person with excess money it is a means of reducing the tax burden while still enjoying the benefits of a high income or desired lifestyle. I confess to having had a few fantasies about "Pleasant Valley" and the produce I would raise when I retired. Most, if not all, failures in horticulture occur because the investor had quite unreal expectations and these unreal expectations were not subjected to a realistic examination.

Opportunities in horticulture exist only if:

- There is a market for the product
- An appropriate production environment exists
  - Soils
  - Climate
  - Irrigation
- The producer has the expertise to grow and market the crop
- Suitable finances are available
- Production and marketing risks are understood and can be managed

2007 has been a difficult growing season for much of Kentucky. An early spring, followed by freezing temperatures, followed by heat and drought has made fruit and vegetable production very difficult. How many backup plans and how much equipment does it take to get through one growing season? In a year like this, for many growers having a good irrigation system, adequate water and the management skills to operate it can mean the difference between success and failure.

Sensible Irrigation Requires Three Steps:

- Using an irrigation system able to deliver the correct amount of water when the crop needs it at an economical price
- Ensuring that the application of water is uniform

Scheduling irrigation using monitoring equipment (tensiometers, gypsum blocks, etc)

Tomato and melon crop quality is very sensitive to improper water application. It is foolish to spend thousands of dollars on an irrigation system but refuse to spend $80 - $120 on monitoring equipment. It makes no "cents" to invest in an irrigation system and not use it properly.

Because vegetables are 80 – 95% water their yield and quality suffer quickly from drought. Water shortages early in crop development will delay maturity and reduce yield. Moisture shortages late in the year often reduce quality. Vegetable crops are shallow rooted and even short periods of drought (2-3 days) will hurt marketable yield. The "It will rain tomorrow!" mentality results in yield and quality reductions. It is better to do a good job on less land than a halfway job on more. Up to 1½ inches of water is needed each week during hot weather to maintain vegetable crops that are 12" or more in width.

In addition to drip irrigation, plastic mulch increases water use efficiency on vegetable crops. Mulch reduces evaporation, the downward movement of water and weed growth. Weeds are severe competitors for water and nutrients. It takes about 80 gallons of water to grow one pound of weeds. Except for grasses, it is very difficult to clean up a weedy vegetable field once the crop is up and growing.

Drought periods during the long-day months of June and July are more damaging to vegetables than those in August and September. Dry breezes also contribute significantly to crop drought stress.

Secondary problems associated with drought include: Spider mites, Blossom end-rot on tomatoes peppers and melons, increased wildlife feeding on fruits and vegetables, and increased insect feeding. Being prepared to avoid these problems is much better than trying to correct them after they occur.

Dry years are often those with the highest pumpkin prices. Drip irrigation can make a dramatic difference in pumpkin fruit set, size and color during dry years. I use drip irrigation on pumpkins any year that I must plant into dry soil and the agricultural weather forecast is for a continuation of hot dry weather. It really pays!

Additional information on various aspects of irrigation can be obtained from your local Cooperative Extension Office or by contacting me at R. Terry Jones, Robinson Station, 130 Robinson Road, Jackson KY 41339. I have several hand-outs on drip irrigation, monitoring soil moisture and a Dealers Directory that might be of use to you. There is also a power-point presentation on drip irrigation that you may find useful in managing your fruit and vegetable crops http://ces.ca.uky.edu/robinsonstation/HortPowerpoints.htm.

Table 1.	Temperature Effects on Various Vegetable Crops
Crop	Effect of prolonged hot weather
Beans	Pollination problems
Cabbage	Loose, light heads
Cucumbers	Lack of pollination, misshapen fruit
Peppers	Sunburn on fruit, misshapen fruit
Potatoes	Poor tuber set
Pumpkins	Poor fruit set
Sweet Corn	Pollination Problems, ear fill
Sweet Potatoes	Tolerant
Tomato	Flower drop, pollination problems
Watermelon	Sunburn
Zucchini	Poor pollination

Blueberries and strawberries both set next years flower buds in late summer so remember to water them adequately so that next year's crop will not be reduced.

Table 2.	**Vegetable Irrigation Needs and Critical Periods**			
Crop	Preferred Minimum Soil Moisture		Critical Moisture Period	Defect Caused by Water Deficit
	Tensiometer (centibars)	Gypsum Block (ASM*)		
Pole Beans	34	60%	flowering	Poor pod fill and pithy pods
Snap Beans	45	50%	flowering	Poor pod fill and pithy pods
Cabbage	34	60%	head development	Growth Cracks
Cantaloupe	34	60%	flowering and fruit development	Poor Size
Sweet Corn	45	50%	silking	Poor ear fill
Cucumbers	45	50%	flowering and fruit development	Pointed and cracked fruit
Peppers	45	50%	transplanting, flower to 1/2 " fruit	Shrivelled - squatty fruit, Blossom End Rot
Potato (Irish)	35	70%	after flowering	Second growth, misshapen
Pumpkins	50	40%	fruiting	Blossom End Rot, sunburn, poor color and size
Summer Squash	25	70%	fruit sizing	Pointed and misshapen fruit
Sweet Potatoes	60	30%	fruit and last 40 days	small, misshapen roots
Fresh Staked Tomatoes	45	50%	fruit expansion	Blossom End Rot, failure to blossom, growth cracks
Watermelon	60	30%	fruit expansion	Blossom End Rot

- * ASM – Available soil moisture.

Weed Control in No-Till Pumpkin – UKREC

Joseph Masabni, Fruit and Vegetable Extension Specialist

Article issued originally in 2006 Fruit and Vegetable Research Report. Due to popularity of this subject, the article is reprinted here.

