2010 Proceedings

55th Atlantic Coast Ag Convention & Trade Show

January 12-14, 2010

Sponsored by
Vegetable Growers' Association of New Jersey, Inc.

In Conjunction with
Rutgers Cooperative Extension

And the
New Jersey Department of Agriculture

Trump Taj Mahal
1000 Boardwalk at Virginia Avenue
Atlantic City, New Jersey

Education **Program Chairman**

Mel Henninger
Specialist in Vegetable Crops

Session Organizers

Tuesday, January 12

Sweet Corn – Raymond Samulis, Agricultural Agent, Rutgers Cooperative Ext. of Burlington County.

General Vegetables – Joseph Ingerson-Mahar, Rutgers Vegetable IPM Coordinator

High Tunnel – A.J. Both, Rutgers Specialist in Controlled-Environment Engineering

Marketing I – Richard VanVranken, Agricultural Agent, Rutgers Cooperative Ext. of Atlantic County

Animal Topics – Joseph Heckman, Rutgers Specialist in Soil Fertility

Cucurbits – Michelle Infante-Casella, Agricultural Agent, Rutgers Cooperative Ext. of Gloucester County

Leafy Greens – Brad Majek, Specialist in Weed Science, Rutgers Agricultural Research & Extension Center

Specialty Potatoes – Mel Henninger, Ext. Speciality in Vegetable Crops, Rutgers Cooperative Extension

Marketing II – Richard VanVranken, Agricultural Agent, Rutgers Cooperative Ext. of Atlantic County

Fertility & Field Crops – William Bamka, Agriculture Agent, Rutgers Cooperative Ext. of Burlington County

Bedding Plants/Transplants – Robin Brumfield, Specialist in Farm Management, Rutgers Dept. of Ag, Food and Resource Economics

Wednesday, January 13

Peppers – William Tietjen, Agricultural Agent, Rutgers Cooperative Ext. of Warren County

Food Safety – Wesley Kline, Agricultural Agent, Rutgers Cooperative Ext. of Cumberland County

AgriTourism – Steve Komar, Agricultural Agent, Rutgers Cooperative Ext.of Sussex County

Bioenergy Overview – William Hlubik, Agricultural Agent, Rutgers Cooperative Extension of Middlesex County

Cut Flowers – Jenny Carleo, Agricultural Agent, Rutgers Cooperative Ext. of Cape May County

Tomatoes – Andy Wyenandt, Specialist in Vegetable Pathology, Rutgers Agricultural Research & Extension Center

Blueberries – Gary Pavlis, Agricultural Agent, Rutgers Cooperative Ext. of Atlantic County

Tree Fruit – Dan Ward, Specialist in Pomology, Rutgers Agricultural Research & Extension Center

Applied Efforts in Renewable Energy – Dave Specca, Assistant Director for Controlled Enfironment Ag and Bioenergy, Rutgers EgoComplex

Ag Mediation & Leadership – David Kimmel, Ag Resource Specialist, NJDA

New Farmer Training I – Dan Kluchinski, Ag Agents Department Chair, Rutgers Cooperative Extension

Thursday, January 14

New Farmer Training II – Peter Nitzsche, Agricultural Agent, Rutgers Cooperative Ext. of Morris County

Producing Energy Crops – Bill Sciarappa, Agricultural Agent, Rutgers Cooperative Extension of Monmouth County

NJ Agbusiness Topics – Pete Grehlinger, Retired Bayer Representative

Preparing for a USDA Third Party Audit – Wesley Kline, Agricultural Agent, Rutgers Cooperative Extension of Cumberland County

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of the

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After the meeting, additional copies of the Proceedings may be obtained by contacting:

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SWEET CORN

SESSION

IS NO-TILL SWEET CORN IN THE FUTURE FOR YOUR FARM?

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Our farm grows over 70 acres of sweet corn. About 75% of that is planted no-till. We have been growing corn with this system for over 15 years. This practice has several advantages:

1. The roots of the killed grass stabilize the soil, allowing us to plant in very wet conditions while planting on tilled ground would not be possible. This is important because we need to maintain a strict planting schedule in order to have a steady supply of corn throughout the season. There have been several instances when we were able to plant while other growers were not and it made the difference between having corn and being out for days.
2. The surface residue reduces moisture loss. This is especially important in our sandy soils, which tend to dry out quickly to the point that the corn will not germinate. The surface residue conserves moisture and helps ensure a good stand.
3. Wind and rain erosion are greatly reduced because of the grass roots' ability to stabilize the soil. The surface residue also reduces the impact of raindrops on the soil. This has been great for some of our hilly fields.
4. Soil structure is improved. We use no-till as part of a rotation with vegetable crops that require plowing and we see some soil structure improvement.
5. Less labor, fuel, and equipment costs than tilling.
6. Minimal equipment investment makes it easy to get started.
7. Yields are comparable to a tilled system when you get it right.

Our system is this:

1. The previous fall we sow annual ryegrass in September (ideally).
2. Spread a mixed analysis fertilizer on the grass when it starts to grow in the spring.
3. Mow the grass to maintain a 6-inch height.
4. Kill the grass with Round-Up two weeks before corn is to be planted.
5. Plant corn with properly equipped planter. We use a Monosem with three important modifications: 13-wave coulters in front of seeder, double disk openers for starter fertilizer, and heavy disk markers.
6. Spray Atrazine, Dual, and Round-Up after planting. Sometimes we use Gramoxone instead of Round-Up, depending on the types of weeds present.
7. After harvest, mow-off the corn, subsoil spray lanes, disk corn residue, and sow ryegrass for a winter cover crop.

Some pitfalls to avoid are:

1. This system is not feasible for early production as the soil does not warm-up as quickly as tilled soil
2. The production costs may not be lower when you consider the increased herbicide use and expense.
3. Do not wait too long to mow the ryegrass in the spring or the trimming will lay too thick and kill the grass. The grass could also become difficult to penetrate with the planter if it lays too thick.
4. Beware of poor herbicide performance when the grass is drought stressed. It helps to add some nitrogen fertilizer to the spray mix. This encourages the grass to grow so it can absorb the Round-up.
5. Make sure that the coulter is cutting the residue well. If it just pushes the residue down into the soil, seed to soil contact will be reduced.
6. When planting in very wet conditions, you may not get stuck, but the corn seed may still rot from excessive soil moisture. Yields may be compromised.
7. It is important to subsoil the spray lanes in the field at the end of the previous year to alleviate soil compaction. Before we started doing this, it was possible to see in the corn crop where the spray lanes had been the year before because the corn grew poorly there.
8. The use of ryegrass is not the only option; it is simply the only crop that we have used except for wheat. I would not recommend wheat because it just does not endure like ryegrass. The roots are not as dense and the stalks rot more quickly.

Don't just take my word for it; there are many educational resources for no-till corn production. Some of the more extreme people such as Steve Groff at www.cedarmeadowfarm.com and the Rodale Institute at www.rodaleinstitute.org/no-till_revolution have done some interesting things with no-till. Overall, our success with this system has been such that we plan to keep no-till sweet corn as part of our operation.

SWEET CORN VARIETIES FOR 2010

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Objectives:

This study was developed to determine suitability of growing various varieties and genotypes of bicolor sweet corns in southern New Jersey. The study is divided into two separate sections namely SE bicolor sweet corns and Sh_2 bicolor sweet corns and their variants. Plots were isolated by 150 feet separation in order to have minimal cross pollination between the two types.

The earliest test consisted of 32 sugar enhanced bicolor sweet corns and 19 super sweets of various genetic configurations. Data was collected for various habituated traits including yield, tip cover, tip fill, eating quality, and ear length. A newly added criterion for this year was measurement of actual sugar content. This was done in order to prove or dispel myths regarding which sweet corns are the sweetest varieties. Finally, detailed observations were made regarding peculiar traits that might make a particular variety unacceptable for the commercial sweet corn market. Examples might include ears that grow significantly longer than the provided husk cover which would encourage significant bird damage.

This study was conducted at the Rutgers Research and Extension Center located in Centerton, New Jersey.

Discussion and Results:

Yield observations are made in crates per acre with each crate containing approximately 50 ears of sweet corn. The data charts list the seed supplier. Please note some varieties are listed twice due to multiple companies offering the same variety.

Tip C is the measurement of husk tip cover and refers to the amount of green husk cover that extends beyond the tip of the ear. This measurement is given in inches with ears containing .5 to .75 being very marginal in protecting the ears from both bird damage and sap beetle infestations.

Tip F refers to ear tip fill and the tendency of the variety to have full kernels all the way to the ear end. Tip fill problems can be the result of insufficient irrigation practices; however, since all varieties in this test have the exact same irrigation, the results show how each individual variety fills ear tips. The rating scale is from 1 being severe problems filling tips to 5 which would indicate no unfilled kernels.

Eating quality was a subjective test performed by myself which combined tenderness, sweetness, and flavor into a single number rating from 1 tough, lacking flavor and sweetness up to 5 significant flavor, sweetness and tenderness.

Ear length in inches tells if the ears are of sufficient length to be commercially acceptable.

This study also made measurements of total chlorophyll content of the plants using a SPAD meter. This basically tells how green the varieties were. Plants with readings from the mid 40's into the 50's were vigorous, dark green, and healthy plants, while plants with readings in the 30's were chorotic, yellow, and generally less vigorous.

With recent problems in both fertilizer supply and pricing, I feel that these readings might be an indication of which hybrids might grow adequately with reduced fertility rates. A second study conducted in 2009, was established to investigate this idea. Preliminary results were very promising, and will likely result in future experimentation.

Conclusion:

I am often asked to just tell us which are the best varieties. This is a near impossible task because each farm has specific conditions and problems that must be addressed. If you have had problems, sell at road stands, want the sweetest corn possible, or can't sell small ears, the variety you want will be different in each case. I encourage all growers to look at the data charts and determine which fits their situation best.

The numerous pictures I took of each variety will eventually be put on the Rutgers vegetable web site, where you will be able to see exactly what each ear looks like.

Bicolor Sweet Corn Trial Results

Variety	Yield	Source	Tip C	Tip F	Eating	Length
Fastlane	330	Mesa	1	5	5	7.25
Bon Jour	296	Stokes	1.5	2	2	7.5
Native Gem	296	Mesa	.75	4	4	7.25
Navajo	383	Stokes	1.5	5	3	7.5
Envoy	209	Mesa	.75	4	2	7.5
Chippewa	278	Stokes	1.5	4	5	7.5
Bon Appetite	383	Mesa	1.5	4	4	7.25

Bicolor Sweet Corn Trial Results

	Yield	Source	Tip C	Tip F	Eating	Length
Nantasket	348	Mesa	1	2	3	7.25
Awesome	261	Stokes	1.5	2	2	7.5
Lucious	261	Mesa	2	5	3	7
Legion		Stokes	.75	3	3	7.5
Saugatuck	365	Mesa	2.5	5	5	7
BC 0822	296	Syngenta	1.5	3	3	7.25
Fantastic	296	Stokes	1	5	4	7

Bicolor Sweet Corn Trial Results

Variety	Yield	Source	Tip C	Tip F	Eating	Length
Montauk	278	Stokes	2	3	4	8
Brocade	278	Mesa	1.75	2	1	8
Precious G	383	Mesa	1.5	4	4	7
Manitou	330	Mesa	2.5	3	4	7.25
Synergy	418	Stokes	2.5	3	5	7.25
Kristine	278	Stokes	.5	3	4	6.75
Lancelot	261	Mesa	2.5	1	4	7.5

SPAD Readings

• Fantastic	• 50.6
• Legion	• 50
• Native Gem	• 49.6
• Awesome	• 47.6
• Envoy	• 46.3
• Bon Jour	• 34.3
• Chippewa	• 35.6
• Ovation	• 37
	• LSD 3.7

GENERAL VEGETABLES

SESSION

DRIP-IRRIGATION INSECTICIDE APPLICATION FOR EGGPLANT

Dr. Gerald M. Ghidiu
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Plastic mulches and drip irrigation have been used by vegetable growers since the early 1970's, and their usage is still increasing. Drip irrigation has many benefits, including the capability to conserve water. Water savings can be as much as 80% compared to other irrigation systems. Currently, drip systems with plastic mulch are the irrigation systems of choice for eggplant in many areas of vegetable production.

As drip irrigation systems developed, researchers examined the injection of agrichemicals through the drip irrigation system. The earliest 'chemigation' trials involving drip irrigation and insecticides (insectigation) with vegetables were conducted at RAREC, Bridgeton, NJ with tests in bell peppers in 1980-1981 and pole beans in 1982. However, results were not promising, partly because there were no insecticides available that could be effectively used in a drip irrigation system. Plus, the technologies necessary for trouble-free injection of insecticides in smaller research plots utilizing drip irrigation were still lacking. Injection equipment improved over the next several years, and trials with insecticides injected through the drip system in bell peppers increased at the Rutgers Argicultural Research Center in the mid- 1980's and early 1990's. But the insecticides available for use in drip systems were still limited, and the pest control results were inconsistent. New chemistry insecticides were needed that were effective in controlling vegetable pests, were highly systemic but non-phytotoxic, and were highly soluble in water so they would not plug the micro-emitters in the drip tape and be uniformly distributed throughout the system.

Such new-chemistry insecticides were developed in the 1990's that were not only well-suited for use in drip irrigation systems, but were highly effective against many insect pests of vegetables when used at low rates. Materials such as dinotefuran (Venom), oxamyl (Vydate L), imidacloprid (Admire), chlorantraniliprole (Coregan), thiamethoxam (Platinum), and combinatons such as thiamethoxam + chlorantraniliprole (Durivo) received labels, many of them recently, for use in eggplant and other vegetables via application through a drip-irrigation system. These materials are very soluble in water, highly soil-systemic, effective against various pests of eggplant, and non-phytotoxic when used at labeled rates.

It is crucial to read and understand the pesticide label before use to ensure that the material can be applied through a trickle irrigation system, and to be aware of all the label requirements (safety equipment, use rates, mixing instructions, etc) for that application. Remember that many of the drip-applied insecticides are pest-specific, so it is important to match up the correct insecticide with the pests infesting your eggplant!

Growers who already use the drip system to inject fertilizers will be all set to inject insecticides – no additional equipment should be necessary. For growers setting up injection equipment, remember that it is necessary to have a little extra safety equipment to properly inject chemicals through the drip system.

A positive displacement pump or other injection unit that provides a consistent, measurable injection rate is a key componet. A back-flow preventer, pressure regulator, and sand filter are important units that should be located between the injection pump and water source. And a pressure reduction shut-off unit should be used to shut the injection pump off should a sudden pressure drop occur, such as due to a hole or break in the drip line.

Uniformity of application is important. It is desirable to have the same quantity of insecticide drip equally from every emitter in the system. 'Prime' the system before injecting an insecticide so that the dry soils have a normal moisture range before insectigation. Underwatering will prevent the insecticide from reaching the entire root zone of all plants, and overwatering will leach the material from the root zone. The correct timing of the injection period depends on soil type, distance covered, product mobility in the soil, and location of the emitters relative to the root system. Remember that the goal is to deliver the insecticide to the root zone of all plants equally. Don't rush injection time – extending the length of injection will actually improve the uniformity of delivery.

Remember that the rates used in the drip system are based on the actual area wet by the drip system. For example, a 5-ft bed generally becomes a 3-ft bed when covered with plastic mulch with drip tape. Thus the rate used for this setup would be based on [3-ft X total distance] to determine square foot area, divided by 43,560 sq ft for acres to be treated.

DuPont Crop Protection, Inc., has a 7-page brochure available, entitled *Drip Chemication: Best Management Practices*, that will help growers with their questions and decisions concerning drip irrigation and the injection of crop protection materials (www.Dupont.com). Also, each insecticide label that allows trickle/drip chemigation has a section on proper application of the insecticide via the drip system, including equipment requirements, mixing rates, etc. (www.CDMS.net, click on "services", then "labels" to download specific labels)

WHOLE FARM IPM

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For most of us when we speak about IPM we tend to think of each crop as a separate unit. After all that is how we have separated our crops either as fields or at least different plantings within a field. Most of the tactics we use for managing pests are effective within these units, or at least if they aren't, we try to correct our practices so that in another season or planting we will be successful.

The question is, is this the best way to manage our farms, field by field, planting by planting? If we step back and look at the overall farm, we find that with vegetable producers a number of different crops are being grown over sometimes a pretty wide area. Concerning pest management we have to ask ourselves a few questions like: How do the soils change across all of the acreage? Where is the best site to raise a particular crop? What are the field borders – wood lots, fence rows, other fields? Is there adequate space to rotate crops sufficiently? And so on.

The answer to these questions depends upon the crops being grown. Just as farmers try to manipulate the placement of different crops on the farm to take advantage of differences in soil pH, % organic matter and other factors, just as much effort should be going into the direct management of pests.

For crop pests we have an assortment of organisms which limit production of our crops: weeds, plant diseases, insects, nematodes, deer, ground hogs, black birds and geese.

There is no question but what some pests help influence the severity of other pests. The following example shows the interconnectedness of various pest problems. Let's say that a particular farm grows tomatoes and peppers. These are members of the solanaceous family of plants and included in this group are the nightshades, ground cherries, horsenettle, and jimson weed. Since herbicides applied to tomatoes and peppers are generally tolerated by the solanaceous weeds there are more of these weeds present than what there might be in other cropping systems. Several significant pests are maintained on these weeds including: Colorado potato beetle, corn earworm, tomato hornworm, several species of stinkbugs, pepper weevil and plant diseases such as, bacterial canker of tomatoes and an array of other bacterial diseases and viruses.

Weeds hurt crops in many ways including competition for light, water and space. Even though weeds may be well controlled within fields, if you look at the farm lanes you may see a wide array of weeds that are growing on the edge of the drive, near the field headlands, in the fencerows or trashy areas around the farm buildings. Because

weeds harbor pests, their presence on the farm helps provide a reservoir for these pests close to your crops.

One of the best examples of this is the relationship of carrot weevil and carrots. If the weed host plants for carrot weevil are not in the immediate area of carrots, the likelihood of having significant damage from carrot weevil will be very low. However, allowing curly dock, buckhorn, broadleaf plantain and sorrel to exist within close proximity of a carrot or parsley field will increase the odds of damage to the crop.

Broadleaf weeds serve as alternate hosts for many disease pathogens. The transfer of plant viruses from weeds to cucurbit crops is well known. Research conducted by the Vegetable IPM Program has shown that bacterial canker, a serious, potentially yield limiting disease of tomatoes can reside in weed hosts on the farm on both annual and perennial weeds, even when tomatoes were not grown near these weeds.

So, what can be done to help reduce pest pressure on a farm-wide basis?

1. Be aware of the soil and general growing needs of your crops – paying particular attention to soil pH, soil fertility and drainage.
2. Learn what the pests are of the crops that are being raised.
3. Learn to identify at least the most common weeds on your farm: *lambsquarter, pigweed, purslane, ragweed, velvetleaf, jimson weed, nutsedge, horsenettle, galinsoga, curly dock, nightshade,* for examples.
4. Eliminate weedy areas on the farm, field borders, shoulder areas of farm lanes and trashy areas around buildings.
5. Create rye strips or strips containing the flowering plants buckwheat, coriander and other plants between blocks of crops or in fence rows to provide food and cover for natural enemies, predators and parasites, of insect pests.
6. Use pesticides when necessary but otherwise increase practical, non-chemical tactics that will reduce the development of pesticide resistance in plant pests. Two examples:
    a. as soon as a crop is finished, till up the plants removing them as a source of pests for other plantings
    b. maintain a 3 to 4 year rotation out of a field for any crop if you have the ability to do so
7. Exclusion of pests: deer fencing, row covers, ditching

HIGH TUNNEL

SESSION

Presentation by Bob Rimul

EARLY HIGH TUNNELS

PENN STATE HIGH TUNNEL EXPERIENCES AND PEST CONTROL

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High tunnels do not offer the precision of conventional greenhouses for environmental control, but they do sufficiently modify the environment to enhance crop growth, yield, and quality. Although they provide some frost protection, their primary function is to elevate temperatures a few degrees each day over a period of several weeks.

In addition to temperature control, there are also the benefits of wind and rain protection, soil warming, and in some instances control of insects, diseases, and predators such as rodents and birds. Overall, this growing system should be considered a protected growing system that enhances earliness and promotes higher yields, improves quality and shelf life, and reduces the use of pesticides.

High Tunnel System

High tunnels encompass a crop growing system that fits between row covers and greenhouses. They are relatively inexpensive (about $3.00/sq. ft, excluding labor), permitting a grower to enter into high tunnel crop production with limited capital. This system is particularly appealing to new-entry growers who utilize retail-marketing channels.

High tunnels are not conventional greenhouses. But like plastic-covered greenhouses, they are generally a peaked quonset-shape, constructed of metal bows that are attached to metal posts which have been driven into the ground about two feet deep. They are covered with a single layer of 6-mil greenhouse-grade polyethylene, and are ventilated by manually rolling up the sides each morning and rolling them down in early evening. There is no permanent heating system although it is advisable to have a standby portable propane heater to protect against unexpected below-freezing temperatures. There are no electrical connections. The only external connection is a water supply for trickle irrigation. Dr. Otho Wells, from the University of New Hampshire, was a pioneer in promoting the use of high tunnels in the northeastern United States and developed the New Hampshire design and system of production that involved covering the entire soil surface inside the tunnel with a solid sheet of 6-mil thick plastic. At Penn State we re-designed the endwalls so that they can be raised up to facilitate easy access into the tunnel with a small tractor and tiller and a system of production that uses 18- inch wide raised plastic mulch covered beds with drip irrigation tape buried 2-3 inches beneath the bed. The raised mulch beds are 44 inches apart, which allows 4 rows in a 17-foot wide high tunnel or 5 rows in a 21-foot wide tunnel.

General Suggestions for High Tunnel Management

High tunnels are not automated. Consequently, for maximum efficiency, they require regular daily attention, especially in the morning and evening, and during heavy rain events or strong winds. Temperature and humidity are the two critical factors that should be controlled as much as feasible. Early each morning, the sides should be rolled up to flush out the humidity and to keep temperature in check. The temperature in a closed high tunnel rises very rapidly on a clear morning! In other words, don't put off rolling up the sides. Ken-Bar Inc., Reading, MA. has developed a top vent that fits right on the plastic and can be used to ventilate a tunnel in the early spring and late fall when one does not really need to roll the sides up for temperature control. In the early evening, roll-down the sides to entrap as much heat as possible. To increase soil and air temperatures within a high tunnel the following materials have been used successfully over the last four years: floating row covers, thermal blankets, hoop supported low tunnels (plastic film with or without ventilation holes or row cover material). Close the sides each evening until the night temperature reaches about 65^{o}F. In the northeastern United States, this could mean that the sides would be rolled down each day well into the summer. Ventilation is best accomplished when wind moves through the tunnel from side to side; therefore orient the tunnel accordingly. The width of the tunnel also impacts ventilation. It is hard to be specific on the maximum width, but from experience, about 21-26feet seems to be the maximum high tunnel width that will allow for good ventilation, especially as plants grow taller and block the airflow.

Pest Control

Integrated pest management (IPM) is an approach to dealing with pest problems that relies upon a variety of tactics to maintain pest numbers below economic levels. Any good IPM program begins with prevention, but may progress to use of pesticides or introduced biological controls as circumstances warrant.

Research being conducted at The Penn State High Tunnel Research and Education Facility has continued to note that pest and disease problems common to greenhouse production also predominate in high tunnel systems. An important difference, however, is that economically significant pest problems in high tunnels during the winter cropping months (November-March) are generally uncommon. This feature makes winter cropping an attractive option for market farmers with year-round outlets. It also makes pest control less overwhelming since there are only certain times of the year when one would expect to find severe infestations.

As with greenhouse production, a combination of biological control with other tactics should prove to be successful in managing insects within high tunnels. The present challenge for researchers and growers is to determine which of the integrated pest management (IPM) tactics developed for greenhouse production are effective and economical for high tunnel systems. Until there are more thorough studies of biological control in high tunnels, recommendations can only be cautiously generated and adopted. Nevertheless, the application of biological control to tunnel cropping has great potential and should be strongly considered by growers.

There may be circumstances in which it is necessary to control insect pests through pesticide applications. Growers should begin by selecting materials that are least toxic to both humans and beneficial insects, including pollinators. Pesticides that are low in acute toxicity and also display a low residual activity are often referred to as "soft" pesticides. These materials should be strongly considered in high tunnel cropping because of the "closed" nature of the system, which may prolong any residual activity of applied pesticides.

Common examples of "soft pesticides" include insecticidal soap, horticultural oils, and biological pathogens such as *Bacillus thuringiensis* (Bt) and *Beauveria bassiana*. In addition, many of the botanical pesticides available to growers are also regarded as "soft," including neem (azadirachtin) and ryania. These materials usually provide adequate control of pests and are compatible with biological control programs. However, the toxicity of each material to humans can vary greatly and so caution must always be exercised.

Pesticide applications should be timed to avoid beneficial insect and pollinator activity. Generally, this means that applications should be made in early morning or late evening. If possible, applications should also be strategically localized. This will require scouting to determine where pest "hot spots" occur. If pest problems are restricted to a small area or several small areas in high tunnels, then applications should be limited to these "hot spots." This simple practice will save money, labor, and time but will also allow beneficial insects or biological control agents to "retreat" to safe (untreated) spots. In this manner, one can effectively conserve introduced and/or background beneficial insects and pollinators, while simultaneously using multiple pest control tactics.

Biological Control in High Tunnels

The three insect pests most frequently encountered in high tunnels at Rock Springs, PA are whiteflies, aphids, and mites. Fortunately, all of these pests are manageable by combining tactics such as biological control (bio-control), with judicious use of "soft" pesticides like insecticidal soap. Table 7A lists a number of biological control agents that can be used by growers against these three major pests of high tunnel crops. To date, there has been limited research into the performance of these bio-control agents in high tunnel cropping systems and so growers should begin cautiously.

There is much to gain by adapting greenhouse biological control to high tunnel systems. If done correctly, the use of bio-control can reduce pesticide applications dramatically. This, in turn, limits or eliminates pesticide residues on product and can be a strong selling point to customers. In addition, fewer pesticide applications make the tunnel environment safer and allow work to proceed uninterrupted without the need to be concerned about reentry intervals.

The transition from relying on pesticides to biological control may seem like a daunting challenge, however. It requires that a grower become more knowledgeable about both pest and potential bio-control options. It will also probably require a few shifts in management style. Managing pests with biological controls requires thoughtful, careful planning and the realization that every crop cycle may present a unique

situation. Results are not instantaneous and so patience and diligence is absolutely necessary. The results, nevertheless, can be highly rewarding---both personally and financially.

Benefits of High Tunnels

The primary benefit of high tunnels is earliness. Tomatoes in a high tunnel mature on average about one month before field tomatoes. Earliness is the combination of being able to plant in high tunnels about two weeks earlier than in the open- field and faster ripening (about two weeks) inside the tunnel. Overall, the cost of a tunnel is usually recovered the first year when selling at retail prices. Another highly beneficial advantage of tunnels is disease control. The plastic cover acts like a rain shelter, the raised plastic mulch beds are a barrier against evaporation of soil moisture, and early morning ventilation reduces relative humidity. Therefore, the leaves of crops are dry for most of the day and night. Because of low humidity, plant leaves remain dry, impeding the incidence and spread of disease. For example, early blight of tomatoes, a serious foliage and fruit disease on field tomatoes, is not a problem in high tunnels when the tunnels are vented daily, though powdery mildew can be a problem because the conditions in a high tunnel are more favorable for the development of this disease.

Summary

High tunnels can provide an ideal protective growing environment for any number of crops, but all crops might not be economical for any number of reasons. Therefore, a good approach to take would be to try different crops in light of market demands and marketing strategies. Although tunnels do require more manual attention than do greenhouses, the benefits of high tunnels in a diversified farm operation have proven to be a valuable asset in overcoming a short growing season and expanding the marketing season.

There are temperature limitations in high tunnels since they are not designed to be as warm as a greenhouse. Some type of supplemental heat should be available just in case there is a sudden unexpected drop in the temperature that would permanently injure the crop. The critical low temperature will depend on the crop. If the intent is to have a permanent heat source in a high tunnel, then if would be well to consider constructing a bona-fide greenhouse which easily could be used year around.

For addition information on plasticulture contact the following websites:

American Society for Plasticulture: **http://www.plasticulture.org/**
Center for Plasticulture, Penn State University: **http://plasticulture.cas.psu.edu**
Penn State High Tunnel Production Guide is available from
Dr. William James Lamont Jr.
Associate Professor of Vegetable Crops
Department of Horticulture
206 Tyson Building
The Pennsylvania State University
University Park, PA 16802
E-mail: wlamont@psu.edu

MARKETING I

SESSION

CONSUMER ATTITUDES & PURCHASING INTENT: A PROJECT UPDATE OF THE MID-ATLANTIC SPECIALTY CROP RESEARCH INITIATIVE

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Industry reports suggest that certain segments of consumers are acquiring food items directly from the farmer who grew them and purchasing cheaper organic "private-label" products from both specialty and non-traditional retailers (Lukovitz, 2008). Consumers may also be altering their purchasing and eating habits in response to a salmonella outbreak first linked to tomatoes and now jalapeno peppers. Half of the consumers who participated in a telephone survey conducted from July 10 through 14, 2008 by the Associated Press-Ipsos, stated concerns about becoming sick from eating contaminated food (Alonso-Zaldivar, 2008). A majority of survey participants (86%) expressed the need for traceability and the need for produce to be labeled "all the way back to the farm."

It is in response to this and other data that prompted researchers at the Pennsylvania State University to submit a planning grant proposal to the USDA Specialty Crops Research Initiative in 2008 (CSREES Award Number 2008-51180-04891). The proposal, submitted by faculty from several departments within the College of Agricultural Sciences, focused on aligning consumer demand, agricultural industry resources, research, and education to service mid-Atlantic fruit and vegetable markets. A component of the effort was to conduct quarterly consumer research to determine consumer attitudes and behaviors towards food purchases.

As of November 2009, three of the four Internet surveys were conducted involving consumers residing in five metropolitan areas within the mid-Atlantic region: Baltimore, New York City, Philadelphia, Richmond, and Washington, D.C. These metropolitan areas were chosen based on the diverse demographics of consumers who reside in each area. The objective was to gain a better understanding of factors influencing consumer purchasing decisions regarding fresh produce and value-added processed products.

Reported Weekly Food Purchases by Mid-Atlantic Consumers

We asked participants to provide an approximate percentage of how much (quantity) of their average weekly food purchases consisted of "fresh" products versus "processed" products. We also asked what percentage of these weekly food purchases could be categorized as "meat," "vegetables," "grains," "fruit," "dairy," "snacks," and "sweets." Results showed that approximately half of food purchases could be categorized as "fresh" (51.08%) with the remainder categorized as "processed." While

"meat" products were reported as the largest single category of food purchases (20.2%), approximately 36% of their purchases are in the "fruit" and "vegetable" product categories (Figure 1.).

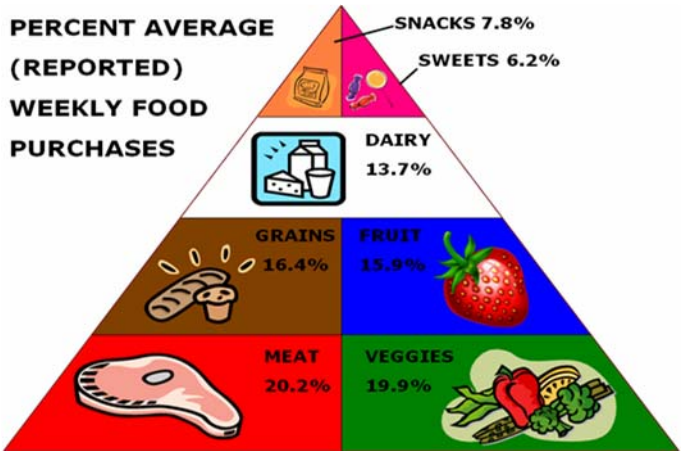


Figure 1.

Motivation for Purchasing Locally-Grown Fruits and Vegetables

A majority of consumers (71.8%) responded that whenever possible they purchase fruits and/or vegetables from the farmer who grew them or that are labeled locally-grown. To understand why this might be, participants were asked to indicate what motivated them to respond in this way. The top five concerns (measured by those that at least "somewhat agree") included 1) produce freshness (96.1%); 2) supporting the farmer and the local economy (95.2%); 3) produce quality (95.4%); 4) produce taste (94.1%); and 5) produce food safety (88.2%) (Figure 2).

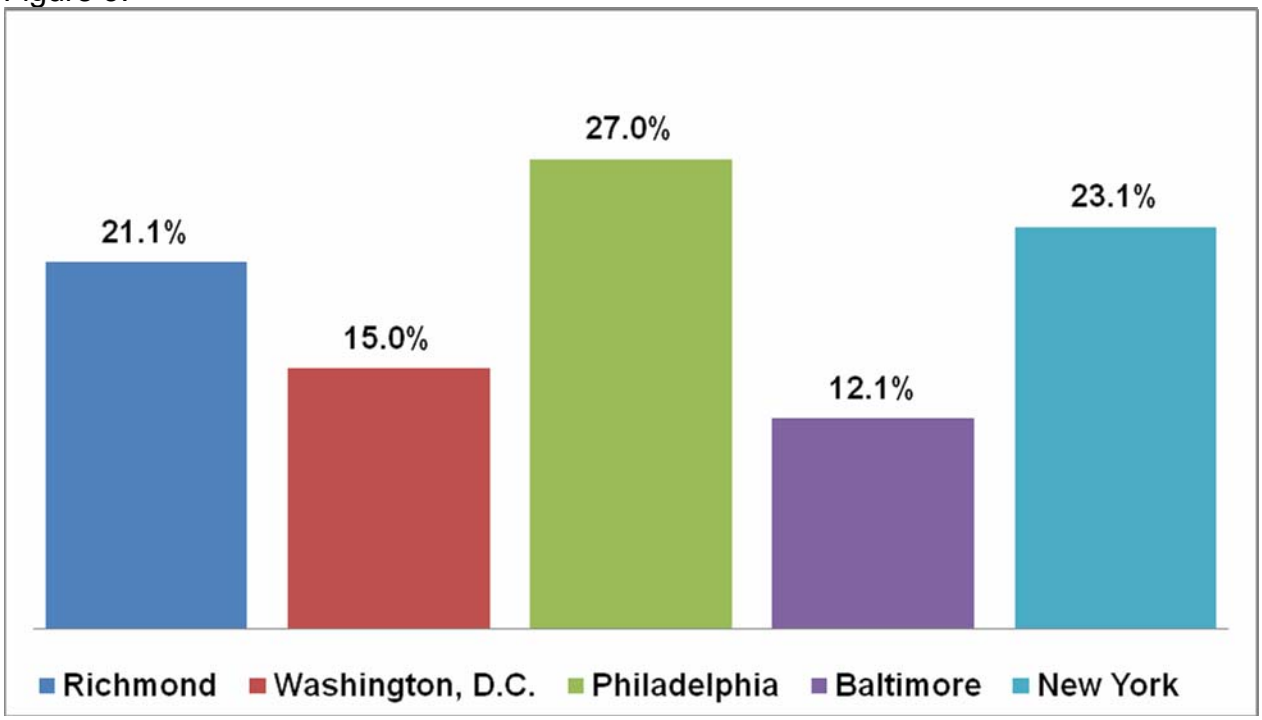
Figure 2.

Concern	Agree to Somewhat Agree (%)	Strongly Agree (%)
Produce freshness	36.5	59.6
Supporting the farmer and the local economy	30.0	65.4
Produce quality	43.2	52.2
Produce taste	42.9	51.3
Produce food safety	43.2	45.1

What Influences the Selection and Purchase of Food Products for the Household

Participants were also asked to respond to the question: Pertaining to how food products are packaged, which of the following do you consider when choosing and purchasing food products for yourself and/or your household? Responses, in order of highest to lowest percent, were: 1) food products "branded" with the logo of a national food brand of company (43.7%); 2) minimal or recycled materials used for packaging of food product (41.5%); 3) health-related food endorsement by an association or group is printed on the package (29.7%); 4) food product is "branded" with the logo of the store selling the product (24.9%); 5) recipe or serving suggestion is printed on the package (23.5%); and 6) food product is "branded" with the logo for my state's promotional branding program (21.3%). When responses for food products "branded" with the state promotional branding program were analyzed for difference by metropolitan area, we found that a greater percentage of consumers residing in the metropolitan Philadelphia area selected this response as an option that influenced their purchasing decisions (Figure 3).

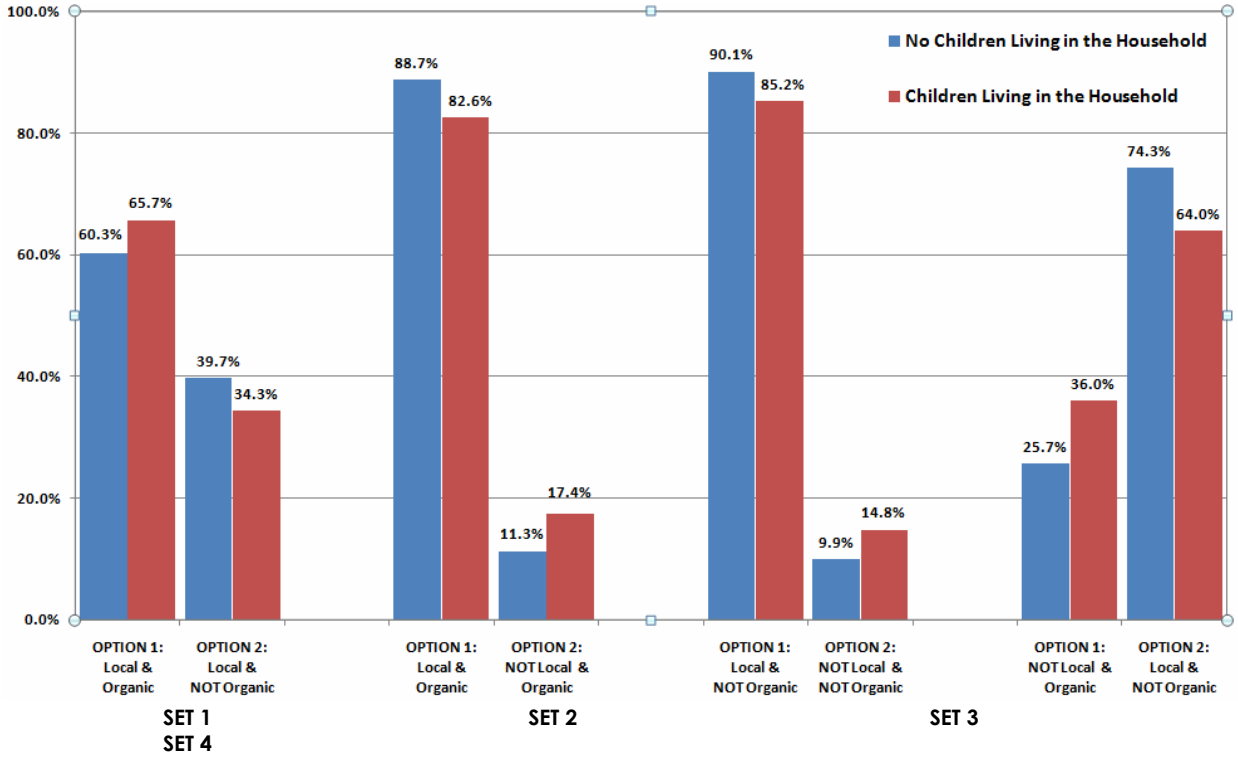
Figure 3.



Preference for Locally-Grown and Certified-Organic Produce

We also asked participants to indicate preferences for purchasing locally-grown and/or certified-organic specialty crops. The responses suggest that those individuals who had children in the household selected options that emphasized "Certified-Organic," while those without children in the household were more likely to select options that included "Locally-Grown." For example, in Set 1, both options were "local." However, 65.7% of those with children living in the household selected the

certified organic option, versus 60% for those with no children. In Set 2 (both certified organic) and Set 3 (neither certified organic), those with no children in the household preferred the local option by 5 to 6 percentage points. Set 4 is more difficult to compare because both conditions are different. The first option is certified organic, but not local while the second option is local, but not certified organic. The majority of both groups (those with and without children in the household) chose local, but not organic. However, 36% of those with children would prefer the item that was organic but not local. This compares to less than 26% of those without children in the household.



Information gathered through these surveys will assist producers, retailers, marketers and other produce industry members to better understand consumer awareness, interests, and potential demand for specialty crops. Select results are presented in this proceedings with additional results presented during the presentation on January 12th, in addition to strategies and techniques for implementing survey responses.

To be added to the Mid-Atlantic Specialty Crops Research Initiative list serve and receive bi-monthly updates about the workshop and subsequent efforts, contact specialtycrops@psu.edu or 814-863-5567. For more information about the USDA Specialty Crop Research Initiative program, visit http://www.csrees.usda.gov.

FARM-TO-SCHOOL OPPORTUNITIES IN THE DELAWARE VALLEY: A PANEL DISCUSSION

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Increasingly, the terminology “farm to school” has been cropping up in school food service and agricultural circles. To highlight what is currently happening in the Delaware Valley region with local sourcing of fruits and vegetables as well as grains, honey, dairy and other products, this panel discussion will cover sourcing and procurement from both a school food service viewpoint and that of a distributor’s.

FOOD SERVICE:

1. Making initial contact with schools or responding to inquiries from food service directors.
2. Developing trust and flexibility into terms of agreement.
3. Respecting pricing, consistency and volume needs of schools.
4. Stating long term goals beyond first year of agreement.

DISTRIBUTION:

1. Using established distribution companies to sell to institutions.
2. Payment schedules that work for both parties.
3. Creating local, cooperative back-up with neighboring farms in times of need.
4. Pick up or delivery?

SOCIAL MEDIA:
GETTING BY WITH A LITTLE HELP FROM YOUR FRIENDS ON FACEBOOK AND TWITTER

Bill Bakan
FunTSAR
Maize Valley Farm Market and Winery
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Social Media has all the buzz out there right now. You can hardly turn on a news program that does not list their Facebook address or Twitter handle. But what is in it for you, and should you use your valuable time exploring this method of communication.

Printed agricultural publications also are trying to adapt to this format for news and information dissemination as well. So why should you even consider learning a new technology?

Social Media is just a word used to describe the current technological vector we use to interact given today's context of social interaction. There has always been social media—it just was not as instant. Social Media today is just "Word of Mouth on Steroids". So again why should you, a grower get involved? Given the pace of today's information transfer unless you live under a rock and can make a good living under a rock you need to be in touch with this pace of life.

Information is power, but even more powerful is the control of that information or message. You need to be in control of your message to some degree. Even if you are solely a producer rather than a direct marketer, you can no longer ignore what others say about your industry or personal business. To do so is dangerous. And more and more everyday, it is being said on the web, especially in the new vectors of social media.

During this presentation we will cover getting started using social media and how one farmer/direct marketer has approached this. We will also try to make it as dynamic and interactive with the audience as possible as this is what this vector of communication is all about.

About Bill Bakan -

At age 46, Bill Bakan has been married 24 years to Michelle (Vaughan) Bakan. They have three children ages 16, 13 and 9. Bill is a 1985 graduate of The Ohio State University with a B.S. in Agricultural Education. He is a former Certified Crop Advisor and Custom Applicator. Since 1985, Bill has worked with his wife and family on their farm since getting married and graduating from college. His current title at Maize Valley Farms, Farm Market and Winery of Hartville, Ohio is FunTSAR (CZAR).

Bill's duties in his various positions have included managing inventories of 475,000 bu. grain storage facility, blending operations of fertilizer plant, crop advisor responsibilities including crop protection product application and customer service, assisting in families' 3,000 acre row crop farm as well as lending a hand in their

registered Holstein herds' operations.

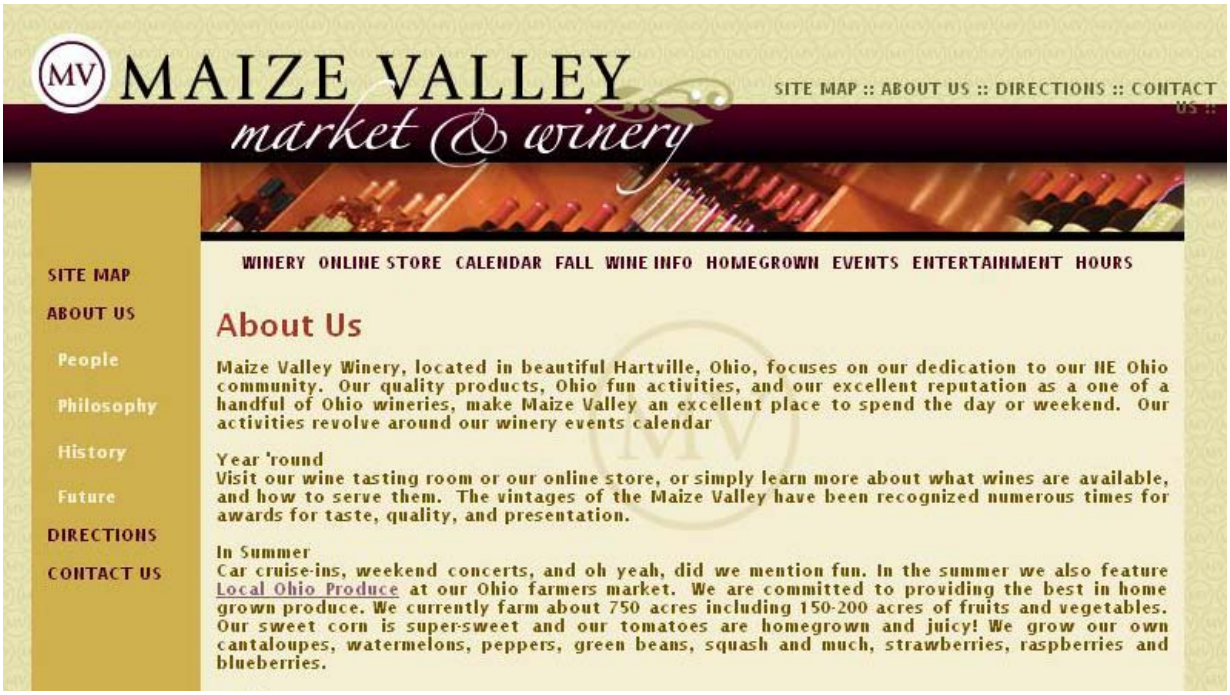
In 1998 the family farm operation diversified into vegetable production and direct marketing including agritourism. Corn Mazes, wagon rides, and pumpkin picking began displacing more conventional aspect of the family farm and approximately 8 years ago most of the "big" equipment along with the cows was sold at auction. A commitment was made to further pursue vegetable production with more emphasis was placed upon direct marketing. In 2005, Maize Valley added a winery.

Michelle's father Kay now grows everything from Garlic to Greenbeans, and Mustard Greens to Melons. Bill's job is to help market not only the products but also the experience associated with locally grown produce. They attended 7 farmers' markets in 2009 and have over 150,000 people visit their own farm market and winery. Social Media outlets such as Facebook and Twitter are now a part of the marketing mix beginning in December of 2008.

Bill will discuss in his presentation his integrated approach to using social media along with a quality web site, good e-mail list, and special event marketing as a coordinated marketing strategy.

Please, Don't be shy, check us out!

http://www.maizevalleywinery.com/ (Main Website)
http://www.ohiowineandmore.com/ (Blog)
http://www.facebook.com/pages/Maize-Valley-Farm-Market-Winery/40966862642 (Facebook)
http://twitter.com/FunTSAR/ (Twitter)



ANIMAL TOPICS

SESSION

PASTURE FARMING BUILDS SOIL FERTILITY & FOOD QUALITY

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A growing demand for milk, meat, and eggs produced by animals on pasture is creating new opportunities for diversifying farm income and at the same time providing sustainable ways of building soil fertility. Well informed consumers seek out pasture-raised animal products for a variety of reasons. These may include concern about how a farming system impacts the environment, animal welfare, and expected health benefits from eating nutrient dense foods. Families eating animal products raised on pasture, as opposed to the typical CAFO (Confined Animal Feeding Operation), are rewarded with higher levels of special nutritional components such as CLA, vitamin D, vitamin E, and vitamin K. Many consumers also prefer the flavor of these pasture-raised foods. Consequently, pasture-raised foods often command premium prices, especially with an effective direct-farm-to-consumer marketing program.