INTRODUCTION

Pumpkin acreage in Kentucky has increased recently. Also, more growers are benefiting from double cropping their fields by planting pumpkins after winter wheat. They harvest two crops in one season, and they also benefit from the wheat stubble left after harvest. It is a natural weed control barrier. This is becoming popular with growers. Some are sacrificing a fall-planted rye or wheat crop with an herbicide kill, pushing the dead straw down, and no-till planting pumpkins on the heavy straw stubble. One advantage is that expensive, selective herbicides have to be used only in the planting strip instead of the whole field.

MATERIALS AND METHODS

In order to evaluate this system, an experiment was started in fall 2005 with the drill seeding of winter wheat at about 90 lb/A. Wheat was burned down with Gramoxone on 10 June 2006, which was later rolled down to provide a thick cover.

Herbicides were applied using a CO_2-pressurized backpack sprayer with a 4-nozzle boom calibrated to spray a 5 ft band at 30 psi and a 3 mph walking speed. The 8002-nozzles were set at 17 inches above ground to obtain good spray overlap and complete weed coverage.

Plots were 10 ft x 35 ft long. The experimental design consisted of a randomized complete block with three replications. Each plot was sprayed with two passes of the boom to cover the 10 ft plot width.

Preemergence herbicide treatments were applied on 19 June five days after seeding pumpkins using a no-till tobacco transplanter to cut the mulch and disc the planting strip.

Postemergence herbicide treatments were applied on 11 July. Two varieties of small-fruited pumpkins were planted in each plot; Cotton Candy (white) and Hybrid Pam (orange).

RESULTS

About two weeks after preemergence (PRE) application, weeds were completely controlled by all treatments, except Sandea at 1 oz, with only 60% control. Weeds in this treatment consisted of grasses, which is expected since Sandea has no grass control effectiveness. Significant visual injury to the two pumpkin cultivars was observed with the following treatments: Outlook high rate 1.8 pt, Spartan high rate 12 oz, Prowl + Sandea and Sandea 1oz.

Pumpkin stand and vigor were comparable in the control plots and in the plots treated with the labeled herbicide Strategy. Similar observation were seen with the non-labeled herbicide Outlook at the 0.9pt.

At 36 days after PRE application (Table 2), crop injury was only observed for Spartan at 6oz/A rate. All other treatments that showed injury at 17 DAT, namely 4, 7 and 8, do not show any further injury at 36 DAT and appear to be safe on both cultivars.

At harvest, only Hybrid Pam was harvested. All Cotton Candy fruit had rotted due to a severe powdery mildew infection. Table 3 shows data for Hybrid Pam. Of the treatments that showed significant injury at 17 DAT (namely, treatments 4, 6, 7, 8), only treatments 6, 7, and 8 had residual effect on yields, even though visual injury symptoms had disappeared by 36 DAT (See Table 2). Outlook 1.8 pt had no residual effect, didn't affect yields at harvest, and was similar to the rate of 0.9 pt. Yields of Outlook plots were similar to the Strategy plots. Significant yield reduction was observed with treatments 6-8(Table 3), both in terms of number of pumpkins per plot and total weight per plot. Sandea alone or in combination with Prowl, or Spartan at the high rate of 12 oz are not safe either. Spartan at low rate of 6 oz and Outlook appear to be safe for use as a preemergence herbicide in no-till pumpkin. Please note that Outlook, Spartan, and Prowl are not currently labeled for use in pumpkin.

Untreated Control, 17 days after preemergence treatments

Strategy 6 pt/A, 17 days after preemergence treatments

Table 1. Crop injury ratings and overall weed control effectiveness, 17 days after preemergence treatments

			% Control		
	Treat-ment	Rate/ A	Cotton Candy	Hybrid Pam	Weeds Overall
1	Un-treated Control		30	30	10
2	Strategy	6 pt	30	30	100
3	Outlook	0.9 pt	30	30	100
4	Outlook	1.8 pt	50	60	100
5	Spartan	6 oz	40	40	100
6	Spartan	12 oz	90	90	100
7	Prowl	32 oz	70	70	100
	Sandea	2/3 oz			
8	Sandea	1 oz	60	70	60
LSD (P=0.05)			25	27	27
Standard Deviation			15	15	16
CV			19.1	30.8	22.35

Table 2. Crop injury ratings and overall weed control effectiveness, 14 days after postemergence treatments

			% Control			
.	Treat-ment	Rate/ A	Cotton Candy	Hybrid Pam	Large Crab-grass	Redroot Pigweed + Horsenettle
1	Un-treated Control		10	20	10	40
2	Strategy	6 pt	10	20	90	100
3	Outlook	0.9 pt	10	10	50	100
4	Outlook	1.8 pt	10	10	90	100
5	Spartan	6 oz	30	40	70	100
6	Spartan	12 oz	80	90	90	100
7	Prowl	32 oz	20	30	80	100
	Sandea	2/3 oz				
8	Sandea	1 oz/A	20	40	40	40
LSD (P=0.05)			19	26	27	38
Standard Deviation			11	15	15	22
CV			40.09	43.25	25.36	26.48

Table 3. Harvest – 92 days after preemergence treatment

			HYBRID PAM	HYBRID PAM
		Rate/ A	YIELD	YIELD
	Treatment		No./PLOT	LB/PLOT
1	Untreated Control		18	61.6
2	Strategy	6 pt	30	132
3	Outlook	0.9 pt	28	105.6
4	Outlook	1.8 pt	30	138.6
5	Spartan	6 oz	21	125.4
6	Spartan	12 oz	12	39.6
7	Prowl	32 oz	17	59.4
	Sandea	2/3 oz		
8	Sandea	1 oz	13	35.2
LSD (P=0.05)			14.9	82.06
Standard Deviation			8.7	47.96
CV			43	60

COOPERATIVE EXTENSION SERVICE

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