It is the perennial pasture/forage phase in a crop rotation cycle that does the most to build soil fertility. This was demonstrated in a recent survey comparing soil organic matter content levels in the surface 0-6 inch layer between pastureland versus tilled row crop land. Soil samples were collected and compared at 16 paired sites in the Mid-Atlantic region. Soil test results showed that the average soil organic matter content level was 4.1% for pasture and only 2.4% for row crop land (statistically different at P=0.01). Soil organic matter accumulates in a pasture/forage system and provides the storehouse for both carbon and nitrogen fertility. Pasture forage generally includes a mix of grasses and legumes. The legume grows on-farm nitrogen and the root density of the grass minimizes the leaching of nitrogen from the soil. Such soil building can also be accomplished by growing cover crops. While cover crops do feed the soil, pasture and forage crops serve to both feed the soil and produce nutritious foods for people. When pasture sod is eventually broken or tilled for the purpose of rotating to row crop grains or vegetables, much accumulated soil fertility is released. In such rotations there is often no need for purchase of expensive nitrogen fertilizers. The organic matter rich soil also provides drought resistance to following crops.

In terms of marketing, pasture-raised animal products have a strong draw for attracting people willing to travel to the producer for local direct-farm-to-consumer sales. This is especially the case in states that allow farms to provide full fat, unprocessed fluid milk. Raw milk from pasture-fed cows is the food that brings the dedicated consumer to the farm each week. Thus, it is raw dairy products that encourage the sale of all other farm fresh foods including eggs,
meat, and even vegetables, and fruit. This special session will explore

opportunities in pasture-raised animal systems and farm biodiversity. The following is a list of resources for further information on pastured-livestock and markets:

Stockman Grass Farmer: www.stockmangrassfarmer.net

Eat Wild: www.eatwild.com

The American Pastured Poultry Producers Association: www.apppa.org

Farm-to-Consumer Legal Defense Fund: www.ftcldf.org

Weston A. Price Foundation: www.westonaprice.org

ATTRA National Sustainable Agricultural Information Service: www.attra.org

Polyface Farm: www.polyfacefarms.com

Garden State Raw Milk: www.gardenstaterawmilk.org

How Grass-fed Beef and Milk Contribute to Healthy Eating: www.ucsusa.org

PROFITABLE PASTURED POULTRY

David R. Smith
LtCol, USA Ret. - Springfield Farm, Sparks, MD

This is a basic introduction to pastured poultry to show it can be a profitable addition to any farming operation, or a standalone enterprise. While essential material will be covered, more detailed information is available through traditional written sources as well as the internet. The American Pastured Poultry Producers Association (APPPA) has a reference book as well as a list serve which members can draw upon. Discussions will steer producers to cost effective methods of operation, emphasizing function over form, which in turn will move you more rapidly towards profits. The focus will be on operational research, operations and marketing. The target audience is those with little or no pastured poultry experience. At the end of the session, attendees will have adequate knowledge to begin operations within 90 days.

Step-by-Step

1 – Research regulatory requirements

2 – Research market potential

3 – Determine sources for birds and feed (broiler and/or pullet)

4 – Establish facilities, including land, equipment and utilities plan

5 – Determine processing option(s) for slaughter / egg cleaning

6 – Determine refrigeration options

7 – Develop sales and delivery plan

REFERENCES:

Salatin, Joel – Pastured Poultry Profits; You Can Farm; other titles
ATTRA – various publications
APPPA – American Pastured Poultry Producers Association
Internet searches: hatcheries; poultry equipment; pastured poultry; egg boxes/cartons; poultry processing equipment; PASA

1 – Regulatory:

- Your Department of Agriculture may have operational rules for raising poultry and the Department of Health may have rules for processing.

- Selling direct from your farm or elsewhere could require licensing and /or zoning permits

- If your State does not have specific requirements, then the USDA and FDA will.

2 – Market:

- Before starting any business venture, you need to determine your market. While there may well be research reports available, nothing informs you better than talking to others. Talk to individuals, grocers, restaurants, farmer's market managers, other farmers

- Determine pricing and method of distribution. Talking with others who sell the same products is helpful, but investigate supermarket pricing as well. Wholesale pricing is available for reference relative to selling to restaurants, but you can typically expect a better price for your fresh local product. Be a price maker, not a price taker.

3 – Supply Sources:

- Chicks, poults, ducklings, goslings and/or ready-to-lay. Baby birds are available from many sources. Research hatcheries offering the birds you are looking for. If you are going to do chicken eggs, ready-to-lay hens are available, typically at a lower cost than you can raise yourself.

- Equipment – brooding, fencing, feeders, water, etc. If you are going to bring in baby birds, you will need a facility in which to house (brood) them which has either electric or gas heat. Pastured free-range birds will require fencing and you will need to decide if you are going to have portable facilities or permanent. Either paradigm can require permanent or portable fencing and both need to be electrified for predator protection. In either approach, you will need access to electricity and water.

- Feed – Organic or traditional. In your market research, you will be able to determine demand for organic vs. traditional. If you decide to go the organic route, you will have to determine availability of certified organic feed as well as apply for certification with the appropriate authority.

4 – Facilities:

- Dependent on your planned activities, determine land availability. Housed / confined birds require one set of facilities and relatively little land. Pastured free-range, on the other hand, requires a different set of facilities and availability of a certain amount of land.

- Determine shelter plans - Shelter from the elements can be permanent, or portable, or both and each requires different approaches.

- Utilities – electric for lighting; electric or gas for heat; water. Production and growth of birds is affected by light, so it is needed for lights as well as heat and fencing. Gas heat is more reliable for heat, as it is not affected by electrical outages.

5 – Processing:

- EGGS (chicken, duck, goose, turkey):

- Chicken eggs @ $5.00/dz, duck eggs @ $20.00/dz, goose eggs @ $5.00/ea, turkey eggs @ $6.00/dz
- Collection schedule – minimum of once a day
- Cleaning program – quantities collected will determine frequency (daily, of less) as well as type of equipment (kitchen sink to $50,000 machine)
- Packaging (carton and/or case)–State/local regulations may govern how you sell. Marking of packaging needs to be followed.

- Meat Birds (chicken, duck, goose, turkey):
- Chicken @$5.00/lb ($11.00 for breast); duck $7.00/lb; Goose @ $10.00/lb; Turkey @ $13.00/lb.
- Year-round or seasonal – with proper facilities, production can be year round. Pastured free-range is typically seasonal.
- At an inspected facility – regulatory authorities will dictate. Frequently, on-farm is considered a private sale and offers more flexibility.

- DIY: equipment sources / needs / labor / regulatory. Production numbers will determine the type of equipment and amount of labor you will need. Local authorities may have requirements as well.

6 – Refrigeration:

- Eggs – typically require temperatures at or below 45 degrees, but not below freezing.
- Poultry – typically needs to be mid-low 30's. Can be down to 26 degrees.

7 – Sales and Delivery:

- Farmers Market. Can mimic on-farm in terms of regulation. Can be best price (highest)
- On-farm. Usually the easiest as is frequently the least regulated. Excellent pricing.
- Restaurants – Usually regulated and next lowest price.
- Grocers – Usually regulated and also lowest price.

CUCURBITS

SESSION

2008 AND 2009 KABOCHA SQUASH VARIETY TRIAL RESULTS

Michelle Casella, Agricultural Agent
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Introduction

Kabocha squash is similar to Spanish calabaza squash for culinary purposes. For production purposes there is a shorter days to harvest period for Kabocha. This factor may make this crop fit better into Northeastern production systems. A study was conducted during the 2008 and 2009 growing seasons at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ to evaluate eight varieties of Kabocha squash for yield and quality.

2008 Materials and Methods

The varieties 'Sweet Mama', 'Cha Cha', 'Hokkori' and 'Black Forest' were seeded on June 18, 2008. Single rows were planted with a waterwheel transplanter at a spacing of 3 feet between plants in a row and 6 feet between rows. Plots consisted of two rows side by side with six plants per plot. The 2-row plots were separated by 12 foot breaks that also served as drive rows for spraying, irrigating, and harvesting. There were 9' breaks between plots and the breaks were planted with six plants of mixed gourds. Treatments (varieties) were replicated three times in a random complete block design. Irrigation was supplied using a traveling hard hose gun and applied weekly until the third week of August. Weekly applications of fungicide began when vines began to run. Insecticide applications were done as needed according to field scouting for insects. Harvest was completed on September 22, 2008. Fruit were counted, weighed, and quality comments were recorded on this date.

2009 Materials and Methods

The varieties 'Nutty Delica', 'Special Export', 'Sweet Mama', 'Thunder', 'Super Delight', 'Cha-Cha', 'Hokkori', and 'Confection' were seeded on June 11, 2009. Single rows were planted with a waterwheel transplanter at a spacing of 2 feet between plants in a row and 6 feet between rows (a closer row spacing than what was used in 2008). Treatments (varieties) were replicated three times in a random complete block design. Weekly applications of fungicide began when vines began to run. Insecticide applications were done as needed according to field scouting for insects. Harvest was completed on September 30, 2009. Fruit were counted, weighed, and quality comments were recorded on this date. Also, internal color ratings were taken on this date.

Results and Discussion

In 2008, the variety 'Sweet Mama' out performed all other varieties in the trial for number of fruit per plant, average weight per fruit and total yield (see Table 1). However, in 2009 'Nutty Delica' out-yielded all varieties and had the best internal color rating of all

varieties. The 2009 season was an unusual growing season with above average rainfall and below average temperatures. In 2008, temperatures were higher and the crop grew under drought conditions and needed supplemental irrigation.

Table 1. 2008 Number of fruit per plant, average weight per individual fruit and yield in tons per acre.

Variety	Number Fruit per Plant	Average Wt. per Fruit	Yield (Tons/Acre)
Sweet Mama	3.6	4.6	17.4
Cha-Cha	2.2	3.5	8.0
Hokkori	2.3	3.0	7.2
Black Forest	1.5	2.5	4.0

Table 2. 2009 Number of fruit per plant and yield in tons per acre

Variety	Number Fruit per Plant	Yield (Tons/Acre)	Color Rating*
Nutty Delica	3.5	8.40	5
Special Export	3.25	6.82	4.5
Sweet Mama	2.926	6.47	4.5
Thunder	2.83	6.35	4
Super Delight	2.25	4.35	4
Cha Cha	1.67	3.92	3.5
Hokkori	1.25	2.40	3
Confection	1.42	2.25	2

* Color rating 1=light orange (worst), 5=dark orange (best)

2008 AND 2009 SMALL PUMPKIN VARIETY TRIAL RESULTS

Michelle Casella, Agricultural Agent
Gloucester County
1200 N. Delsea Dr., Clayton, NJ 08312

Ray Samulis, Agricultural Agent
Burlington County
And
Mary Cummings, Program Associate
Gloucester County

Introduction

Pumpkins are an important fall crop for both wholesale and retail producers. Fall retail sales often include school trips with elementary students and require small sized pumpkins for these events. Eighteen small pumpkin varieties were evaluated in a research trial during fall of 2008 and eleven varieties were evaluated in 2009. Pumpkin varieties were submitted by Johnny's Select Seeds, Rupp Seed Company, Siegers Seed Company, and Stokes Seed Company. The study was conducted during the 2008 and 2009 growing seasons at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ.

2008 Materials and Methods

The 2008 varieties included 'We-B-Little', 'RPX739', 'Baby Bear', 'Rockafellow', 'Touch of Autumn', 'Trickster', 'Batwing Mix', 'Orange Smoothie', 'Pick-A-Pie', 'Prankster', 'Small Sugar' (Asgrow strain), 'Spooktacular', 'Iron Man', 'Cannon Ball', 'Field Trip', 'Gargoyle', 'Goose Bumps' (medium warty type) and 'Knuckle Head' (medium warty type) were all seeded on June 18, 2008. Single rows were planted with a waterwheel transplanter at a spacing of 3 feet between plants in a row and 6 feet between rows. Plots consisted of two rows side by side with six plants per plot. The 2-row plots were separated by 12 foot breaks that also served as drive rows for spraying, irrigating, and harvesting. There were 9' breaks between plots and the breaks were planted with six plants of mixed gourds. Treatments (varieties) were replicated four times in a random complete block design. Irrigation was supplied using a traveling hard hose gun and applied weekly until the third week of August. Weekly applications of fungicide began when vines began to run. Insecticide applications were done as needed according to field scouting for insects. Harvest was completed on September 24. Fruit were counted, weighed, and quality comments were recorded on this date.

2009 Materials and Methods

The 2009 varieties included 'Small Sugar', 'Orange Smoothie', 'Hybrid Pam', 'Chucky', Prankster', 'Fall Splendor', 'Iron Man', 'Cannon Ball', 'Field Trip', 'Spooktacular', 'Mystic Plus' and 'New England Pie' were all seeded on June 1, 2009. Pumpkins in the under 2

pound category were not included in the 2009 trial. Single rows were planted with a waterwheel transplanter at a spacing of 2 feet between plants in a row and 6 feet between rows. Treatments (varieties) were replicated three times in a random complete block design. Irrigation was supplied using a traveling hard hose gun and applied only once after seeding to activate the herbicide. Weekly applications of fungicide began when vines began to run. Insecticide applications were done as needed according to field scouting for insects. Harvest was completed on September 30, 2009. Fruit were counted, weighed, and quality comments were recorded on this date.

Results and Discussion

In 2008, two varieties, 'We-B-Little' and 'RPX739' were very small, almost gourd like, with average weights under half a pound (see Table 1). The rest of the small pumpkin varieties were divided into two categories of 1-2 pound pumpkins and 2-4 pound pumpkins. 'Goose Bumps' and 'Knuckle Head' were not included in the categories since they were medium sized specialty pumpkins. In the 1-2 pound category the varieties, 'Baby Bear' and 'Trickster' were top choices due to high yields, highest number of fruit per plant, consistent color, size and shape with good handles (see Table 1). In the 2-4 pound category top picks included 'Orange Smoothie', 'Small Sugar', 'Spooktacular', 'Iron Man', and 'Field Trip' (see Table 2). 'Orange Smoothie' had good yields, was in the mid range for number of fruit per plant, consistent size and shape, good color, and nice thick handles. 'Small Sugar' was one of the highest yielding varieties with a high number of fruit per plant, consistent size and shape, nice long and interesting shaped handles. Color was satisfactory, but not as dark orange as others. 'Iron Man' had high yields, good number of fruit per plant, nice deep orange color, consistent size and shape with good thick handles. 'Spooktacular' had good yields and good number of fruit per plant. However, with 'Spooktacular', the handles could have been better, color was inconsistent and fruit size and shape were irregular.

In 2009, the varieties 'Small Sugar', 'Orange Smoothie', 'Hybrid Pam', 'Chucky', 'Fall Splendor', 'Field Trip', 'Cannon Ball', 'Ironman', '0Spooktacular', 'Mystic Plus', and 'New England Pie' were included in the trial. 'Fall Splendor' showed high yields similar to 'Orange Smoothie', 'Field Trip', 'Mystic Plus', 'Hybrid Pam', 'Ironman', and 'Chucky'. The 2009 season was an unusual growing season with above average rainfall and below average temperatures. In 2008, temperatures were higher and the crop grew under drought conditions and needed supplemental irrigation.

Table 1. 2008. Number of fruit per plant, average weight per individual fruit and yields.

Variety (Under 1lb.)	Seed Company	Number Fruit per Plant	Average Wt. per Fruit	Yield (Tons/Acre)
We-B-Little	Johnny's	8.75	0.49	5.2
RPX739	Rupp	20.3	0.36	8.9

Variety (1-2 lbs.)	Seed Company	Number Fruit per Plant	Average Wt. per Fruit	Yield (Tons/Acre)
Baby Bear	**Johnny's**	**11.2**	**1.56**	**21.2**
Rockafellow	Siegers	7.8	1.08	10.1
Touch of Autumn	Siegers	8.8	1.58	16.9
Trickster	**Siegers**	**9.1**	**1.89**	**20.6**
Batwing Mix	Rupp	7.3	1.41	12.3

Variety (Under 2-4lbs.)	Seed Company	Number Fruit per Plant	Average Wt. per Fruit	Yield (Tons/Acre)
Orange Smoothie	**Johnny's**	**5.3**	**3.22**	**20.8**
Pick-A-Pie	Siegers	4.3	2.99	15.3
Prankster	Siegers	4.7	2.42	13.5
Small Sugar (Asgrow Strain)	Rupp	8.0	2.30	22.0
Spooktacular	Rupp	8.1	2.29	21.7
Iron Man	Stokes/HM	7.6	2.62	22.8
Cannon Ball	Stokes/HM	5.4	2.80	17.4
Field Trip	Stokes/HM	4.6	3.34	18.8
Gargoyle	Stokes/HM	4.9	2.98	17.6

Table 3. 2009. Number of fruit per plant, average weight per individual fruit and yield in tons per acre for pumpkin varieties.

Variety	Seed Company	Number Fruit per Plant	Average Wt. per Fruit	Yield (Tons/Acre)
Fall Splendor	Siegers	2.50	3.80	17.23 a
Orange Smoothie	Siegers Johnny's	2.25	3.67	15.01 ab
Field Trip	Stokes	2.58	3.16	14.83 ab
Mystic Plus	Stokes (HM)	2.08	3.60	13.60 ab
Hybrid Pam	Siegers	1.91	3.69	12.84 ab
Ironman	Stokes	2.33	2.86	12.11 ab
Chucky	Siegers	3.08	2.09	11.69 ab
Cannon Ball	Stokes	2.17	2.93	11.51 b
New England Pie	Johnny's	2.17	2.91	11.45 b
Spooktacular	Stokes/Rupp	3.0	2.07	11.27 b
Small Sugar	Siegers/ Rupp/Stokes	2.25	2.75	11.22 b
LSD 0.05				**36.78**

GRAFTING SEEDLESS WATERMELONS, HOW AND WHY? WILL GRAFTING HELP WITH DISEASE CONTROL?

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In recent years the practice of grafting seedless watermelons (triploids) onto rootstocks belonging to other Cucurbitaceae genera has gained importance in the United States. Grafting vegetable crops, especially cucurbit's, is very common in Europe and Asia. In these regions the practice of crop rotation is difficult, as land available for farming is limited and under intense use. The continuous use of land eventually leads to the increase of soil borne pathogens such as those causing Fusarium and bacterial wilts. Watermelons are grafted on diverse rootstocks in many parts of the world primarily for managing Fusarium wilt (*Fusarium oxysporum* f. sp. *niveum*), which is a major limiting factor. The practice began in the 1920's in Japan, where today over 90% of the watermelons grown are grafted. Grafting has been reported to provide other benefits such as: tolerance to drought, high water table, low temperatures, and high winds; it is also known to provide improved nutrition uptake, increased plant vigor and yield, firmer fleshed fruits and the ability to thrive in a wide range of soils. There are several methods of grafting available such as: tongue approach grafting, hole insertion grafting, one cotyledon grafting, and side grafting. In some countries robotic machines are available to help make the grafts. Currently researchers across several universities and the USDA are evaluating the benefits of grafting in the United States using commercially available rootstocks. However, at this point, it is not known how these rootstocks will respond to the diseases prevalent in the local production areas. Phytophthora crown and fruit rot caused by *Phytophthora capsici* is emerging as an important disease of watermelon (*Citrullus lanatus*) in south eastern United States. We evaluated seventeen commercial rootstocks for tolerance to Phytophthora crown rot by inoculating them with a zoospore suspension consisting of a mixture of *P. capsici* isolates in the greenhouse. Several commercial bottle gourd (*Lagenaria siceraria*) hybrid rootstocks (e.g. Macis, Emphasis, FR-Strong, WMXP-3944, and WMXP-3938) were tolerant to Phytophthora crown rot when compared to susceptible watermelon controls (Mickey Lee). All the *Cucurbita* inter-specific rootstock hybrids evaluated (e.g. Strong Tosa, WR-15006 and WMXP-3943) were extremely susceptible to *P. capsici*. Similarly, the wild watermelon rootstock 'Ojakkyo' was also susceptible. Seedless watermelon grafted on bottle gourd rootstocks Emphasis or Macis appeared to be tolerant compared to susceptible watermelon cultivars. Real-time quantitative PCR using a SYBR green based assay indicated the presence of more *P. capsici* DNA in crowns of the susceptible *Cucurbita* inter-specific hybrid rootstocks and seedless watermelon, compared to the tolerant bottle gourd rootstocks. All the currently available bottle gourd or Cucurbita rootstocks

we evaluated were susceptible to root knot nematode. We are now evaluating and developing bottle gourd and other cucurbit germplasm for resistance to *P. capsici*, root knot nematode, powdery mildew and other diseases to be used as rootstocks for grafting watermelon. The ultimate success of grafting as a tool to manage soil borne diseases of watermelon in the United States will depend upon the appropriate rootstock/scion combination used in any given location.

POWDERY MILDEW CONTROL STRATEGIES FOR CUCURBITS

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There are two major types of tools for managing powdery mildew in cucurbits (resistant varieties and fungicides) and one important strategy (delay pathogen evolution to overcome individual tools by using an integrated management program). This pathogen cannot be avoided due to the quantity of wind-dispersed spores produced and the wide range of conditions under which it develops. It does not require wet leaf tissue for penetration unlike most other pathogens. The management program often needs adjustments each year as the pathogen changes and new management tools become available. An integrated program with fungicides applied to resistance varieties is needed to minimize selection pressure for pathogen strains able to overcome either plant resistance genes or fungicides, and to maximize the potential for successful control of new strains when they arise. The pathogen has exhibited adaptation to both types of tools, and this has been associated with control failure where a good management program was not in place. Current information on the performance of specific fungicides and resistant varieties as well as pathogen sensitivity to fungicides is needed to develop the most effective management program. Obtaining this information has been an on-going goal of research being conducted in Riverhead since 1989.

Powdery Mildew Resistant Varieties. Many varieties of melon, squash and pumpkin with genetic resistance to powdery mildew are now available. Variety evaluations conducted recently have documented that resistant varieties can provide a very high level of suppression of powdery mildew, but there is variation in performance among varieties, across cucurbit crop types, and also among years. Pumpkin varieties with resistance genes from each parent (homozygous resistance; PMRR) usually exhibit better performance than those with one copy of the resistance gene (heterozygous resistance; PMR). The difference can be great. While this was not the case with squash varieties a few years ago, it has been the case the past three years in experiments conducted in NY and elsewhere, with some varieties now providing very little suppression. This suggests the pathogen is adapting to genetic resistance. Most resistant squash and pumpkin varieties have the same major gene for resistance from a wild relative. Varieties from Hollar Seeds have a different major gene for resistance.

Genetics of resistance in melons is entirely different. The pathogen is defined as races based on ability to infect melons with specific resistance genes. There are several genes in commercial melon varieties conferring resistance to Race 1 and/or Race 2. Varieties with resistance to both races have provided a very high degree of powdery mildew suppression in NY experiments; however, powdery mildew has been severe on resistant varieties in GA recently where a new pathogen race ('S') was detected.

Powdery mildew has not been a concern with cucumbers. Resistance has been a common feature of varieties for many years, and this resistance is extremely good. It is important to realize that this lack of powdery mildew developing on cucumber is not because this cucurbit type is immune. If symptoms are seen, this should be promptly reported to local extension specialists so that possible occurrence of pathogen adaptation can be investigated.

Tables of resistant varieties and reports from variety evaluations in NY are available at: http://vegetablemdonline.ppath.cornell.edu/Tables/TableList.htm.

Fungicides and Fungicide Resistance. Mobile fungicides, which are at-risk for resistance because of single-site mode of action, are critical for effectively managing cucurbit powdery mildew, but the pathogen's ability to develop resistance has been challenging management since the first mobile fungicide was developed. This is important to understand. Powdery mildew develops best on the lower surface (underside) of leaves where conditions are more favorable for disease development than on upper surfaces. When it is not controlled on the lower surface, leaves die prematurely. There are many contact, protectant fungicides effective for powdery mildew, but it is challenging to deliver them to the underside of leaves, especially in a dense cucurbit canopy. Fungicides that are mobile provide the most effective control on lower surfaces of leaves, but they are at risk for resistance developing due to their single-site mode of action. These include fungicides that are systemic (e.g. Topsin M, Rally) or have translaminar activity (e.g. Flint, Amistar, Cabrio). Quintec, a new fungicide at risk for resistance, is very volatile and redistributes to the lower surface as a gas.

The powdery mildew fungus has demonstrated a high potential for developing resistance. It has developed resistance, often quite quickly, to every chemical class at risk for resistance following repeated use somewhere in the world. Presence of resistant strains has been associated with control failure. This pathogen has a long history of adapting: its resistance to Benlate (MBC fungicide, FRAC Code 1) was the first documented case of fungicide resistance in the US. Strains able to resist Benlate were detected 5 years before this fungicide was registered. At the time there was a lack of understanding about resistance. One year after registration control failure occurred in university fungicide efficacy evaluations. Bayleton (DMI fungicide, FRAC code 3) was the next mobile fungicide registered for cucurbit powdery mildew. It was registered in 1984. Two years later control failure occurred in efficacy experiments. The next mobile fungicide registered was Quadris (QoI fungicide, FRAC code 11) in 1999. Control failure occurred in 2002. Since 2006 there has been evidence of resistance affecting control with the new fungicides Rally (previously named Nova), Procure and Pristine.

The overall strategy to managing fungicide resistance is to minimize use of each chemical class of at-risk fungicide without sacrificing disease control. This is accomplished by alternating among all effective classes and tank-mixing these with protectant fungicides, starting applications early and maintaining a short spray interval,

and using an integrated disease management program with non-chemical control measures, such as resistant varieties. Cross resistance is common among chemically-similar fungicides because of similar mode of action. Therefore, alternations need to be among chemical classes, indicated by FRAC code, rather than individual fungicides. It is not known whether a strict alternation (apply once and then switch) is better than a block alternation (apply twice in a row and then switch). At-risk fungicides should be used at the manufacturer's recommended rate and application interval. Using highest label rates is expected to minimize selection of strains with intermediate fungicide sensitivity when resistance involves several genes (quantitative resistance).

Tank-mix at-risk fungicides with protectant, multi-site fungicides because these have low resistance risk. Multi-site fungicides (those with a FRAC code that includes 'M") will control any resistant strains they contact. Maximize spray coverage by adjusting application methods. The better the coverage, the greater the contribution of the multi-site fungicides to control and the lower the selection pressure for resistance development. Multi-site contact fungicides should be used alone late in the growing season, where they have been shown to provide sufficient disease control to protect yield, or when powdery mildew is becoming severe on the lower surface of leaves possibly due to fungicide resistance.

The larger the pathogen population exposed to an at-risk fungicide, the greater the chance a resistant strain will develop. Thus it is important to start fungicide applications very early in disease development or before symptoms are seen. It is not possible to control the pathogen in an established lesion, as opposed to a germinating spore, thus the potential is greater for resistance to develop. When an integrated program is used to manage resistance and resistance develops to one of the fungicides, the other practices and fungicides used may provide enough control that the inefficacy of the one fungicide can be difficult to detect, especially in a commercial field.

Follow any additional resistance management guidelines specified on the label. Remember that the label is a legal document. In addition to manufacturer restrictions pertaining to alternations and tank-mixtures, there are often limits on the total amount to be applied and the number of allowable applications per season. Another important component of management is assessing control and reporting any loss of efficacy potentially due to resistance to local extension specialists.

It is critical to recognize that the primary goal of resistance management is to delay the build-up of resistant strains rather than to manage them after development. Therefore management needs to start the first season a new fungicide class is used. Adding new classes to a fungicide program as soon as they are registered will help manage resistance to older classes being used.

Following is a list by FRAC code of mobile fungicides currently registered in the USA for powdery mildew in cucurbit crops and recommendations based on their efficacy and resistance status in the pathogen.

FRAC code 13. Quintec is the current best choice of mobile fungicides because it has typically been the most effective registered fungicide in efficacy evaluations, including in 2009, and the pathogen is more sensitive to its active ingredient than other registered fungicides. However, initial evidence has been obtained that pathogen sensitivity is shifting in the USA. Quintec is only labeled for use on non-edible-peel cucurbit types (melon, pumpkin, winter squash, gourds) due to phytotoxicity. It is only effective for powdery mildew. Broad-spectrum activity was an advantage of the QoIs. Quintec needs to be applied in alternation with another mobile fungicide not only because it is recommended for resistance management, but also because the label has a restriction of no more than 2 consecutive applications plus a crop maximum of 4 applications.

FRAC code 3. The DMI fungicides remain an important tool for managing cucurbit powdery mildew although it has been over 20 years since control failure due to resistance occurred with the first fungicide in this group. This is partly due to the fact resistance is 'quantitative', involving several interacting genes, rather than 'qualitative' as with other fungicide classes. Variation has been detected in efficacy and pathogen sensitivity among code 3 fungicides. Procure tends to be more effective than Rally, which partly reflects the fact Procure is labeled for use at a higher rate. These tend to be better than the new fungicides Inspire and those with tebuconazole (Tebuzol, Folicur). Code 3 fungicides should not be used in alternation due to cross resistance.

FRAC code 7. Boscalid, an active ingredient in this class, is in Pristine, which also contains a FRAC code 11 component. Pathogen isolates completely insensitive to this fungicide (able to grow on leaf disks treated with labeled rate in the laboratory) were detected in NY and PA in 2008 and in 2009 in NJ. Efficacy was poor in a fungicide evaluation conducted in NJ in 2009, but in NY and GA Pristine was more effective than Rally, likely reflecting differences in frequency of resistant strains (In all 3 evaluations fungicides were tested alone to be able to assess their efficacy). Pristine likely will continue to provide some control in 2010, but limiting use is prudent. A new fungicide being developed in this FRAC group, LEM 17, appears to be sufficiently different from boscalid that cross resistance may not render it ineffective.

FRAC code 1. Topsin M is not expected to be effective for cucurbit powdery mildew because resistance to this fungicide group continues to be very common and widespread. Resistance is qualitative.

FRAC code 11. Quadris (aka Amistar), Flint, and Cabrio are not recommended for cucurbit powdery mildew because resistance continues to be common and widespread. Resistance is qualitative, thus isolates are sensitive or completely resistant.

FRAC code 12. Fludioxonil, an active ingredient in this class, is in Switch. It is not considered sufficiently effective for cucurbit powdery mildew to be recommended for this use over other mobile fungicides; however, it is worth noting that it may contribute to control when applied for other labeled diseases (gummy stem blight or Alternaria).

Protectant (contact) multi-site fungicides are an important component of the integrated program for managing powdery mildew. Many effective products are now registered. Active ingredients in these include chlorothalonil, sulfur, copper, mineral oil, botanical oils, potassium bicarbonate, and microbes (e.g. *Bacillus subtilis* and *Bacillus pumilus*).

Note: Specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. Always read the label before using a product.

LEAFY GREENS

SESSION

Escherichia coli (E. coli) Control in Irrigation Water

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Introduction

Water quality is a major issue in food safety with the concern related to E. coli, Salmonella, etc. There are numerous examples of surface water contamination that may have been the source of a foodborne illness outbreaks e.g. spinach in California and tomatoes from Virginia. All food safety programs and audits require some form of water testing to ensure pathogen levels are not above acceptable levels thus not contributing to pathogen loads on produce. However, there is no national standard for what is an acceptable level of a pathogen in irrigation water or how often water should be tested for pathogens. Generally, auditors acceptable open water swimming standards as being adequate for irrigation. The California Leafy Green Marketing Agreement uses these standards.

Sampling Standards

Under the California agreement water sampling is divided between foliar and non-foliar applications. When the irrigation is overhead (foliar application), no one sample can be higher than 235 colony forming units (CFU)/100 ml of water and the average of all samples is less than 126 CFU/100 ml. With non-foliar applications, no one sample can be over 576 CFU/100 ml of water and the average of less than 126 CFU/100 m. They sample at least monthly and use a rolling five sample average to calculate if the water is acceptable. These are the same the standards used in this 2009 sampling study.

Controlling E. coli

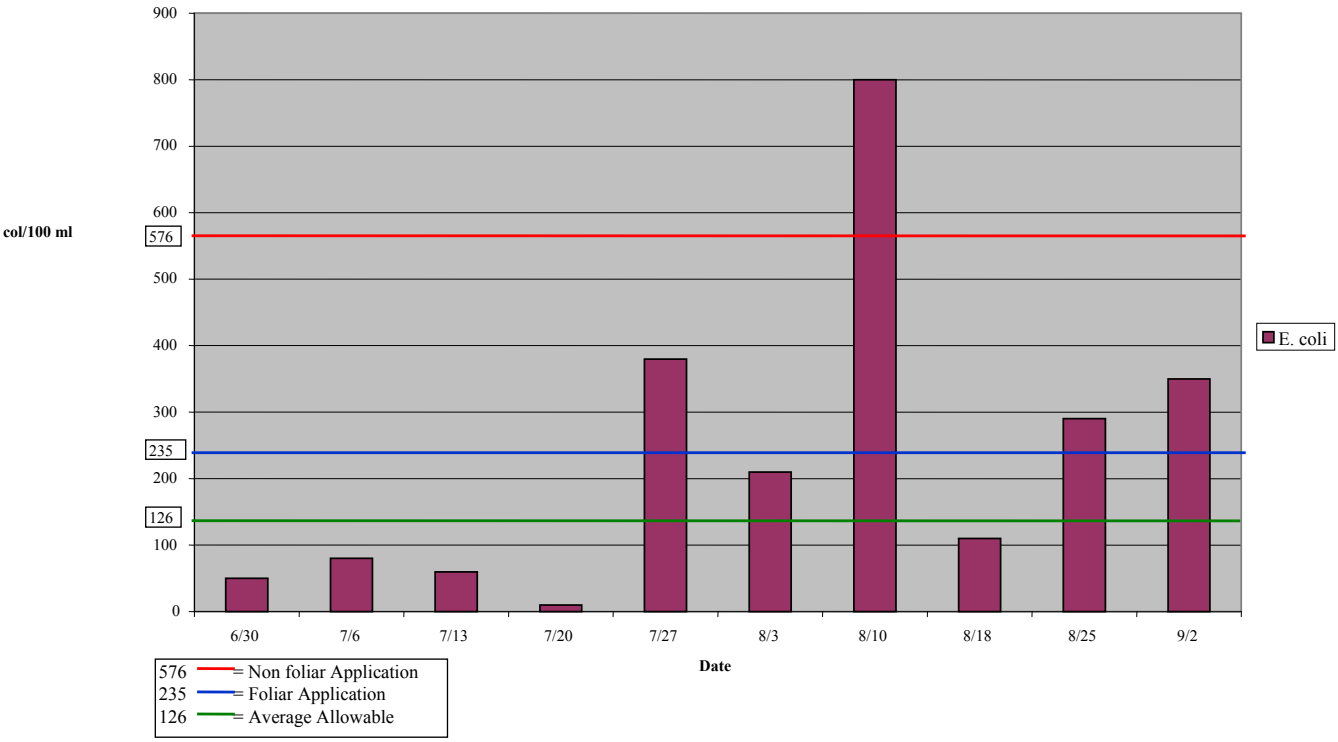
How do you control E. coli if it is found above acceptable levels? In wells the process is relatively simple. Calculations have been worked out for the use of Calcium Hypochlorite (70%) in the well to control the pathogen. However, with surface water the process is more complicated since the water is not enclosed in a pipe.

Surface water can be continually recontaminated from wildlife, domestic animals and runoff from surrounding fields. Also, rainfall and air temperature can have an effect on the amount of pathogen load and growth. A system must be in place that continually disinfects the irrigation water as it is being applied to the crop.

Water Sampling Research

A pond was sampled weekly from June to September for E. coli. The samples were taken directly from the pond and analyzed by a private company using the EPA 1603 which is the accepted method for testing. There were four samples over the acceptable level for foliar application and one over for non-foliar application. All samples collected from July 27 to the end of the study on September 2 were over the acceptable average of 126 CFU/100 ml of water. The data is presented in table 1.

Table 1. Pond Microbial Study 2009



At four sampling dates calcium hypochlorite was injected into the irrigation water at the pump at the rate of approximately 4 ppm and the E. coli level was checked at the pond, at the filter and at the end of the drip line. The pathogen was almost zero at the end of the irrigation line after injection and above acceptable levels in the pond. See table two.

The goal was to maintain 4 ppm at the point of injection (pump) and 2 ppm at the end of the irrigation line. When the trial started it took one week to register any chlorine at the filter and 14 days to register at the end of the drip line. The drip system had been operating and organic matter had built up in the line. Chlorine is tied up with organic matter so it took time for the system to be cleaned. The amount of chlorine did fluctuate through the season, but E. coli was controlled even when the levels were 0.5 ppm at the end of the drip line. See table 3

Table 2. Irrigation Water Treatment Study 2009
E. coli levels

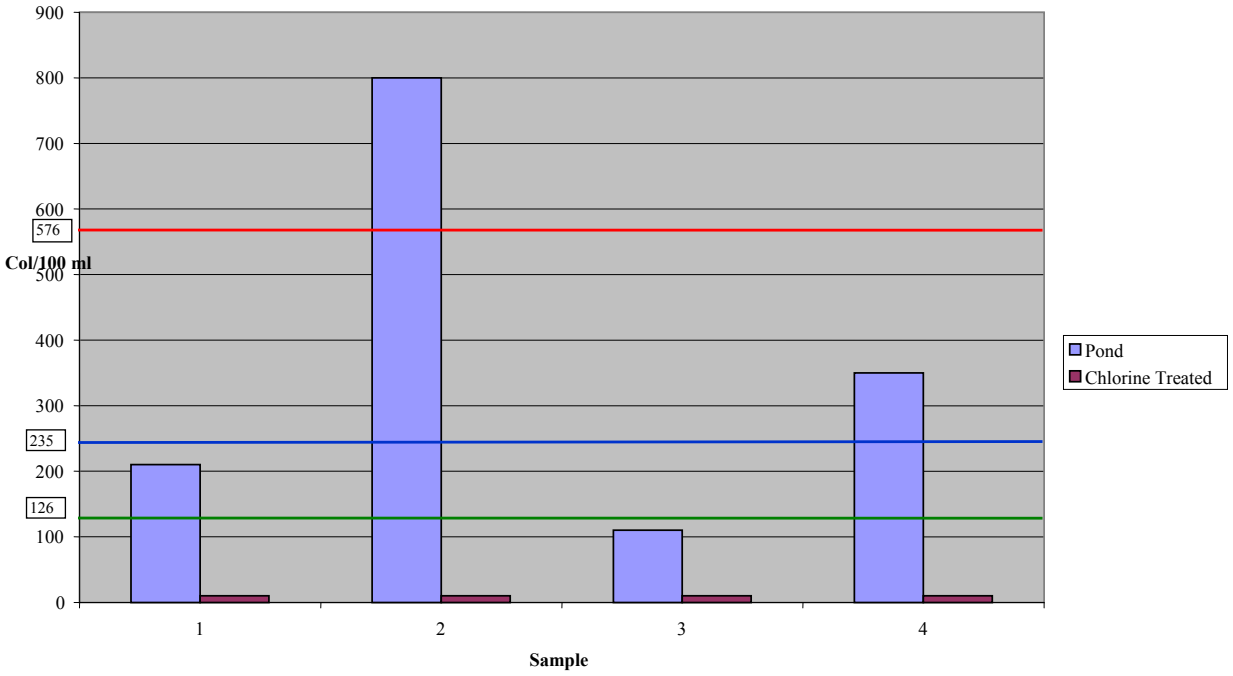
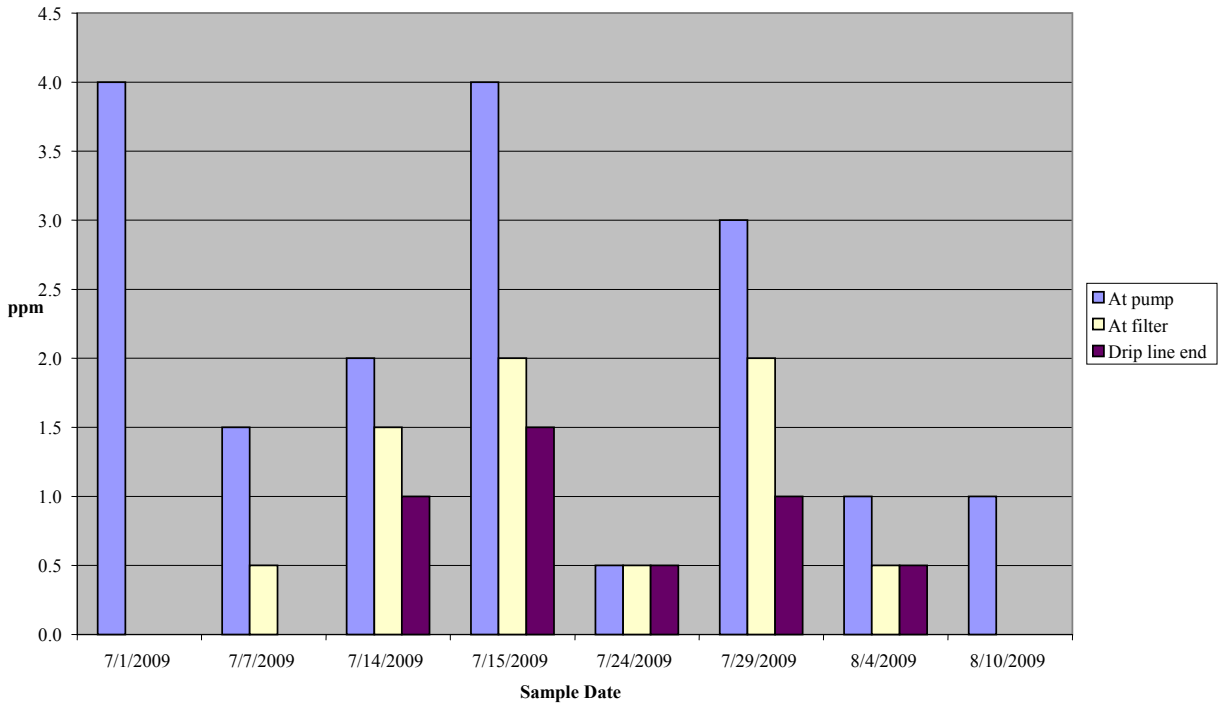


Table 3. Irrigation Water Treatment Study 2009
Chlorine Treatments



UPDATE ON BASIL DOWNY MILDEW

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Basil downy mildew is a new, devastating disease of basil grown in the eastern United States. The pathogen*, Peronospora belbarhii*, was first identified in Europe earlier this decade and in parts of Africa where the pathogen has been known to exist for a long period of time. Contaminated seed is the most likely mechanism by which basil downy mildew has been spread over vast geographic regions and continents the past few years. Basil downy mildew was first reported in the United States in Florida in October 2007. In 2008 and 2009, the disease was widespread throughout much of the eastern region of the United States. The basil downy mildew pathogen can be spread by contaminated seed, as spores via wind currents and on infected, living basil leaves. Now that basil downy mildew (BDM) is established in the US (it's mostly likely to only overwinter in southern FL or in greenhouses in the North), the threat exists for the disease to occur on an annual basis in our region. Therefore, it's critical that growers know (i) how to identify this disease; (ii) know where their seed is produced and (iii) if the seed has been tested for, or produced, in a downy mildew free operation.

Recent varietal studies conducted at the Rutgers Agricultural Research and Development Center (RAREC) determined that all the traditional sweet or Italian commercially-grown *O. basilicum* varieties were susceptible to BDM and that 'Nufar' and 'Poppy Joe' were among the most susceptible to BDM. Other *O. basilicum* varieties (i.e. red leaf, ornamental types) are also susceptible to the disease. *O. citriodorum* (i.e. Lemon/Lime types) and *O. americanum* x *O. basilicum* (i.e. Spice types) are less susceptible to basil downy mildew than other *O. basilicum* types. These findings were also observed at the Snyder Agricultural Research Station, Pittstown, New Jersey.

Control of basil downy mildew begins with purchasing disease-free seed and scouting for the disease on a regular basis. Two phosphanate fungicides (FRAC code 33), Pro-Phyte and K-Phite, list downy mildew control under the herb section of the label and research has shown that these fungicides are most effective when applied prior to infection. Quadris (azoxystrobin, FRAC code 11) also has a basil label, but not specifically for Downy mildew control. Other fungicides are expected to be labeled for basil downy mildew control in the future. Thorough coverage of all leaf surfaces will be extremely important for controlling BDM with fungicide applications. Cultural practices which minimize leaf wetness and promote the drying of leaves (i.e. such as wider plant spacing) will also help in reducing the potential for downy mildew infections to occur. Overhead irrigate only during times when leaves have adequate time to dry out quickly. Once crops are finished, thoroughly disc under all debris, any living debris left in field has the potential to act as a source of inoculums for later plantings.

HARVEST CHARACTERISTICS AND OTHER ATTRIBUTES OF BROCCOLI, CAULIFLOWER AND CABBAGE VARIETIES

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Broccoli, cauliflower and green cabbage varieties were transplanted at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ and at the Rutgers Snyder Research Farm in Pittstown, NJ on August 11 and August 12, respectively. Plants were side dressed with 40 pounds of Nitrogen three weeks after planting at the Bridgeton site. No subsequent side dress fertilizer was needed at the Pittstown site. Standard herbicide, insecticide and fungicide treatments were applied as per the 2009 Commercial Vegetable Production Recommendations for New Jersey. See information in the table below for details on each variety.

Broccoli Varieties	***Head comments***	***Dome 0=flat 5=high***	***Color 1=worst 5=best***	***Comments***
Castle Dome	Good shape	5	4.5	Good tight shoots that are head quality, concentrated first harvest = all ready at same time, short plants, heads get loose if too large
Diplomat	Good size, large heads stayed tight	4.5	4.5	Good tight shoots, but not many shoots, light color head area where shaded
Green Magic	Large beads	4	4.5	Mixed maturity, not all ready at same time, nice color
Imperial	Good shape	4.5	4.5	Lodged some, thick stems, not a concentrated harvest, Mixed maturity, no shoots yet
Premium Crop	Good shape	4.5	4.5	Tons of shoots of good quality
Gypsy	Nice shape and stem pattern, smooth	4	5	Plants lodged more than other varieties, mixed maturity, tight bead, early
Concord	Great dome	5	5	Later variety, good color and dome, very thick stem, hard to pull off petioles
Arcadia	Nice	4	4	Thin stem diameter, easy to pull back petioles
BI 10	Good dome, tight bead even when large heads	4.5	4	Thick stem, petioles a bit difficult to pull off, concentrated harvest, tight bead
Emerald Pride	Nice heads	4	4	Big heads, very early, very concentrated harvest.
Avenger	Mid season variety	4.5	3	Thick stems and petioles, difficult to pull leaves off

Cauliflower Varieties		***Wrapper leaves 0=none 5=tight***	***Head color 0=yellow 5= white***	***Comments***
Amazing		1	3	Small plants, curled leaves, small heads
Falmenco		3.5	3	White when small and wrapped, yellowed as it grew
Snow Crown		1	3.5	Very early variety, Ricey when large
Whister		3.5	3	White when small and wrapped, yellowed as it grew
Ravella		3	4	Purple on heads when exposed to light and frost, leaf edge necrosis
Minuteman		3	3	Purple on heads when exposed to light and frost
Cheddar		3.5	Orange	Small heads compared to other years
Incline		4	3.5	Large plants smooth leaves
Fremont		3	3	Good large plants, upright leaves good for shading head
Novaria		4	3.5	Nice plants large, very upright leaves for shading head
Majestic		3	3.5	Early variety, not self blanching, some purple, ricey appearance even when small
E51.M3440		2.5	3	Not very white in color
Absolute		4.5	3.5	Curled twisted leaves around head, good for head cover, may be difficult to remove for packing
Snow Grace		2.5	3.5	Early variety, not very white, more creamy color
Candid Charm		3	3	Good size plant, smooth leaves

Green Cabbage Varieties	*Ave head wt*	*Head Width inches*	*Head Height inches*	*Raw flavor comments*	*General Comments*
Benelli	5.96	9	6.5	pungent taste	Flat heads, wrapper leaves pointed upward, deep blue green color
Checkmate	6.52	7.5	6.75	crunchy, standard cabbage taste	Not many wrapper leaves, pale green head color, some red tips, easy to harvest, not many wrapper leaves to remove
Gunma	4.68	11	5.75	sweet, tender, loose head	Flat heads, curled leaf edges, very little red tips
Milestone	4.52	6	6	tough and strong sulfur taste	Red tipped, cupped leaves surrounding head, thick white veins, not yet ready, late variety
Vantage Point	4.34	7	7	sweet flavor	Red tipped wrapper leaves, smooth blue green leaves
Ultima Vantage	3.16	7	6.25	pungent taste	Red tipped wrapper leaves and reddened veins on top of head, not a smooth appearance
Green Cup	3.22	6.5	5.5	Crunchy, mild flavor	Semi-flat head, nice head presentation, medium amount of wrapper leaves, tinge of red in veins, but not much red at all
Emblem	5.22	7.25	7	bland taste, but crunchy	Red-purple color on top of heads, wide plant, may need wider row spacing than other varieties
Atlantis	4.34	7	7	gassy after taste	Purple veins and head tops, very hard even when smaller, good for small head harvest
Blue Dynasty	3.32	7	5.25	strong cabbage flavor	Nice leaf pattern, deep blue/green color, wrapper leaves pointed upward, no red-purple
Platinum Dynasty	3.4	6	6	very sweet and crunchy	No purpling at all, medium sized heads, wrapper leaves have a bit of a curled edge
Royal Vantage	5.48	7	6	crunchy and pungent	Some purpling on top of heads, wide plant , good amount of wrapper leaves, medium blue-green color, not best color, but good color

SPECIALTY POTATOES

SESSION

GROWING POTATOES ORGANICALLY

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Treatments
1. Conventional Bare Ground
2. Organic Bare Ground
3. Organic Leaf Mulch
4. Organic Black Plastic + Leaf Mulch between rows.

All seed potatoes were cut and suberized for 5 days @ 55^{o}F and 95% Relative Humidity after which they were returned to 40^{o}F until planting on April 25th. No other seed-piece treatment was used on any of the treatments.

1. Conventional Bare Ground Treatment
   -- 4/24 - 800 #/A of 15-0-15 / A pre-plant and disk-in
   -- 4/25 - planting 36" rows & 9" in the row
      + 8 oz/A of thiamethoxam + .42 fl oz/1000 ft of row of mefenoxam sprayed over seed-pieces as they were covered.
   -- 5/01 – Prowl 2 pts/A + metribuzin 75DF @ 5.7 oz/A
   -- 5/15 - 100 #/A of Nitrogen as 45-0-0 and cultivated in
   -- 6/09 – Hilled and sprayed with
      Metribuzin 75DF @ 5.7 oz/A + S-metolachlor @ 1.6 pts/A
   -- 6/16 - Foliar Spray with imidacloprid 1.6 @ 3.75 oz/A
   -- 7/24 - Foliar Spray with beta-cyfluthrin @ 6 fl oz/A + spinosad @ 6fl oz/A

All Organic Treatments Number 2,3,&4
   -- 4/24 9600 #/A chicken compost disk-in.
   -- 4/25 - Planting

2. Organic Bare Ground No Mulch
   -- 5/07 - Drag off with a spike tooth harrow no potatoes showing.
   -- 5/15 - Cultivate and drag off (potatoes are breaking)
   -- 5/22 and 6/02 – Cultivate
   -- 6/09 - Hilled
   -- 6/17 and 7/11 - Hand weeded.
   -- 8/06 - Harvested, Washed, and Graded

3. Organic Bare Ground with Leaf Mulch
-- 5/07 - Drag off with a spike tooth harrow (no potatoes showing).
-- 5/15 - Cultivate, drag off, hill & spread leaf mulch, (potatoes are breaking)
- Two manure spreader loads 5/15 and two more 5/30 per plot
- It would be better to spread leaves before potato break
-- 6/17 - More leaf mulch & hand weeded.
-- 8/27 – Harvested, Washed, and Graded

4. Organic Black Plastic with Leaf Mulch
-- 5/07 - First potatoes to emerge
-- 5/15 - Cultivate between row of plastic (most potatoes up)
-- 5/28 - Cultivate and spread leaf mulch between rows
-- 6/17 - More leaf mulch & hand weeded
-- 8/27 – Harvested, Washed, and Graded

First Problem: Weeds
-- Weeds that are 1" tall are too big for dragging off
-- Dragging off, cultivating, or weedering
twice a week to keep weeds from emerging

Next Problem: Bugs
- - Colorado Potato Beetle
Hand Picked Adults until larva hatched
spinosad @ 3 oz/A (max rate) = $65/A
-- Works on the larva (Excellent control)
-- Three sprays 6/05, 6/12, and 6/25
- - Potato Leaf Hopper
PyGanic 5.0 EC @ 1 pt/A = $46/A
-- 6/05, 6/12, 6/19, 6/25, 7/01, 7/10, & 7/16
-- Killed Leaf Hoppers but reintroduction rate was too high

Observations with Drip Irrigation
- Installed it after Hilling in Mid-June except tr 4 Black Plastic
- It worked well in all treatments except Conventional Bare Ground.
There was something drilling holes into the tape.
- Kept the surface dry less grass until rain of 7/04.
- Needed tape on every row.

Final Observations
- The conventional treatment had the highest marketable yield with Katahdin, Dark Red Norland, and Yukon Gold.

- The leaf mulch treatment had the same marketable yield as conventional with Blazer Russet, Superior, and King Harry.

- The black plastic was disappointing but it may be due to harvesting problems.

- The bare ground organic treatment had the lowest yield with each variety.

- Size was good except organic bare ground.

- Tuber Appearance
    - Blazer Russet and King Harry each had a big improvement in tuber appearance with leaf mulch; fewer knobs and misshapen.
    - All varieties except Superior had significantly less culls in the leaf mulch as compared to the conventional.

- The leaf mulch was a big problem on the harvester. It took twice as long to harvest. The leaves may have been less of a problem with a regular digger.

- Drip tape was removed before harvest.

- The plastic went over the harvester with little problem.

- As a research plot and on your farm if part is organic and part is conventional, it was very time consuming. We spent 263 hours extra on the organic area.
    Cleaning Equipment
    Pulling Weeds
    Picking CPB
    Spreading Leaves
    Record Keeping
    Planting through the Black Plastic

- The largest increases in costs were the labor, insecticides, drip, and plastic.

- Is it worth the increase in cost? If you have the market that will pay!!

POTATO PLASTICULTURE

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Introduction

The production of early potatoes for direct marketing or sale to consumers can be a very lucrative enterprise for many growers who only grow 3-5 acres of potatoes in Pennsylvania. There are many excellent farm markets located throughout the Commonwealth that sell a wide variety of produce to consumers throughout the growing season. It is traditional here in Pennsylvania that in the late spring/early summer consumers are anticipating the arrival of "new potatoes" or "B" size red potatoes at the local retail stands. These early potatoes command a high price and with the increasing popularity of specialty potatoes (different colored skins and flesh), growers are able to offer an increasing colorful display of potatoes to the consuming public. In order to provide high quality, early potatoes for their markets, an increasing number of growers in Pennsylvania are using intensive production technology or plasticulture (plastic mulches, drip irrigation, fertigation, high tunnels, and row covers). They have used this technology extensively for other selected vegetable crops on their farms. The use of plasticulture technology can provide for earlier production, increase marketable yields and improved quality of the product. In Pennsylvania we can have not only unpredictable growing conditions in the spring both in terms of temperatures and amount of precipitation, but during the growing season, which can cause a delay in the maturity of the potato crop. The quality of the potatoes can be affected by too much or too little water during the growing season. The use of plasticulture helps ensure that a grower can have potatoes for the early market. Here at the Pennsylvania State University we have been investigating the production of potatoes using plasticulture and in the succeeding paragraphs will explain the system of production for potatoes in both field and high tunnels.

Field Production

The benefits of using plastic mulch, drip irrigation and row covers has been well-documented in both the research literature and popular press and is an accepted practice for the production of many vegetable crops not only in Pennsylvania but around the United States and the world. The primary benefit of using plasticulture for potatoes is earlier production, greater yields and higher quality. Obvious advantages of

plasticulture are: (1) plastic mulches warm the soil up earlier in the spring which in turn hastens the emergence and development of the potato plant and prevents weed growth in the row, (2) drip irrigation in conjunction with the plastic mulches offer excellent control of soil moisture and the ability to fertigate, (3) elimination of hilling and (4) the potential reduction in disease pressure as well as the opportunity for insect management are all provided with the use of plasticulture.

Soil temperatures taken in May using a hand held soil thermometer at noontime under a clear sky are typical of those experienced in constant monitoring. The ambient air temperature was 74° F. The soil temperature was measured at a 4-inch depth on the raised beds with and without plastic mulch and with and without row covers. The soil temperatures for the raised beds without row covers were: red mulch 72° F, black mulch 72° F, silver mulch 69° F and no mulch 71° F. Soil temperatures on raised beds under row covers were: red mulch 78° F, black mulch 80° F, silver mulch 73° F and no mulch 77° F. This was a consistent trend and will continue until the plant canopy covers the surface of the raised bed at which time the temperatures under the mulch even out. The addition of row covers clearly increased soil temperatures. Faster emergence and increased growth of potato varieties grown under row covers has been observed each year. For potatoes grown without row covers, the growth of the potato plants on the red and black mulch were equal while the silver mulch was slightly behind and no mulch was much further behind. Under row covers, emergence and growth of potatoes under red and black mulch were again equal, with silver mulch slightly behind and then even further behind no mulch.

The following potato varieties have been used in the plasticulture system: Keuka Gold (a light yellow flesh with white skin), Dark Red Norland (a white flesh with red skin), Eva (a white flesh with a bright white skin), Michigan Purple (a bright white flesh with a purple skin color), Red Pearl (a white flesh with a red skin producing 71% B size potatoes), Adirondack Blue (a blue flesh with a dark blue skin). Dark Red Norland is a very early maturing variety with a relatively small plant canopy, Keuka Gold, Michigan Purple, Adirondack Blue, Red Pearl, and Eva are later maturing varieties and have larger plant canopies.

The plastic mulch/drip tape applicator used in vegetable production is also used for potatoes. The raised beds are 4-inches high and 30-inches wide with the drip tape buried 3 inches deep in the center of the bed. The drip tape used has been T-Tape TSX 508-12-450, which is 8 mil thick, has a 12-inch spacing between the emitter openings and a flow rate of 0.450 GPM/100feet of row. Seedpieces can be hand-planted using a bulb setter to make two rows of holes spaced 18 inches between the rows with the holes spaced 8-inches apart in the rows on the 30 inch wide raised beds. This would be for very small plantings. For larger plantings, potatoes are planted in double rows 18 inches apart with 12 inches in row using a water wheel planter without water application at the time of planting the potato seedpiece as is done with vegetable transplants. It is important to have adequate soil moisture prior to making the beds and applying the plastic mulch and drip irrigation tape to ensure that the hole made by the waterwheel transplanter will not collapse before the seedpiece can be placed in the hole. Working with colleagues in the Department of Agricultural and Biological

Engineering we have recently developed a new transplanter that utilizes cone-shaped dibbles, that punch holes in the plastic bed and can make holes 4 across, 2 across or 1 depending on the crop and in-row spacings from 6 to 24 inches again depending on the crop. We will be testing this unit at the Horticulture Research Farm this spring and hopefully it will be available for sale in the near future. Prior to making the beds and applying the plastic mulch and drip irrigation tape, fertilizer can be broadcast on the field. An example used in our plantings is for 450 lbs/acre of 34-0-0, 500 lbs/acre of 0-10-10 and 500 lbs/acre of 0-20-10 to be broadcast evenly across the field. Spacing between the mulched beds is 6 feet. Though the distance between the mulched beds could be decreased to 5 feet apart, the plant canopies will quickly cover the space between the rows and can limit air circulation that is needed for disease control. Typar, a floating row cover material, is applied once the potato seedpieces are planted. Admire is injected through the drip irrigation system for control of some insect pests, such as the Colorado potato beetle and then standard pest management practices are utilized the remainder of the growing season. It is interesting to note the results of counting Colorado potato beetles adults on plastic mulches and bare ground on May 30, 1998: black mulch-94 beetles, red mulch-54 beetles, no mulch-36 beetles and silver mulch- 13 beetles The potatoes size was monitored and potato vines were killed at the appropriate time.

The potatoes are routinely checked for development and when the tubers are nearly marketable size the vines are killed using Diquat. The potatoes are dug using a double row level bed digger and then picked up by hand. We have used a single row digger with bagging attachment but is sometimes hard to get the whole 30 inch wide bed up the digger. Potatoes will be set right out on the edge of the bed. Harvest begins with Dark Red Norlands, then Michigan Purple, Red Pearl, Adirondack Blue, Kueka Gold and Eva. Although the plastic mulch and drip irrigation tape will travel up the digger chain it is easier to remove the plastic mulch prior to digging. This is best accomplished by mowing the dead potato vines as close to the plastic as possible with a rotary mower and then loosen the soil along the edges of the plastic and either remove it by hand or use a small retrieval unit that will make a small round bale of plastic.

All plastic mulches have significantly increased total and marketable yields for all varieties compared to bare ground. Marketable yields for potatoes grown with plastic mulch as compared to bare ground for the 2000 growing season were Dark Red Norland: Black-271cwt. Red-249 cwt., Silver-246 cwt., and no mulch-173 cwt. For Keuka Gold: Black-357 cwt., Red-372 cwt., Silver-364 cwt., and no mulch 262 cwt. For Eva: Black-325 cwt., Red-298 cwt., Silver-301 cwt., and no mulch-182. The same holds true for Michigan Purple, Red Pearl, and Adirondack Blue. The increased yields more than pays for the additional cost of the plastic mulch and drip irrigation tape. The influence of the amount and quality of reflective light back into the plant canopy has not been measured and could be a significant factor in influencing the growth the potato plant. Although, silver mulch with or without a row cover had the coolest soil temperatures and slowest plant growth of the three colored mulches the final yields are

equal and sometimes better than the red and black mulch. There doesn't seem to be a corresponding increase in yield associated with an increase in plant growth. The positive effect of the red and black mulches covered or uncovered on the emergence of the potato is probably do to an increase in the soil temperature. This goes back to the fact that the rate of emergence and growth of sprouts from the seedpiece once it is planted is mostly a function of the soil temperature. It is important to remember that the bare ground potatoes also received drip irrigation so the yield response is mainly a result of the plastic mulch. Plastic mulch and drip irrigation should be used together to get the maximum benefit from the system. It is recommended that a good strong black plastic mulch 1 to 1.25 mil thick be used for the production of potatoes since, if a plastic mulch lets any light through the potatoes that are on the surface or partially exposed will green up and be render unmarketable.

High Tunnel Production

High tunnels are part of plasticulture technology and are used worldwide for the production of a wide array of horticultural crops. In Pennsylvania the use of high tunnels permits the earlier production of a number of vegetable crops such as tomatoes, peppers, eggplant, and leafy greens. The use of high tunnels allows the production of early potatoes and is especially profitable if grown/marketed in conjunction with fresh garden peas and pearl onions which are used together for a tasty spring dish. The use of high tunnels can provide growers the opportunity to market early red potatoes or red, white and blue for the 4th of July holiday. The system of production is very similar to field production, except the equipment size is smaller. Plastic mulch, drip irrigation and row covers are use inside the high tunnels. In a 17-foot wide high tunnel, 3-foot wide plastic mulch is used to make four small raised beds 18 inches wide and 3 inches high which are spaced 44 inches apart. A small 21 HP tractor and plastic laying machine is used to apply the 3-foot wide plastic mulch and drip irrigation tape. Application of the plastic mulch and drip irrigation tape is similar to field production. In the high tunnel black or red plastic mulch are good choices, since we want to really warm the soil up. If the plastic mulch and drip irrigation tape could be applied in the preceeding fall, it could then be ready for an early spring planting. A note of caution, rodents may be a problem if plastic mulch and drip irrigation are applied in the fall. If fall application is not possible, then the plastic mulch and drip irrigation tape can be applied as soon as it is possible to enter the high tunnel in the early spring.

Fertilizer can be broadcast in the high tunnel and pulled into the row or some can be broadcast and then fertigated. The rates would be similar to the field situation, although lesser amounts can be used since in a high tunnel a grower has complete control over soil moisture and fertilizer. Potato varieties used in the high tunnels have been Red Pearl (W8475-R), a red-skin/white flesh that makes 71% B size potatoes from the Wisconsin Potato Breeding Program; Eva- a white skin/white flesh from the Cornell

Potato Breeding Program; and Michigan Purple- a purple skin/white flesh from Michigan State Potato Breeding Program. These were chosen in order to have some red, white and blue skinned potatoes for our "Patriot Potato Salad" for the 4th of July. The potatoes were hand-planted April 6, 2001 on double-rows 13 inches apart, with the potatoes spaced 8 inches apart in the row.

The row cover is placed over the plastic covered beds and the soil temperature is monitored until it reaches 50° F and then the potatoes were planted which for us in State College, PA in mid-March to early April. Note: the row cover will provide some protection from an unexpected freeze event but it is recommended that some source of portable backup heat is available to prevent the tops of the potatoes from being killed off.

Potatoes were irrigated as needed and no pesticides were applied to the crop. The potatoes were dug by hand on June 27, 2001 to be ready for the 4th of July market. The soil temperature at time of digging was 79° F. Red Pearl yielded 120 lbs. of potatoes, the Eva yielded 100 lbs. of potatoes and Michigan Purple yielded 139 lbs. of potatoes. There were less than 10 tubers in the entire tunnel that had any defects. Red Pearl yielded 375 tubers/30 plants or 12.5 tubers per plant. Eva yielded 112 tubers/30 plants or 4 tubers per plant and Michigan Purple yielded 90 tubers/30 plants or 3 tubers per plant.

The skin colors were excellent on all varieties. To take advantage of the skin colors of the potatoes and the 4th of July holiday, an American flag (3' wide by 5' long) made of the potatoes was constructed to show how they could be promoted in a retail market. These potatoes lend themselves to marketing in small woven baskets, in attractive displays, in polybags, or plastic clamshells and can command a high price.

If a grower had a 17' by 96' high tunnel and grew four rows at the 13" double-row, 8-inch in-row spacing, the yields for Red Pearl would be 1,104 lbs. of potatoes, Eva- 920 lbs. of potatoes and Michigan Purple- 1,278 lbs. of potatoes. The price of specialty potatoes at the food stores, according to a chart presented by the National Potato Promotion Board is .86/lb. If advertised and promoted at local retail markets, $1.50 for 1.5lbs. should be reasonable price to expect. If we use $1.50 for 1.5 lb. then the gross return for each of the varieties would be Red Pearl- $1,104, Eva- $920 and Michigan Purple- $1,278. This is for an area of production that is only 0.037 of an acre.

MARKETING II

SESSION

PACA – A VALUABLE TOOL FOR GROWERS

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Your crop is harvested and ready to market. Getting to this point has not been easy—you have endured sleepless nights worrying about weather conditions, bank loans and spray schedules. You have spent thousands of hours working tirelessly to ensure that your crop is top quality and will provide the best return on your investment. However, until you have actually received payment for your hard-earned labors—and the checks have cleared the bank—all of your time and effort has been for nothing.

Producing a crop is only half the job. The rest involves marketing. Too often, however, growers encounter a myriad of difficulties when selling and marketing their produce. Some of the more common dilemmas include buyers who arbitrarily “clip” invoices—or do not pay at all; loads that are rejected at destination without justification; and sales agents who do not properly account for sales and expenses. Any of these can put your entire business at risk. However, whom can you turn to when problems like these arise?

The PACA Can Help

The Perishable Agricultural Commodities Act, or PACA for short, is a law that enacted by Congress in 1930 to promote fair trading practices in the fruit and vegetable industry. The law is designed to protect growers, shippers, distributors, and retailers dealing in those commodities by prohibiting unfair and fraudulent trade practices, and provides a forum that can be used to settle commercial disputes. Although, the PACA is administered by the U.S. Department of Agriculture, no tax dollars are used—the program is funded almost entirely by license fees that are paid by companies which buy, sell, or broker commercial quantities of fruits and vegetables. This license requirement is what makes the law so effective. USDA can suspend or revoke the license of firms that do not abide by the law, and hold them liable for any damages that result. Naturally, the type of penalty issued depends upon the seriousness and nature of the violation.

Dispute Resolution

What should you do if you encounter problems getting payment from a buyer, or believe that you have suffered damages resulting from unfair trade practices? Your first step should be to call a PACA office to discuss the matter. PACA representatives provide

unbiased assistance—whether this involves interpreting a contract term, analyzing an inspection result, or merely providing advice regarding your rights and responsibilities. Frequently, timely guidance such as this is sufficient to avoid any further action on your part. There are instances, however, when disputes are not so easily settled. In those cases, you'll need to file a claim with a PACA office.

To file a claim, simply submit a letter to any PACA office outlining whom you are filing against and the nature of your complaint. Along with your letter, you will need to send copies of any supporting evidence such as invoices, broker's memoranda of sale, accountings, or other paperwork. Also, keep in mind that you must file your claim within 9 months of date that payment became due, or the date that performance of the contract was required. The cost of filing a claim is only $100.

Once the PACA staff receives your complaint, they will gather the relevant facts from all parties involved in the dispute and assist in reaching a settlement. The PACA Branch received more than 1,700 such cases during fiscal year 2008. About 89 percent of those claims were resolved informally, generally within 8 weeks. Ninety-one percent of all informal reparation cases were completed within a four-month timeframe. Informal settlements exceeded $20.4 million in fiscal year 2008. If an informal settlement is not possible, USDA will issue a binding decision and order. Although it costs an additional $500 to obtain a formal ruling, you can recover this fee from the other party if you prevail.

Sales Agents

Many growers hire sales agents to sell and market their crop. Although arrangements vary, agents typically receive a percentage of the sales price as their commission, and may be entitled to deduct other expenses. The PACA requires that agents outline the duties and responsibilities of both parties in writing before the first lot is received. In addition, agents must issue you accurate accountings documenting the sales prices obtained and the expenses deducted from each transaction. Agents are generally required to submit these accountings in 10-day intervals throughout the season, and must promptly pay you the net proceeds due once payment is collected. If you believe your sales agent has not met its responsibilities, you should speak to a PACA specialist. If necessary, you can file a claim and a PACA representative will audit the agent's records to determine whether any additional proceeds are due.

Mediation Service

Mediation is an effective way to resolve disputes, since it places the resolution of the dispute directly in the hands of the interested parties. It provides an outlet for settling differences outside of the legal system, strengthens business relationships, and provides a forum where both parties can air their differences in a neutral atmosphere.

Mediation sessions can be held face-to-face or over the telephone. All PACA personnel that handle disputes are trained in mediation, and can mediate your dispute upon request provided both parties are agreeable. Furthermore, there is no additional cost to mediate a dispute beyond the initial $100 filing fee. To obtain more information about this service, or to arrange for mediation of a dispute, you can contact any PACA office.

The PACA law is there to ensure fairness, and offers many services to assist you. For additional information, call any PACA office at (800) 495-7222 or visit our website at www.ams.usda.gov/paca. After all, you have worked too hard to be treated unfairly!

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FERTILITY & FIELD CROPS

SESSION

SOIL SAMPLING STRATEGIES & SOIL TEST RECOMMENDATION UPDATES

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One best management practice that must remembered in tough economic times is soil testing. Having fields tested for fertility will allow scarce management dollars to be used most effectively. Soil sampling procedures will be reviewed to assure accurate results.

Efforts to improve soil test reports are underway at Rutgers Soil Testing Laboratory. In addition to improving understanding of results, computer generation of recommendations for farm reports is in the process of being automated. The soil test report will provide the general Rutgers Cooperative Extension fertilization recommendations for the specified crop. These recommendations may be subject to modifications by RCE agents according to specific management factors in consultation with the grower. Some of the factors that may justify adjustments include: very coarse or very fine soil texture, green manure cover crop, previous legume crop, and leaf or compost application. Despite the potential need for adjustment, the generic recommendation will provide an initial point of reference for the final recommendation.

Another improvement in soil test reporting will be the option to have reports emailed to clients and to appropriate RCE agents to minimize turnaround time. Besides quicker response, email reporting has the advantage of electronic records management. It is expected that this new soil reporting system will be initiated early in 2010.

BEDDING PLANTS/ TRANSPLANTS

SESSION

AM I MAKING ANY MONEY?

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How do producers make money with shrinking margins, rising costs, and demanding customers? Which crops are making money, and which ones are losing money? Or more optimistically, this has been a good year, and some growers may be making money on everything, but which crops make the most? Once producers know this, they can look at ways to increase sales of the profitable crops, or find ways to cut costs on the less profitable ones. They can decide to drop unprofitable crops, or consider new ones.

Profit for any business can be calculated by the simple formula: profit equals number of units sold times (sales price per unit minus total costs per unit). Amazingly, most producers know how many units of a specific crop they sell at a given price. They also know the profitability of their business from their income tax records at the end of the year. However, most growers produce many crops; thus, the third vital component of the profit equation, the cost of producing an individual unit, is often not known. Determining the profitability for each crop requires knowledge of its production costs. The process of assigning production costs to each crop and subsequently calculating the profit of each crop is called cost accounting.

To make cost accounting easier, I developed a simple cost accounting program distributed by Rutgers University Cooperative Extension. The program enables producers to perform cost accounting and to determine the profitability of greenhouse crops. The newest version also calculates costs of crops produced outdoors as well as greenhouse crops. New features of the Rutgers Cost Accounting Program include calculating the percentages of each overhead costs, information from the balance sheet and calculation of key ratios. In addition to analyzing their actual costs, producers can use the program as a planning tool to analyze the impact of increased energy costs and prices as well as changes in marketing mixes, or other changes they are considering in their businesses.

The program uses cost information producers already have. Much of the data needed is typically found on income statements and balance sheets and the rest is direct cost information for each crop. From these inputs, the program allocates as many

costs as possible to individual crops. The remaining unallocated costs are assigned to each crop on a per square-foot-week basis.

The program generates information showing total costs, and net returns per unit. It enables producers to easily determine the profitability of each crop. From this information, they can determine which crops are their winners and losers. This software also will help them make decisions on pricing, identifying and reducing unprofitable production costs and increasing sales of profitable crops.

Overhead and Variable Costs

The costs incurred in the greenhouse business can be grouped into two categories: variable and overhead costs. Variable costs are costs that change with the level of production and can usually be allocated to a particular crop. Examples of variable costs are the costs of petunia seeds and bedding plant flats; both relate specifically to petunia production. They are part of the total costs per unit given in the profitability equation above. Overhead or fixed costs are those costs that are incurred regardless of the level of production and are common to all crops. These costs include depreciation of the greenhouse structure, equipment, and other facilities and costs such as interest, repairs, insurance, taxes, and salaries of overhead personnel (i.e., the manager, sales people, growers, secretaries, bookkeepers, etc.). The total cost of production is the sum of variable and overhead costs.

Inputs. The first step in cost accounting is to enter all of the costs from the input statement. I used figures from a 2003 survey of Northeast greenhouse growers where the average size was 138,759 square feet with sales of $2.2 million and net returns of $211,152 or 9.5% (Table 1).

We need a little more information:

1. What is the selling price of each crop?
2. How many square-feet of space does each crop take on the bench?
3. How many pots or flats of each crop do are produced?
4. What percentage of each crop is sold?
5. What are the production (variable) costs for each crop?

Even if producers don't know the answer to questions number 5, they can still get a rough idea of production costs for each crop by entering the first 4 items. They can enter any variable costs that they have for a specific crop. The program will subtract the variable costs that are entered from the costs in the income statement. This will leave costs that can't be allocated. These unallocated costs will then be treated as overhead costs.

The figures in Tables 1 are actual results of surveys of Northeast growers, Table

2 is a hypothetical production schedule constructed to match the actual income from the 2003 surveys. The program gives these results on a per crop, per unit, and per square foot basis

Results. We have calculated overhead costs, costs per crop, and costs per unit (flat or pot) and highlighted the largest number in each case (Table 3).

Table 1. Income statement data from a survey of Northeast Greenhouse Growers in 2003 entered into the Rutgers Cost Accounting program.

	Values from Income Statement (Schedule F or C)	
	2003 Actual	
	$	*% of Sales*
Sales	**$2,219,560**	**100**
Directs costs		
Seeds, cuttings, or plants	$490,863	22.1
Pots or containers	$140,984	6.4
Marketing containers	$ 38,567	1.7
Growing medium	$ 4,689	0.2
Fertilizer and chemicals	$ 43,163	1.9
Tags	$ 0	0.0
Sales Commissions	$ 2,875	0.1
Other	$ 37,468	1.7
General wages	**$729,233**	**32.9**
Overhead salaries (incl benefits)	**$ 2,895**	**0.1**
Utilities		
Heating fuel/Machinery Fuel	$ 77,566	3.5
Electricity	$ 40,352	1.8
Telephone	$ 5,894	0.3
Water	$ 464	0.0
Overhead		
Depreciation	$ 92,642	4.2
Interest	$ 8,080	0.4
Repairs	$ 43,829	2.0
Taxes	$ 26,131	1.2
Insurance	$ 37,546	1.7
Advertising	$ 11,277	0.5
Dues and subscriptions	$ 100	0.0
Travel and entertainment	$ 7,431	0.3
Office expense	$ 9,589	0.4
Professional fees	$ 19,444	0.9
Truck expense & eq. rental	$ 46,954	2.1
Land rental	$ 2,112	0.1
Contributions	$ 0	0.0
Bad debts	$ 0	0.0
Miscellaneous	$ 87,956	4.1
Total expenses	**$2,008,104**	**90.5**
Net Returns	**$ 211,152**	**9.5**

Greenhouse area (ft²) 138,759
Greenhouse space used for production (%) 82
(e.g., enter 75% as 75, 125% as 125)
Weeks in operation (52 if a full year) 40

Differences in profit pictures exist between cost per square foot-week and cost per unit. Poinsettias have the largest sales per crop, but are actually the greenhouse crop with the lowest profit per square foot-week. Petunia flats are the most profitable crop per unit and per crop, but geraniums in 4-inch pots are the most profitable crop per square foot-week. Geraniums in 4-inch pots have a lower profit per pot (unit) than any other crop because they are sold at a lower price per unit than the marigold flats. However, geraniums in 4-inch pots are the most profitable crop per square foot-week because of more efficient use of space. Returns per square foot-week of bench space may be the most informative way of comparing profitability among crops because of differences in use of space. This grower could increase profits if it is possible to sell more geraniums in 4-inch pots and reduce costs, especially costs of producing poinsettias.

With fluctuating fuel costs and competitive markets, managers need to pay close attention to the bottom line and how changes in costs impact it. The Rutgers Cost Accounting program will allow managers to analyze how you business is doing. It will also allow them to do "what if" planning on paper instead of making bigger, real mistakes in the greenhouse. As shown in this hypothetical example, knowledge of the profitability of each crop can help make production and marketing decision to improve their businesses.

Table 2. An example of input section, which includes information on specific crops from the Rutgers Cost Accounting program.

	Petunia Flats	**Marigold Flats**	Geranium Flats	Geraniums (4-inch pots)	Poinsettias (6-inch pots)
No. of units	50,000	**50,000**	100,000	126,000	26,136
Sq. ft./unit	1.64	**1.64**	1.64	0.11	1.00
Weeks to grow	8	**6**	13	6	15
Percent sold	98%	**98%**	98%	95%	95%
Sales price	$ 7.93	**$ 7.00**	$ 11.73	$ 1.20	$ 5.00

Table 3. An example from the Rutgers Cost Accounting program of output information per units and per crop using 2003 Northeast cost.

	Petunia Flats	Marigold Flats	Geranium Flats	Geraniums (4-inch pots)	Poinsettias (6-inch pots)
Sales	$388,570	$343,000	$574,770	$157,700	$653,562
Profit (loss) per crop	$ 69,844	$ 50,080	$ 54,026	$ 14,039	$ 64,424
Profit (loss) per unit	$ 1.43	$ 1.02	$ 1.10	$ 0.15	$ 0.54
Profit (loss) per sq.-ft. wk	$ 0.11	$ 0.10	$ 0.05	$ 0.21	$ 0.03

MARKETING TRANSPLANTS: HOW WE DO IT

David Miller
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Dave Miller is President of Miller Plant Farm Inc., a family owned Greenhouse and Farm operation located in York, PA. The farm has been in the Miller family since 1912. Dave represents the fourth generation in the business. The first greenhouse was built in 1928 for the purpose of growing vegetable transplants for their own use.
Dave is married to Diane and they have three children, daughters Courtney and Whitney, and son Dustyn. Dustyn and (Dave's) nephew Steve Slyder represent the fifth generation in the business.

Areas of consideration for successful transplant sales.

I. Cultivar Selection

F-1 hybrid vs open pollinated- "you get what you pay for" * denotes F1 hybrid.

II. Wide Variety

Tomato
*Big Beef
*Big Boy
*Better Boy
*Champion
*Jet Star
*Mt. Fresh
*Celebrity
*Supersteak
*Fourth of July
*First Lady
*Bush Champion
*Patio
*Lemon Boy
*Carolina Gold
*Pony Express (Roma)
*BHN 901 (Yellow Roma)
*Sweet 100
*Jolly Elf (Red Grape)
*Golden Sunshine (Yellow Grape)
*Sunsugar (Yellow Cherry)
*Sungold (Yellow Orange Cherry)
Baby Cakes (Red Cherry)

Bell Pepper
*King Arthur
*Early Sunsation
*Alliance
*Revolution
*Valencia (orange)
*Blushing Beauty
*Chocolate

Eggplant
*Classic F1
*Ghostbuster
Orient Express

Hot Pepper
*Agriset 4108(Jalapeno)
Cayenne large thick
Hot Cherry
Hungarian Wax
*Habanero (orange)
*Habanero (red)
*Superchile
*Inferno
*San Ardo
Tabasco Hot
Thai Hot

Lettuce
Summertime (iceberg)
Ermosa (Boston type)
Super Jericho (Romaine)
Red Sails (red leaf)
Two Star (green leaf)
Outredgeous (red romaine)
All Star Mix (mix leaf)

Cabbage
*Blue Vantage
Stonehead
*Super Red 80

Onion
*Candy
Yellow Sweet Spanish
*Mars (red onion)

Watermelon
Crimson Sweet
Sangria
*Summer Flavor 710
*Summer Flavor 800
*Jamboree
*Jade Star
*Yellow Doll

Seedless Watermelon
*Red Winner
*Revolution (Sangria type)
*Butter cup
*Orange Sweet

Brussel Sprouts
*Oliver

Cauliflower
*Snow Crown

Broccoli
*Green Magic
*Premium Crop

Cantaloupe
*Athena
*Ambrosia
*Burpee Hybrid
*Superstar
*Eclipse

Pollenizer
*Sidekick (for seedless)

Cucumbers
*Fanfare (slicing)
*Burpless 26
*Bush Crop
*Calypso (pickling)

Summer Squash
*Cashflow
*Golden Delight
*Sunray
Patti Pan
*Eight Ball

Specialty Melons
*Morning Ice (Honeydew)
*Courier (Galia)
*Dorado (Canary)

Herbs:

We Grow
Basil, Cinnamon
Basil, Aroma 2
Basil, Genovese
Dill, Bouquet
Chives
Chives, Garlic
Coriander
Fennel, Sweet
Lemon Balm
Lovage
Sage

Buy In
Catnip
Chamomile
Lavender
Oregano
Peppermint
Rosemary
Savory
Spearmint
Stevia
Thyme

III. Quality

1. Consumers recognize quality
2. Pay attention to shelf life
3. Disease and pest free

IV. Counts & Containers

1. One size does not fit all – trend toward pots
2. Large pots – premium price
3. Label in every unit
4. Consider for retail different unit than big box

V. Pricing

1. Look at inputs
2. Don't let big box stores set your prices
3. "You get what you pay for"

VI. Facility

1. Take time to prepare for peak time
2. Clean!
3. Organization
4. Directional signage
5. Parking
6. Whatever it takes to make a positive experience

VII. Service

1. Quality people
2. 15% of success is determined by knowledge and technical skills – 85% attitude and ability to relate to other people - Carnegie Foundation
3. Be helpful
4. Personal service
5. "How to" handouts
6. Technical help though the season
7. Tours
8. Community involvement
9. Website – dedication

PEPPERS

SESSION

PEPPER DISEASE AND CONTROL OPTIONS FOR 2010

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Phytophthora blight (*Phytophthora capsici*) is one of the most destructive soil-borne diseases of pepper in the US. Without proper control measures, losses to Phytophthora blight can be extremely high. Heavy rains often lead to conditions which favor Phytophthora blight development in low, poorly drained areas of fields leading to the crown and stem rot phase of the disease. Infections often occur where water is slow to drain from the soil surface and/or where rainwater remains pooled for short periods of time after heavy rainfall.

For control of the crown rot phase of Phytophthora blight, apply:

Ridomil Gold (mefenoxam, 4) at 1 pt 4E/A or 1 Ultra Flourish (mefenoxam, 4) at 1 qt 2E/A, or MetaStar (metalaxyl, 4) at 4.0 to 8.0 pt/A. Apply broadcast prior to planting or in a 12- to 16-inch band over the row before or after transplanting. Make two additional post-planting directed applications at 30-day intervals.

For prevention of the fruit rot phase of Phytophthora blight, alternate the following on a 7 day schedule:

Ridomil Gold Copper (mefenoxam, 4) at 2.0 lb 65WP/A.

with one of the following materials.

Revus (mandipropamid, 40) at 8.0 fl oz 2.08SC/A plus fixed copper at labeled rate, or

Presidio (fluopicolide, 43) at 3.0 to 4.0 fl oz 4SC/A plus fixed copper at labeled rates, or

Forum (dimethomorph, 40) at 6.0 oz 4.18SC/A, plus fixed copper at labeled rate.

Controlling Anthracnose fruit rot in bell pepper.

Anthracnose fruit rot *(Colletotrichum* spp.) has been an increasing problem in bell pepper production during the past few years. The pathogen, *Colletotrichum*, also causes fruit rot in strawberries and tomatoes. The pathogen can infect bell pepper fruit during all stages of development resulting in serious losses if not controlled properly. Symptoms of Anthracnose fruit rot include sunken (flat), circular lesions. In most cases, multiple lesions will develop on a single fruit. As lesions enlarge, diagnostic pinkish-orange spore masses develop in the center of lesions. During warm, wet weather spores are splashed onto healthy fruit through rainfall or overhead irrigation.

Managing anthracnose fruit rot begins with good cultural practices. The pathogen overwinters on infected plant debris and other susceptible hosts. The fungus does not survive for long periods without the presence of plant debris. Pepper fields should be thoroughly worked (ie. disced, plowed) after the season to help break down and bury old debris. Heavily infested fields should be rotated out of peppers for at least three years. Do not plant or rotate with strawberries, tomatoes, eggplant or other solanaceous crops. Once areas in fields become infested, management of the disease can be difficult. Prevention is key to controlling anthracnose fruit rot.

Beginning at flowering, especially if fields have had a past history of anthracnose.

Alternate:

chlorothalonil at 1.5 pt/A or OLF

with a tank mix of chlorothalonil at 1.5 pt/A plus one of the following FRAC code 11 fungicides:

Quadris (azoxystrobin) at 6.0 – 15.0 fl oz 2.08F/A, or
Cabrio (pyraclostrobin) at 8.0 - 12.0 oz 20EG/A, or
Flint (trifloxystrobin) at 3.0 -4 .0 oz 50WDG/A

Prevention is critical to controlling anthracnose fruit rot. Infected fruit left in the field during the production season will act as sources of inoculum for the remainder of the season, and therefore, should be removed accordingly. Thorough coverage (especially on fruit) is extremely important and high fertility programs may lead to thick, dense canopies.

Skin separation or 'silvering' development in fruit of bell pepper.

In recent years, silvering or skin separation has become a serious fruit disorder in bell pepper production in New Jersey. As pepper fruit mature, the outer epidermis may develop 'silver' colored flecks. These flecks are thought to be caused by the separation of cells just beneath the epidermis. Although silvering does not affect fruit integrity, it reduces fruit quality making affected fruit unmarketable. Depending on commercial variety, silvering can be as high as 60% in some cultivars. Interestingly, the silvering of fruit has been associated to Phytophthora-tolerance in commercial cultivars. The more tolerant the pepper variety is to the crown rot phase of Phytophthora blight (*Phytophthora capsici*), the more likely it is to develop silvering in fruit. The bell pepper cultivars 'Paladin' and 'Aristotle' are grown on much of the commercial acreage in New Jersey because of their tolerance to Phytophthora. Unfortunately, this makes a large percentage of bell pepper production acreage in the state susceptible to silvering. According to USDA grading standards, #1 bell peppers can have no more than 10%

fruit with silvering. Research has shown that production system may also influence the amount of silvering that develops in bell pepper fruit.

Research in New Jersey has shown that the more resistant a bell pepper cultivar is to Phytophthora infection, the more likely it is to develop symptoms of skin separation or 'silvering' in fruit. More fruit silvering was present in the phytophthora-resistant bell pepper cvs. 'Aristotle' and Paladin' compared to the phytophthora-tolerant cv. 'Revolution' and phytopthora-susceptible cvs. 'Alliance' and 'Camelot' across all production systems.

Edema (Eodema) development on bell pepper fruit.

During the past few summers, edema has caused damage on pepper fruit. In most cases, edema developed when i) fruit were in contact (or laying on) black plastic mulch ii) in areas on fruit where more than one fruit were in contact with each other and iii) where developing fruit were in direct contact with a stem or branch on the plant. Edema (oedema) is caused by an imbalance of the plant's water uptake and water loss. (Avarre and Jones). Under these conditions the roots absorb water at a rate faster than is lost through transpiration. During cool, cloudy weather conditions, humidity levels can remain high when transpiration rates remain low. Thus, a plant may absorb more water than is lost through transpiration, and is therefore unable to accommodate for expansion causing eruptions in leaf and fruit tissue. Under favorable conditions, tannish-brown raised, corky bumps (fissures) may develop. Anatomical studies show that under appropriate environmental conditions, cells adjacent to the stomatal cavity expand, divide, reorient and form a corky layer (Wulster, 2004). Growers can try to prevent edema by adjusting cultural practices. Keep plants on the dry side during periods of cool, cloudy weather, especially if relative humidity remains high. Irrigate when air temperature is rising and humidity is low. Do not irrigate on cloudy days when temperatures remain cool. Edema is often confused with 2-spotted spider mite or thrips damage. In some cases, the nymphal stages of thrips has been associated with the problem. Use a hand lens to examine the underside of leaves and growing points for the presence of insects (Pundt).
Evaluation of different cultivars and breeding lines at RAREC the past 2 years for eodema have not shown any consistency in its development among bell peppers and/or breeding lines.

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Evaluation of Bell Pepper Varieties

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Introduction

Several new varieties have been released in the last two years which have increased disease tolerance or resistance. At the request of the pepper advisory committee a trial was established at the Rutgers Agricultural Research and Extension Center, Bridgeton, NJ to compare the yield and horticultural characteristics of named and experimental bell pepper cultivars.

Materials and Methods

Culture: Eighteen varieties were seeded April 7, 2009 in 98 cell trays containing peat-vermiculite media and transplanted on May 27. Plants were set with a water wheel transplanter on raised beds with black plastic mulch and one drip line per bed. Each plot was 15 ft long with 5 ft between beds, 18 inches between plants, 18 plants per plot in double rows 12 inches apart. The plots were arranged in a randomized complete block design with four replications. Plants were staked and tied using the Florida weave system on the first string then running a string on the outside of the plants forming a box around each plot for the second string.

Sixty pounds/acre of nitrogen as calcium nitrate was incorporated at bed making. Additional fertilizer was applied through the drip system on a weekly basis from June 16 to September 16 for a total of 168 lbs/A nitrogen, 108 lbs/A P_2O_5 and K_2O.

Annual rye covercrop was killed with Roundup, 1lb/A (April 17) followed by preplant applications of Devrinol, 3 lbs/A (May 12) and Command, 1 pt/A + Dual Magnum 1 qt/A (May 18). Row middles were sprayed with Gramoxone (July 22).

Insects and diseases were controlled using commercial recommendations for peppers. Admire was applied as a drench to the seedling flats 5 days to prior transplanting at a rate of 3 ml per flat in sufficient water to saturate the growing media. The following materials were applied to the foliage during the production season with an airblast sprayer: Manzate, 2lb/A + Champ 2F, 1 qt (June 17 and 26), Actara, 3 oz + Dithane, 2 lbs (July 7),

Dithane, 2 lbs + Champ 2F, 1 qt + Warrior, 3 oz (July 23), Abound, 15 oz + Gavel 75, 2 lbs
+Previcur, 1 qt + Warrior, 3 oz (August 12), Abound, 15 oz + Champ 2F, 1 qt + Warrior, 3 oz (August 14), Bravo, 1 qt + Tanos, 8 oz (August 21), Bravo, 3 pt + Previcur 1.2 pts + Warrior 3 oz + Quadris 6 oz (August 31) and Abound 15 oz + Champ 2F 1 qt + Spintor 8 oz (September 15).

Peppers were hand harvested five times: July 30, August 13 and 24 and September 4 and 23. Fruits were graded into silvered and non-silvered fruit and into sizes by weight. At the second and fifth harvest five fruit from each replication were randomly selected from the extra large and large fruit to evaluate for recessed shoulder, lobe number, wall thickness, fruit length and width, fruit color, smoothness, glossiness and uniformity. Fruit size and weight categories are as follows: Extra large (0.5 lbs/fruit or larger), large (0.33-0.49 lbs/fruit), medium (0.25-0.32 lbs/fruit), commercial (slightly misshapen fruit) and culls (0.24 lbs/fruit or smaller and diseased or other problems). Yield is reported in 28 lb boxes/A.

Varieties and breeding lines

Variety/Line	Source	Bacterial Leaf Spot[1]	Phytophthora[2]
Alliance	Harris Moran	1-3, 5	(-)
Camelot	Seminis	(-)	(-)
Revolution	Harris Moran	1-3, 5	Tolerant
Aristotle	Seminis	1-3	Tolerant
Paladin	Syngenta	(-)	Resistant
0994-1819	Seminis	1-5	Tolerant
0996-7922A	Seminis	1-3	Tolerant
0991-5776	Seminis	1-3	(-)
0992-7141	Seminis	1-3	(-)
0992-8302	Seminis	1-5	(-)
Tomcat	Syngenta	1-5	(-)
Colossal	Syngenta	(-)	(-)
Intruder	Syngenta	1-3	Tolerant
Hunter	Syngenta	1-5	(-)
Karisma	Harris Moran	1-3	(-)
Excursion II	Abbott and Cobb	1-3	(-)
Plato	Seminis	1-3	(-)
Snapper	Enza Zaden	1-3	(-)

[1]Numbers refer to bacterial leaf spot resistant strains
[2]Tolerance level

Results and Discussion

Hail damage occurred one week after transplanting, but the plants recovered. Little disease or insect damage was observed until the last harvest when anthracnose infected the plots.

Silvering (skin separation) has been a concern for New Jersey growers over the last five years. Our research indicates this is a physiological disorder affecting several varieties. All varieties are now screened for silvering. In the following table, yield data is presented in non-silvered, silvered and total yield.

	Boxes Per Acre - Harvest 1 (7/30), 2 (8/13), 3 (8/24), 4 (9/4) & 5 (9/23/2009)						
Variety	Non-Silvered X-Large & Large	Non-Silvered Medium & Commercial	Silvered X-Large & Large	Silvered Medium & Comm-ercial	Total Yield X-Large & Large	Total Yield Medium & Comm-ercial	Total Yield
Alliance	1428.43	130.73	129.90	10.89	1558.33	141.62	1699.94
Camelot	1220.88	125.07	111.53	3.27	1332.41	128.34	1460.75
Revolution	1423.14	143.33	105.41	15.04	1528.55	158.37	1686.92
Aristotle	1329.50	53.07	317.27	44.82	1646.77	97.89	1744.66
Paladin	1317.83	114.07	297.81	70.45	1615.65	184.52	1800.17
0994-1819	1287.17	67.96	431.96	10.79	1719.14	78.75	1797.88
0996-7922A	1308.08	108.16	142.97	14.42	1451.05	122.58	1573.63
0991-5776	837.11	82.90	683.66	95.66	1520.77	178.55	1699.32
0992-7141	1286.29	71.17	182.96	6.90	1469.26	78.07	1547.33
0992-8302	806.24	68.63	240.91	6.38	1047.15	75.01	1122.16
Tomcat	1132.79	84.50	332.73	20.54	1465.52	105.05	1570.57
Colossal	1095.60	58.20	447.99	47.98	1543.59	106.19	1649.78
Intruder	1048.34	103.34	220.11	35.64	1268.45	138.97	1407.42
Hunter	1074.33	104.48	251.39	29.15	1325.72	133.63	1459.35
Karisma	1336.66	84.56	214.61	20.80	1551.27	105.36	1656.63
Excursion II	1668.04	102.40	90.21	5.29	1758.25	107.69	1865.94
Plato	1180.73	109.20	203.30	58.31	1384.03	167.50	1551.53
Snapper	1202.39	83.76	81.34	9.13	1283.73	92.89	1376.62

There are a number of varieties with acceptable yields in this trial. There are several varieties that are resistant to races 1-5 bacterial leaf spot (BLS) in this trial. Since race 4 has been confirmed in New Jersey, consider trial plantings of the varieties with 1-5 resistance. If silvering is an issue with your market, pay particular attention to the following varieties which had the highest amount of silvering: Aristotle, Paladin, 0994-1819, 0991-7141, Tomcat and Colossal.

NEW TOOLS FOR MANAGING WORMS AND APHIDS IN PEPPERS

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In recent years several new, more selective, insecticide tools have been registered for use on fruiting vegetables. These products provide growers with a range of benefits over more traditional broad-spectrum insecticides such as organophosphates, carbamates, and pyrethroids. The new products are generally safer to use for the applicator, safer for the environment, have less impact on natural enemies, and are often more efficacious. Two important weaknesses however, are having a higher cost generally and being narrow-spectrum in their toxicity and not killing all the pests on the crop.

New Aphid Insecticides. Aphids, most notably green peach aphids, were reported as one of the most important insect pests in a recent survey of bell pepper growers and crop consultants in the northeastern and Mid-Atlantic states. Many of the traditional broadspectrum insecticides such as pyrethroids do not control the aphids, but rather cause aphid outbreaks by killing important natural enemies and stimulating aphid reproduction. Several new aphid insecticides have been registered on peppers including: Fulfill, Movento, and Beleaf (see Table 1). These insecticides provide safe novel modes of action to rotate with or in place of the widely-used neonicotinoid insecticides including Admire and Provado (imidacloprid), Platinum and Actara (thiamethoxam), and Venom (dinotefuran). Insecticide trials conducted in Virginia have shown that all of the aforementioned products provide excellent control of potato aphid and green peach aphid on vegetable crops with 1 or 2 applications at low rates.

New Lepidopteran Insecticides. Lepidopteran pests such as European corn borer, beet armyworm, corn earworm, and hornworm frequently require control measures in peppers in the Mid-Atlantic states. Several new IPM-friendly lepidopteran insecticides have recently been labeled for use on peppers, including: Radiant; Coragen; Synapse; Voliam Xpress; Durivo; Rimon, and Vetica (Table 1). These insecticides have performed very well in efficacy trials in Virginia (Table 2), where lepidopteran pest pressure is generally higher than that in New Jersey. These insecticides offer exciting new modes of action to combat some of our hardest to kill insect pests of peppers in the Mid-Atlantic states such as Beet armyworm; European corn borer, corn earworm; fall armyworm; green peach aphid, and leafminers.

Table 1. New insecticides labeled for use on peppers in recent years.

Product	*Active ingredient*	*Manufacturer*	*Target Pests*	*PHI (days)*
Movento	spirotetramat	Bayer CropScience	Aphids; whiteflies	1
Beleaf	flonicamid	FMC	Aphids; whiteflies; plant bugs	0
Fulfill	pymetrozine	Syngenta	Aphids	0
Radiant	spinetoram	Dow Agrosciences	All lepidopteran larvae; thrips; leaf miners	1
Coragen	RynaXypyr (= chlorantraniliprole)	Dupont	All lepidopteran larvae; leaf miners; whiteflies	
Synapse	flubendiamide	Bayer CropScience	Lepidopteran larvae	
Voliam Xpress	Chlorantraniliprole + lambda-cyhalothrin	Syngenta	Lepidopteran larvae; pepper weevil; whiteflies; leaf miners; stink bugs; and others	
Durivo SC (for soil application)	Chlorantraniliprole + thiamethoxam	Syngenta	Lepidopteran larvae; aphids; thrips; whiteflies; leaf miners	
Vetica	Flubendiamide + buprofezin	Nichino	Lepidopteran larvae; suppression of whiteflies	

Table 2: Control of lepidopteran larvae in bell peppers with soil-applied and foliar insecticides; Painter, VA, 2009. Trial 1:

Plant date: 17 Jul
Application dates: See table below
Data Collection: 10 Sep and 21 Sep

Target Pests: European corn borer
Beet armyworm
Corn earworm

Treatment	Rate / acre	Application Dates	% damaged fruit at harvest	
			10-Sep	21-Sep
1. Untreated Control			26.8 a	29.7 a
2. Synapse + biosurf	3 oz + 0.25% v/v	19, 24 Aug, 1 and 15 Sep	2.0 bc	2.9 bc
3. Alverde	16 fl. oz	19, 24 Aug, 1, 7 and 15 Sep	3.5 bc	2.6 bc
4. Durivo (soil)	10.3 fl. oz	19 Aug	3.3 bc	2.4 bc
5. Durivo (soil)	13 fl. oz	19 Aug	1.3 bc	7.7 bc

6. Voliam Flexi	7 oz	19, 24 Aug, 7 Sep	0.0 c	3.2 bc
7. Voliam Xpress	9 fl. oz	19, 24 Aug, 7 Sep	0.0 c	5.3 bc
8. Warrior II	1.92 fl. oz	19, 24 Aug, 1, 7 and 15 Sep	4.2 bc	1.3 c
9. Coragen 20SC (soil)	5 fl. oz	19 Aug and 1 Sep	13.5 b	9.3 b
10. Lambda-cy	3.84 fl. oz	19, 24 Aug, 1, 7 and 15 Sep	0.0 bc	2.3 bc
11. Vetica + biosurf	14 fl. oz + 0.25% v/v	19, 24 Aug, 7 Sep	0.0 bc	2.5 bc
12. Vetica + biosurf	17 fl. oz + 0.25% v/v	19, 24 Aug, 7 Sep	1.4 bc	5.1 bc
P-Value from Anova			0.008	0.0007

PEPPER INSECTICIDE TRIAL 2:

Plant date: 17 Jul
Application dates: Soil: 18 and 31 Aug
Foliar: 18, 27 Aug and 3, 14 Sep
Data Collection: 10, 16 and 28 Sep

Target Pests: European corn borer
Beet armyworm
Corn earworm

		% damaged pepper fruit at harvest		
Treatment	**Rate / acre**	**10-Sep**	**16-Sep**	**28-Sep**
1. Untreated Control		41.6 a	14.9 a	28.4 a
2. Coragen 20SC (soil)	5 fl. oz	5.0 b	1.9 bc	3.4 b
3. Coragen 20SC (soil)	3.33 fl. oz	1.7 b	7.9 ab	12.1 ab
4. Lannate LV (soil)	48 fl. oz	8.2 b	0.0 c	17.4 a
5. Vydate L (soil)	64 fl. oz	23.6 a	19.8 a	23.3 a
6. Mustang Max (foliar)	8 fl. oz	2.5 b	0.0 c	3.5 b
P-Value from Anova		0.0002	0.0013	0.0062

MANAGING WORMS AND APHIDS IN PEPPERS

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Within the past year of two, many new pest management products have been labeled that will help pepper growers protect their crop from several important insect pests of bell and non-bell peppers throughout New Jersey. Many of these new materials are not only very effective in protecting the fruit, but they also allow a wide range of application methods that give growers a great deal of flexibility in how and when they can apply the material to their pepper fields!

Cutworms

Bifenthrin is labeled for cutworm control both as a pre-plant or post-plant application. Capture LFR and can be applied pre-plant, mixed directly with liquid fertilizer or with water. Apply as a 5-7" band over the row or as a T-band over the open furrow, or in-furrow with the seed, or broadcast over the surface. Empower^2, Brigade, Bifenture, or Sniper can be applied post-plant, when pests are present.

Aphids

Several new-chemistry aphicides are available that are selective for aphids and whiteflies. Spirotetramat (Movento), flonicamid (Beleaf) and pymetrozine (Fulfill) can be applied with ground sprayers, and represent new classes of insecticides that are highly effective against aphids. Imidacloprid (Admire PRO) and thiamethoxam (Platinum) are very effective against aphids, and can now be applied in a variety of methods, including in-furrow spray at planting, transplant water treatment, hill drench, surface band at planting, soil shank injection, and through a drip/trickle irrigation system. Both of these still have foliar spray versions, also (Actara, Provado). And a new combination insecticide, thiamethoxam+chlorantraniliprole (Durivo, Voliam flexi), is effective against flea beetles, thrips and worms as well: Durivo can be applied through the drip/trickle irrigation system, and Voliam flexi is a foliar application.

European corn borer, fruitworms, armyworms

Several new-chemistry insecticides have recently been labeled that are very effective against all of the worm pests of pepper, including the tough-to-control corn earworm and beet armyworm. Both chlorantraniliprole (Coragen) and the ready-mixed thiamethoxam+chlorantraniliprole (Durivo) can be applied through a drip/trickle irrigation system. Further, Coragen can be applied in a variety of pre-plant or at-plant methods, including in-furrow spray at-planting, transplant water treatment, hill drench, surface band at planting, or soil shank injection. As fruit develops, many new options are available as foliar applications, including chlorantraniliprole (Coragen), the ready-mix thiamethoxam+chlorantraniliprole (Voliam flexi), the ready mix lambda-

cyhalothrin+chlorantraniliprole (Voliam xpress), flubendiamide (Synapse), and the ready-mix flubendiamide+buprofezin (Vetica). All of these are in addition to the many effective materials (and different class insecticides as well) already available for worm control on peppers, such as emamectin (Proclaim), methoxyfenozide (Intrepid), spinetoram (Radiant), tebufenozide (Confirm), and numerous pyrethroids.

In summary, growers have many more options to consider for pepper insect management. It's not just selection of a material, but how to apply it (pre-plant, in-furrow, hill drench, drip/trickle, foliar spray) but when to apply it (pre-plant, at-transplant, foliar when pests appear). Pepper growers need to plan ahead, consider their time requirements/needs, equipment capabilities, and have the materials on hand before planting to ensure a successful pest management program for the upcoming season.

FOOD SAFETY

SESSION

Traceback Systems for Food Safety and Third Party Audits

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Introduction

Traceback programs will become the cornerstone of every food safety program in the future. The U.S. Food and Drug Administration is in the process of finalizing their guidelines on produce tracking. Electronic tracking will probably be one of the recommendations which will require some computer expertise and possible specialized software. The bills working through the congress have some form of traceback system included. Until the final bill is signed we will not know what is expected.

Before someone moves into deciding which type of monitoring the operation undertakes think about what they want to accomplish with it. Make sure the system is compatible with other operations in the business Do not implement a traceback system for one customer then find out it is not acceptable for another customer. Build into the system what is needed and make sure modules can be added.

When looking at different systems, cost obviously is a factor, but it is not the only factor. If there is a recall, how fast you can locate the produce must be considered. You can have a $100,000 system, but if the product cannot be traced it is worthless.

Manual Systems

The simplest system is writing the actual date or a code on each carton or box with an indelible pen. Assuming the farm name and address is on the carton you have some of the information needed for traceback. A log with this information would be needed if there is a product recall. Each day the commodity, codes, number of boxes and where shipped would need to be recorded.

The next simplest system is the use of a hand-labeling grocery gun. There are different types of guns which will allow the farm to use a number system for fields, harvest dates,

harvest crews, etc. The sticker can be put on each box if packed in the field or boxes can be labeled in the packing house. Labels stick on waxed or non waxed boxes and there are glues which will allow labels to be applied to wooden crates. Following is an example of a number system. For example 16756169

167 = (date harvested) this could be the first day a grower picked or the Julian calendar date such as 167 for June 14 or use 614. This reserves the first three digits for dates.
5 = field number
6 = picker
169 = (packing date) which would be Julian calendar date 169 for June 16 or use 616.
At the end of the day record the beginning and ending numbers in a log book or computer.

Electronic Systems

Computer based systems can be as simple or complicated as desired. A simple system can start by using an excel file or other spread sheet or database program to record the data collected by hand. This gives a static record of the boxes packed and shipped which can be checked for traceback. It does not allow others along the shipping chain to track the product without recording the same information over or adding another tracking system to the container. The advantage to the grower is low cost. Most growers already have a computer system and a program that could be used.

There are several proprietary software sources in the market which will provide record keeping and traceback. They vary from a simple data entry program to ones that have scanners to record barcode information and enter it into the computer. With the more expensive systems those growers will need proprietary software, scanners and a special printer to print barcodes. These systems will run between $9,000-18,000. There are companies that will print the barcodes and send them overnight. There are some recurring costs depending on the system and whether the software is rented or purchased. These systems work best for large growers or cooperatives where the costs can be shared.

Most systems have been developed to comply with the Produce Traceability Initiative (PTI) that is being promoted by the Produce Marketing Association and United Fresh Produce Association. The PTI is based on using barcodes with unique numbers for each grower and product produced. These numbers can also store additional

information such as harvest date, packing date, etc. The numbers are maintained for a fee from the GS1 organization. Cost for the number and produce numbers will depend on how many produces are produced. For example, cilantro that is bunched is different from cilantro that is not bunched. Each one is unique and must have a separate commodity number. These barcodes printed and put on each box or container at packing. The information can then be scanned by each step along the marketing chain once they have a list of the codes.

The plan is to have the whole system in place by the end of 2012. There are many steps that are required before this system can be in place. The majority of growers have not bought into this system and it will take a majority to make the system work. There is still a lot of misunderstanding how the system will work. Also, retailers are still trying to decide whether they will use the system.

NATIONAL LEAFY GREENS MARKETING AGREEMENT: IMPACT ON NJ

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At the request of the fresh produce industry, the U.S. Department of Agriculture has proposed a National Leafy Greens Marketing Agreement to provide a mechanism to enable leafy green handlers to organize; to enhance the quality of fresh leafy green vegetable products available in the marketplace through the application of good agricultural production and handling practices; to implement a uniform, auditable, science-based food quality verification program; to provide for USDA validation and verification of program compliance; to foster greater collaboration with local, state and federal regulators; and, to improve consumer confidence in leafy green vegetables.

The amended proposal can be found at http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5078915. By publishing the proposal, USDA set in motion a deliberative process by which interested parties can comment on the proposal. USDA held seven hearings around the country to gather input from affected stakeholders. When USDA completes the process, the agency will determine whether there is enough support to move forward with the marketing agreement.

The proposed agreement sets out the parameters for the agreement: governance, guidance, duties of signatories (e.g. required food safety practices, record keeping).

It is important to understand what a marketing agreement can and cannot do. Marketing agreements are one tool USDA offers that help industry members come together to work at solving marketing problems they cannot solve individually. Marketing agreements are voluntary, in that no one is required to sign on to (join) them. However, when a company does sign on to a marketing agreement, then it must follow the requirements of the agreement.

The impact on New Jersey takes several forms. Certainly New Jersey industry members have had the opportunity to comment to USDA about the proposal. New Jersey handlers would be eligible to help govern the agreement, should it come to fruition, because the proposed agreement calls for representatives from various zones in the United States, including Zone 5, which includes New Jersey. In addition, the proposal includes establishment of a technical review board to assist the committee in

developing audit metrics, which provides another opportunity for involvement. Handlers would be able to sign on to the agreement; or they could choose not to.

On the marketing side of the agreement, there is a provision for a Market Review Board to advise the committee on retail, foodservice, and consumer issues that should be addressed to maximize consumer confidence through market acceptance and recognition of the program. This board would consist of nine non-voting members (retailers, foodservice operators, consumers, and university representatives). This could provide opportunities for New Jersey retail or foodservice buyers to participate on the marketing agreement.

The proposed National Leafy Greens Marketing Agreement comes after successful state-level efforts in California and Arizona. More information on each of those marketing agreements is available at http://www.caleafygreens.ca.gov/ (California) and http://www.azlgma.gov/ (Arizona).

AGRITOURISM

SESSION

INNOVATIONS IN AGRITOURISM MARKETING AND PROMOTION

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INTRODUCTION

Changes in the economy combined with fluctuations in agricultural income and the desire to preserve land and resources has placed increased pressure on farmers across the nation to examine alternative economic opportunities. In response, many farmers are turning to agritourism as a means of economic diversification. As noted by McGehee (2007), "When developed sustainably, agritourism can increase the long term potential for higher margin on-farm sales of value-added products and services, particularly for small farms in crisis" (p. 111). Moreover, "Agritourism is increasingly recognized as a means of enterprise diversification for agricultural producers, especially for its ability to increase cash flows to farms and ranch operations and in addition to their surrounding communities" (p. 1). As such, agritourism is a strategy being adopted by farmers to gain a competitive advantage and capitalize on the uniqueness of their farm and farming lifestyle. In turn, farms engaging in agritourism have the opportunity to remain sustainable by increasing profits due to increased sales from non-traditional agricultural practices (agritourism, providing farm-related experiences). For these reasons, agritourism has seen a recent growth in popularity across the nation. For example, in 2007, the USDA reported 160,000 US farms were participating in some form of direct sales/agritourism with receipts totaling $566,834,000, an increase of approximately 180% from 2002. Of these, 23,350 farms claimed income from non-produce related recreational activities, such as farm tours, hunting and fishing (USDA, 2007).

However, as the popularity of agritourism grows, competition in the marketplace is forcing many agritourism businesses to strategize and look for new ways to keep and grow their customer base. In addition to summarizing and reviewing current research surrounding agritourism (e.g., what do other agritourism businesses look like, what types of activities are other agritourism businesses offering), this presentation will also discuss the importance of creating an experience and using the Internet as strategies for marketing and promoting an agritourism business.

AGRITOURISM AND THE EXPERIENCE

Pine and Gilmore (1999) suggest that we have evolved from an agrarian economy, to an industrial economy, to a service economy, and are currently in an experience

economy. The authors suggest that in order to take advantage of the experience economy, memorable events must be available for customers. To better understand the experience economy, Daniel Pink (2006) describes the abundance gap which he suggests has prompted the rise of the experience economy. The notion of the abundance gap describes the contradiction that while we (as a society) have an abundance of things or material goods in our lives and have seen a steady rise in prosperity and standard of living, our general life satisfaction has not increased. This contradiction and lack of life satisfaction, as suggested by Pink (2006), has led us to seek meaning through experiences. With regards to our search for experiences and to the experience economy, the travel and tourism industry is largely dependent upon the experience. For many in the travel and tourism industry, the experience is what can set them apart from other attractions/destinations and is what will keep visitors wanting more.

In order to take advantage of the experience economy, it is suggested that those in the travel and tourism industry, including agritourism businesses, seek to incorporate personal narratives and good customer service into their daily interactions with visitors and into their marketing and promotional efforts. Narratives, or stories, play a key role in creating lasting visitor experiences. In the travel and tourism industry, stories acts as "an identity or an image, and the purpose of using storytelling is to be remembered and to mediate a feeling…storytelling facilitates the communication process between the tourism [hospitality] industry and their customers and it often strengthens customers' attitudes towards the attraction/destination [hotel]" (Ågren & Ölund, 2007). In short, stories are a persuasive tool that, when used correctly, allow visitors to gain meaning and provide a rich connection with visitors on an emotional and personal level. Additionally, with each visitor having an influence of 100, quality customer service is a must for creating positive experiences, attracting visitors, and for overall success. This presentation will include a discussion of the importance of creating an experience and will provide several real-life examples of how other businesses are successfully incorporating an experience into their product or service offering.

AGRITOURISM AND THE INTERNET

How agritourism businesses market and promote themselves is evolving from traditional strategies (e.g., print, radio, and television advertisements, faxed press releases) to newer strategies including websites and and social media. In short, social media refers to a form of communication in which interactions and conversations take place via the Internet. A few examples of social media tools include social and professional networks (Facebook, MySpace, LinkedIn), content sharing (YouTube, Flickr, Photobucket), blogging and microblogging (Twitter, Wordpress), wikis, podcasts, etc. Social media marketing is the use and engagement of these tools to generate exposure and sales. In today's tech-savvy and ever-changing economy, agritourism businesses cannot afford to be invisible in the world of social media. The impact and use of social media is staggering, for example: 68% of adult Internet users already use social media; 33% visit

social media sites to engage in product research before making a purchasing decision; 47% say social media sites influence their decisions to purchase specific brands or services; 26% of respondents changed their minds about purchasing a product after reading about it on a social media site; 91% say consumer reviews are the #1 aid to buying decisions; online users are 3 times more likely to trust peer opinions over advertising for purchasing decisions; Facebook signs up 600,000 new users daily (*Market Tools,* August/September 2008 Insight Report). This presentation will include a review of social media marketing, tips for using social media, and real-life examples of how various agritourism businesses are using the Internet and social media outlets to market and promote their business and the experience they offer to visitors.

Biography:
Samantha Rozier Rich is an Assistant Professor and Tourism Extension Specialist in the Department of Parks, Recreation, and Tourism Management at North Carolina State University. Dr. Rich's general research interests include aspects of tourism marketing and promotion, influence of media and promotional materials, and the use and creation of collaborative relationships among tourism entities. Her most recent research endeavors have included an examination of the use of travel narratives (travel articles versus travel brochures) in promoting travel to destinations. Additionally, Dr. Rich conducts research relating to agritourism marketing and promotion.

CONSUMER ACCEPTANCE OF AGRITOURISM ACTIVITIES

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Agritourism efforts have been steadily increasing in the New Jersey. Although agritourism has tremendous potential to increase the viability of New Jersey agriculture, very little research has been conducted to quantify consumer interest in these activities. In 2007, a survey of consumers in the Highlands region was conducted to quantify the level of participation in agritourism activities. A survey was mailed to 3,000 randomly selected households in the Highlands region of New Jersey. The survey consisted of a series of close-ended questions with additional space for write-in comments. The response rate was slightly higher than ten-percent (n=310). Forty-five percent of the respondents reported having an awareness of agritourism in New Jersey. Few respondents (n=93) reported having an understanding of Community Supported Agricultural activities with one-percent (n=3) reporting regular participation. Most (73%) reported freshness as the most important reason for purchasing from a local farm. Price was not a contributing factor when considering local farm purchases with 19% reporting price as the most important factor in their decision. Most respondents (81%) reported a willingness to pay a premium for agritourism activities with 10% reporting a willingness to pay 20%.

Although agritourism appears to be well accepted by New Jersey residents, producers should assess their goals before beginning any new business enterprise. Several factors should be considered including start-up costs, insurance requirements, labor and consumer demand before expanding a farming operation to include an agritourism component.

BIOENERGY OVERVIEW

SESSION

RUTGERS BIOENERGY OVERVIEW

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Many states are realizing that the utilization of renewable resources to supplement their energy resources can help to provide safe, secure, reasonably priced energy supplies and services to their customers, while reducing dependence on traditional fossil fuels and fossil fuel generation. In the interest of promoting a more secure, economic, and environmentally responsible energy future, New Jersey policy makers have established an over-arching goal for the state in its 2008 Energy Master Plan*: Reduce projected energy use by 20% by 2020 and meet 20% of the State's electricity needs with Class 1 renewable energy sources by 2020.* The combination of energy efficiency, conservation, and renewable energy resources, should allow New Jersey to meet any future increase in demand without increasing its reliance on non-renewable resources.

However, in order to achieve this goal much research is needed to determine the biomass capacity existing in the state, the potential energy that can realistically be derived from them with current and near-term technologies, and the development of new biomass resources, such as energy crops. In addition, analyses of the economic feasibility of bioenergy options and the development of effective policies are critical to ensure that viable strategies are successfully implemented. Given the complexity of these tasks, Rutgers University has been given the primary responsibility for addressing these needs in the state.

This presentation will provide an overview of the various bioenergy research and outreach projects currently going on at the New Jersey Agricultural Experiment Station and the Rutgers School of Environmental and Biological Sciences. Highlights include: switchgrass breeding, hazelnut breeding for high bio-oil content, energy from waste technologies such as anaerobic digestors and microturbines, as well as a summary of the 2007 Assessment of Bioenergy Potential in New Jersey. That research yielded six major findings about New Jersey's biomass resources: ***1)*** An estimated 8.2 million dry tons (MDT) of biomass is produced annually in New Jersey.[1] ***2)*** Of that 8.2 MDT of biomass, approximately 5.5 MDT (65%) could ultimately be available to produce energy, in the form of power or transportation fuels. ***3)*** New Jersey's estimated biomass resource of 5.5 MDT could deliver up to 1,299 MW of power in 2020 (9% of current

[1] This total includes biogas and landfill gas quantities converted to dry ton equivalents on an energy basis. This does NOT include biomass that is currently used for incineration or sewage sludge because these are not classified as Class I renewable feedstocks in New Jersey.

demand) or 335 million gallons of biofuel by 2020 (5% of current demand), if the appropriate technologies and infrastructure were in place to produce the bioenergy. ***4)*** Almost 75% of New Jersey's biomass is produced directly by the state's population, in the form of solid waste (e.g. municipal waste). ***5)*** This large proportion of waste-based biomass supports the recommendation that New Jersey pursue the development of an energy from waste industry. ***6)*** Agriculture and forestry management comprise the majority of the remaining biomass produced in New Jersey and therefore, are also important potential energy sources. The use of agricultural crops for energy production would require the decision to convert a portion of the current food supply chain into energy production, which could have other major policy implications.

BIOMASS ENERGY: OPPORTUNITIES FOR NJ FARMERS

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Why biomass? Why now?

2009 can only be described as a challenging year for New Jersey's farmers. The fickle weather and ailing economy allowed little room for error, reminding us that the business of agriculture is plagued with uncertainties.

With this in mind, New Jersey farmers are beginning to realize that there is one input they can control: energy costs. While energy costs have been on the rise in recent years, producers are now more than every able to take advantage of rich incentives at the state and federal level that encourage the production of renewable energy from solar, wind and biomass.

While solar and wind jumped to the head of the line because of their practicality and applicability in New Jersey, biomass is rapidly advancing, looking to keep pace with its predecessors.

What's available?

Biomass comes in many forms. It can be derived from plant and waste materials. What's more, it can be harnessed as a fuel source for heating oil and transportation and can also be applied to generate electricity. While the full scope biomass' potential as an energy resource is yet to be realized, a number of viable applications for this resource as a energy-producer exist, making biomass energy a very attractive option for New Jersey farmers.

Warm season grasses have been identified as a possible biomass energy option for New Jersey Farmers. Once harvested and baled, these grasses, most notably switchgrass and miscanthus, can be pelletized and burned as a heating oil resource. Perhaps most compelling is the possibility that these grasses can be grown as a complement to a farm's primary commodity. If incentives at the federal and state levels continue to fall into place and the necessary research is completed, warm season grasses may become a tremendous resource for farmers looking to offset energy costs.

In addition to warm season grasses, animal waste has been identified as a potential biomass resource. Using biodigestors, methane can be captured from animal and food waste and converted biogas. The best applications for methane recovery in New Jersey are yet to be identified, but it is possible that this biomass resource could be harnessed through the establishment of a cooperative of livestock or equine farmers who collectively contribute their animal waste for the purpose of large-scale methane recovery.

Biodiesel also presents a viable biomass opportunity in New Jersey. Biodiesel refers to fuels that are derived from food waste, cooking oils and animal fats, among other things. New technology exists that allows for small-scale biodiesel production. Where applicable, biodiesel could present a viable option for reducing transportation fuel costs for farmers.

There are a number of other biomass possibilities that may present themselves in New Jersey. While additional research will be needed to forward the establishment of sustainable biomass resources in New Jersey, it is clear that the aforementioned biomass resources may serve as the starting point for clean energy and partial energy independence for farmers.

Finding the Money to Make it Work

Just as solar and wind energy development in New Jersey has been largely dependent on incentives at the federal and state levels, biomass energy will need to be backed by a thoughtful set of incentive if it is to take on a sizeable role in the state's energy portfolio. While many of the incentives necessary to foster the success of biomass energy are already in place, it is critical that we pursue federal and state policies that further incentivize this energy option.

The state maintains an ambitious renewable energy portfolio of which biomass is a part. Currently, the state only offers incentives for biomass projects that produce electricity. When used for the production of electricity, biomass energy projects essentially enjoy the same lucrative incentives as solar and wind energy. However, limiting the available incentives to those projects that result in the production of electricity effectively discludes the production of biodiesel and growing warm season grasses for heating oil.

The state also participates the Regional Greenhouse Gas Initiative (RGGI) along with 9 other states in the region. As part of the RGGI program, participating states sponsor auctions during which utilities buy allowances to offset greenhouse gases they produce. Methane capture from livestock and equine operations qualifies as an offset under this program. The sale of credits may eventually emerge as a moneymaker for qualifying farms.

At the federal level, there are a number of programs in place to encourage the use of biomass energy on farms. One such program is the recently unveiled USDA-FSA BCAP program. The program provides matching collection, harvest, storage and transportation payments for eligible materials delivered to and purchased by a CHST qualified BCF, paid dollar-for-dollar, limited to $45 per dry ton, not to exceed a 2-year period.

Putting it all together

It is reasonable to assume that energy costs will continue to increase. High energy costs are a fact of life for farmers and New Jersey is no exception.

Solar and wind energy have enjoyed lucrative incentives and, as such, have become increasingly prominent in the state. It is only natural that biomass energy would follow closely behind. The resources and technology may be available to make biomass energy a viable option for farmers seeking to attain energy independence.

CUT FLOWERS

SESSION

CUT-FLOWER GREENHOUSE ROSE PRODUCTION

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Introduction

Cut roses are likely the most recognized and popular flower species found in flower arrangements and at florist shops and retail centers selling cut flowers. Greenhouse rose production has the distinction of also being one of the most intensively managed horticultural crops, with intensive labor requirements and very high applications of - and intensively managed - water, fertilizers and agrochemicals (pesticides). Due to its extremely high production costs, and stiff competition from cut flowers imports (from developing countries), extensive greenhouse rose production has been displaced in the U.S. and former rose growers have diversified their cut flower production palette to other species and commodities that allow them to be more economically competitive. Despite these circumstances, there is still a niche for high-quality cut rose flowers grown and commercialized locally.

Propagation and Rootstock Use

Greenhouse (cut-flower) roses are almost invariable grafted plants. These grafted plants were originally grown in the field (outdoors), with axillary buds of the desired cultivar (scion) budded (T-budding) into virus-free rootstocks and secured by wrapping. Three to 4-weeks later the shoot above the union was partially severed and in another 6-weeks the aerial part of the rootstock was completely removed. Harvesting of dormant grafted (budded) plants and grading started in winter (mid-December), and at this time the new shoot (scion) was cut back to 8-10” above the graft union. Nowadays greenhouse rose plants are produced by the stentling method. In stentling the start of the rooting of the rootstock cutting and grafting of the scion is performed in one action. The scion consists of the cultivar stem taken with one leaf and a dormant bud, which is grafted on a single internode of the non-rooted rootstock. Formation of the graft union and of adventitious roots on the rootstock occurs simultaneously, and the combined process takes about 3-6 weeks. The plant produced in this process is called a miniplant and is transplanted into the production system when the plant is 8 to 15 cm tall and has functional roots. Plants started from budding grafts (i.e. field-grown plants) are generally larger with stronger canes than miniplants. As such there is shorter time from planting in the production system to the first harvest of cut roses for the larger plants. Typically roses grown in the ground or in raised beds are started with the larger bud grafted plants while roses in hydroponic production are started with miniplants.

The production of greenhouse roses for cut flowers is primarily based on hybrid tea cultivars budded or grafted on clonally propagated rootstocks. Rootstock use has been

based on the observation that plant performance and flower productivity in grafted plants is higher than in plants growing on their own roots. Up until two decades ago *Rosa* 'Manetti' (syn. *R. noisettiana* 'Manetti') and *R. odorata* (syn. *R. indica* 'Major', *R. chinensis* 'Major'), and to a lesser extent *R.* 'Dr. Huey', were among the most widely used rootstocks by the greenhouse rose industry in North and South America. During the decade of 1990, however, the introduction of the South African *R.* 'Natal Briar', of unknown lineage, has practically and completely pushed aside 'Manetti' as the rootstock of choice, thanks to its induced vigor (to scion) and ease of propagation and grafting.

Rose Production Practices and Canopy Management

The U.S. market for cut roses is largely driven by seasonal demand, with Valentine's Day being its peak. This requires that growers manage their crops, mostly through judicious pruning practices, to deliver their cut flower flushes within a 1-week window of time. Fortunately the reproductive (flowering) biology of recurrent (perpetual)-blooming rose cultivars (mostly hybrid teas), along with careful management of greenhouse environment (light, temperature and humidity control), allows growers to timely meet their seasonal demand challenges.

Traditionally rose plants were planted in heavily-amended ground beds and the plants managed as tall hedgerows (up to 8-9 feet tall). Typically it takes from 5 to 8 weeks to produce a rose in the greenhouse, depending on variety, time of year, and light conditions. Flush (or peak) flower production for targeted days (Holidays) times usually involves a cycle of pinching and harvesting. This cycle of pinching or harvesting has the effect that within a few days a new shoot begins to grow in the leaf axils of the uppermost remaining leaves. It will then take 5 to 8 weeks until the resulting shoots are in flower and ready for harvest. The goal is to get new shoots to start growing at the right time and to then control the greenhouse environment to produce that flush of harvestable flowers within the target date. Assuming light is non-limiting for flower induction (roses are self-inductive), air temperature regulation controls the rate of shoot development (high temperatures can result in rapid development and poor flower quality). In this traditional in-ground production, flowers are harvested by cutting just above the first or second 5-leaflet leaf, which is left for photosynthesis and the development of a new stem. Throughout the growing season, the plants get progressively taller. During summer when prices are down, they are pruned back.

Around the last part of the 1980's decade growers in Japan and Europe started using a new canopy management technique of bending of undesirable stems (as a replacement for pruning and pinching). With this method rose stems are bent so that all but the bottom two nodes on the stem are bent down. Thus, the stem stops elongating and the buds in the leaf axils at the base of the shoot (below the bend) begin to grow, while those on the bent portion are inhibited. The new shoots are often much

stronger/longer because of the additional boost in carbohydrate supply from the bent shoots. Bending also allows for easier harvest and reduced plant sizes. Bending the stems allows light to penetrate the base of the plant, which increases the shoot quality by promoting the growth of strong basal shoots.

Miniplants are invariably the starting plant material for bent-production systems, and the first set of shoots in this small plants are not harvested but their flower buds removed (pinched) and then bent downward (above the second node from point of attachment to main stem). The bent stems supply photosynthates to shoots that develop from the basal buds. Flower shoots begin to be harvested once the plant is "built" to a certain size that will ensure good flower productivity and quality. Non-harvested (poor-quality) shoots are bent downward to provide axillary buds for the next cycle of flowers. Once the production system is in full production, the upper canopy contains only stems that produce flowers, and this process is repeated throughout the year, and plant height does not increase compared with the traditional hedgerow method. Because plants do not have to be pruned heavily to reduce height, production can continue uninterrupted. Longer stems are often produced in bent plants because there is no need to leave two five-leaflet leaves and the bent canopy provides extra growth potential (higher leaf area) for the growing shoots.

The bent shoot production system favors IPM practices by creating a spatial separation between the harvested flowers and perennial foliage. This facilitates biological control by permitting directed pesticide applications to the flowers, thereby conserving predatory mites in the lower canopy, which is where two-spotted spider mites (a major pest) generally occur.

Intensive fertigation management

Around the late 1980's growers in the U.S. began shifting their rose production from in-ground beds to intensively fertigated container and/or hydroponic systems. The plants are grown in a variety of potting substrate mixes (highly-organic or inorganic) placed in plastic containers of various shapes and sizes, and sometimes are even grown hydroponically (roots in direct contact with nutrient solution and/or supported with an inert/porous substrate). A common denominator in these production systems is the use of fertigation, that is the continuous supply of fertilizer in the irrigation water, delivered to the plants by via water lines and emitters. The goal is to supply the best balance of water and essential mineral (fertilizer) elements at all times. Fertigation is generally done several times per day, and managed by a computer, which delivers pre-programmed volumes of water and amounts of fertilizer salts (injected into the water). Theoretically, by optimizing irrigation and fertilization, hydroponically-grown plants can produce more flowers per unit area than soil-grown plants, and higher quality flowers more consistently.

One major consideration in these intensive fertigation methods is the fact that roses are considered a salt-sensitive species, and as such poor management of fertilizer

applications and/or the use of poor-quality irrigation waters can lead to reduced flower productivity and quality. Environmental pressures to recycle/re-circulate drainage and run-off effluents (which are massive) from greenhouse rose operations are a challenging proposition considering the sensitivity of this crop to salinity stresses.

Postharvest Handling

The two major considerations for the handling of rose cut flowers are hydration and temperature management. Adequate hydration is usually taken care by placing the harvested flowers immediately in clean (disinfected) containers with acidified water (pH 3 to 4). If the flowers are not to be graded or packaged after hydration, then they should be stored in these buckets with clean & acidified water in cooler rooms until grading/sorting/packaging.

Temperature management is of outmost importance throughout the postharvest market chain to ensure longer flower vase for the final consumer. The correct temperature for the storage and shipping of cut roses is close to the freezing point: 33-34°F (0.5 -1°C). Warmer temperatures increase the respiration of the cut flowers, increasing their rate of development and aging, and reducing their eventual vase life. Roses held at 50°F (a temperature that is commonly recorded during transportation of cut flowers) will deteriorate 3-4 times faster than roses held at 33°F. Failure to pre-cool cut properly, and inadequate temperature control during transportation, is particularly damaging to cut roses.

Key Insects and Diseases

The most common (and often most difficult to control) insects on greenhouse roses are Western flower thrips (*Frankliniella occidentalis*), the two-spotted spider mite (*Tetranychus urticae*) and sometimes aphids (*Myzus persicae, Macrosiphum rosae and Aphis gossypii*) and whiteflies (*Trialeurodes vaporariorum, Bemisia argentifolii*). Among diseases the most common are powdery mildew (*Spaerotheca pannosa* var. *rosae*) and flower botrytis (*Botrytis cinerea*). Extensive infestations of these insects and diseases cause reductions both in productivity (number of cut flowers per plant) as well as quality (flowers that are unsalable). A combination of cultural (pest mechanical exclusion, ventilation, temperature, etc.), chemical (chemistry rotation) and biological (IPM) practices are recommended to effectively and economically deal with insect and diseases problems.

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A COMPARISON OF ZINNIA VARIETIES

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Objectives of the flower trials

1) Did the varieties match the catalog descriptions? This includes colors, flower size, number of rows of petals and coloring patterns.
2) How long were the stems and were they straight?
3) What was the degree of disease tolerance?

'Benary's Giant' Mix

Catalog description: "Standard many growers are using; long strong stems; white, yellow, red, orange, pink, and deep pink; 2.5" diameter. Vigorous all-season producer, densely petaled blooms on 39 – 49" stems."

Trial Results: 2.5" diameter expectations were met and sometimes exceeded. This is truly the largest variety we grew. Blooms also commonly had more than one row of petals, flowers with single rows however were unattractive. Colors matched the catalog description of "white, yellow, red, orange, pink, and deep pink" and were appealing to the eye. Stem length was on average only 10" versus the 39 – 49" stems reported in the description. 71% of 'Benary's Giant' stems were straight enough to be used in a bouquet. This variety had good disease tolerance but would have benefitted from a fungicide regimen to prevent powdery mildew especially. No new varieties proved to be any more advantageous than 'Benary's Giant'.

'Oklahoma Mix'

Catalog description: "Old standard, double & semi-double; white, yellow, red, orange, pink, and deep pink; 1.5" diameter. Noted for its uniformity, clarity of color and sturdy 29.5 – 39" stems."

Trial Results: The statement of a small flower size of 1.5" diameter was accurate, which was the smallest flower size we grew. Blooms were often double and "white, yellow, red, orange, pink, and deep pink and typically had uniform, clarity of color. The stems were very small contradicting the catalog description of "sturdy, 29.5 – 39" stems". Our plots produced stems with an average of 8". Stem straightness was 82% but many were much too short to be used in typical bouquets. Disease tolerance for 'Oklahoma Mix' was moderate.

‘Peppermint Stick’

Catalog description: “Double blooms; bicolor and some solid colors - red, cream, yellow, orange, and pink; 2” diameter. Fascinating broken colored flowers - no flower is the same. Grows to 23.5 – 35.5“ tall.”

Trial results: The promise of flowers with a 2” diameter was not met. The average flower size in the trials was 1.5”. Some flowers were as large as the ‘Benary’s Giant’ but others were too small to use in arrangements. The other descriptions sometimes matched and sometimes did not “double blooms, bicolor, some solid colors - red, cream, yellow, orange, and pink, broken colored flowers”. Stem length as shorter than anticipated averaging around 9”. Stem straightness was 83% and disease tolerance was moderate.

‘Whirligig’

Catalog description: “Double blooms; bicolor: yellow-crimson, red-white, pink-white, cream-rose, and bronze-red; 2” diameter. The double flowers display an attractive contrasting color at the tip of each petal. Grows to 23.5“ tall.”

Trial results: This variety was the most variable variety in the trial by far. Bloom size description as accurate at 2” diameter. Flowers were not often double but were almost always bicolor. Colors were typically variations of pink and orange and often somewhat murky rather than clear. The average stem length as 9.5”. Stem straightness was only 74%. ‘Whirligig’ had the highest variability for disease incidence which may lead to a greater need for IPM scouting for disease pressure and treatments.

‘Zowie! Yellow Flame’

Catalog description: “Double blooms, 2006 All-American Selections Winner; bicolor - magenta center with petals orange tipped; 2” diameter. Grows to 29.5 – 35.5“ tall.”

Trial results: This was the most uniform variety of all, flowers were an average of 2” diameter, commonly double blooms, frequently bicolor - magenta center with orange petals. Average stem length was very short, however, 7.5” making many stems unsuitable for bouquets. Stem straightness was 81% straight. ‘Zowie!’ did not exhibit tolerance to powdery mildew necessary for direct marketing without fungicide or cultural intervention but proved to have good tolerance to bacterial leaf spot.

TOMATOES

SESSION

REDISCOVERING THE NEW JERSEY TOMATO PROJECT: TASTE EVALUATIONS - 2009

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Introduction

New Jersey has been known for years as a state which produces great tasting tomatoes. Unfortunately this reputation seems to be tarnished recently with some consumers expressing dissatisfaction with the taste and texture of tomatoes produced in NJ. This dissatisfaction may arise from many factors including the harvest of immature fruit, poor post-harvest handling, confusion in the market between NJ and out of state tomatoes, fertility and irrigation practices, etc. In order to help prevent further erosion of the New Jersey tomato reputation a team of Rutgers NJAES faculty and staff have began developing research trials and extension projects to address the issue of tomato flavor.

One component that is known to strongly impact tomato flavor and texture is variety selection. Recent breeding programs have released tomato varieties with increased emphasis on yield, shelf life, fruit quality and ship-ability; however, these programs have not always focused on flavor and eating texture. Comparing the flavor of tomato varieties recommended today with those recommended in years past will help indicate what role variety selection may be playing in recent consumer dissatisfaction.

Objectives

- Evaluate early and mid season tomato varieties for with emphasis on flavor and consumer preference

- Compare older hybrids with news hybrids to determine what role cultivar selection plays in consumer dissatisfaction

- Identify varieties with what consumers consider “New Jersey tomato flavor”

Materials and Methods

Field trials were conducted at the Snyder Research and Extension Farm in Pittstown, NJ as well as at the Rutgers Research and Extension Center (RAREC) in Bridgeton NJ. Current commercial varieties of fresh market tomatoes were planted as

well as past recommended varieties and newer varieties being touted for improved flavor. The following varieties were planted in the trials at both sites: (early season) Early Girl, Moreton, (mid season) Fla 47, BHN 589, Box Car Willie, Biltmore, Finishline, Sunbeam, BHN 665, BHN 826, DT-05-152, JTO-99197, Rocky Top, RFT 6153, Ramapo. At Snyder Farm only (early season) BHN 189, Early Goliath, Sunshine, Legend (mid season) BHN 964, Fabulous. At RAREC only (early season) Sunleaper, Polbig, Primo Red, Pik Red. (mid season) Scarlet Red, Crista.

The tomatoes were grown using standard commercial production methods with the exception of 6' foot stakes being utilized for some of the varieties that grow taller than standard determinant types. Tomato fruit was harvested from the plots vine-ripe and were completely ripened at room temperature. Ripe fruit samples were made available for flavor evaluations at several public tasting events. Tomatoes were washed, dried thoroughly, and cut into quarters. Samples were numerically coded and evaluators were asked to rate each tomato on the following attributes: sweetness, acidity, flavor, texture, overall on a 7-point liking scale (1=dislike very much, 4 = neither liked nor dislike, 7 = like very much).

Results and Discussion

Consumer flavor evaluations can be challenging since each taster has there own ideas and preferences to what the ideal tomato should taste like. Repeating evaluations with many consumers helps to reveal trends of which varieties consumers prefer for flavor. In the seven evaluations conducted the varieties which were preferred include (early season) Early Girl, Moreton, Polbig (mid season) BHN 826, BHN 665, Ramapo, Box Car Willie. Note that only BHN 826, BHN 665, and possibly Polbig would be firm enough for short distance wholesale markets. The other varieties would be best for direct marketing at roadside stands and farmers markets unless they are specially handled and packaged. It is also worth noting that the variety BHN 589 which had performed very well in 2008 evaluations was not preferred consistently in 2009.

TOMATO BREEDING FOR PEST RESISTANCE AND BETTER PROFITS

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The fresh market tomato breeding program at Rutgers was re-established in 2006. The primary objectives have been higher fruit quality with early maturity. Other important criteria for selection of new varieties are pest resistance, fruit size, and overall yield. Enhanced consumer flavor perception is being pursued as a longer-term goal. The initial releases will be in open-pollinated (OP) form, with the possibility that hybrids will be targeted at a later date. Hybrids are advantageous in tomatoes because many characteristics can be readily combined into a single population. Hybrid vigor has been reported in tomato, but the degree of increased performance is highly dependent on the gene pool utilized for its measurement.

During the 2008-2009 winter season, over 500 crosses were made among selections from summer 2008. Progeny were tested in comparison with checks in two breeding nurseries at the Rutgers Agricultural Research and Extension Center (RAREC). This report will focus on the late blight (LB) epidemic in one of the nurseries, and results of efforts to evaluate and select sources of resistance. Further, two breeding lines will be made available to New Jersey growers for testing during the summer 2010 season. The attributes of these populations will be described.

The appearance and seriousness of LB is highly dependent on environment, since the pathogen may be present in the absence of symptoms. The summer 2009 production season in southern New Jersey was ideal for the disease to flourish, and widespread destruction was evident. Symptoms were observed in the RAREC breeding nursery by August 10, 2009, and they became progressively worse over the coming weeks. This was made worse by a decision to avoid the use of chemical controls, so that genetic resistance could be identified.

Among the 115 entries in this particular breeding nursery, 5 were highly sensitive to the disease and 9 were highly resistant (see Figure 1). The remaining 101 populations fell somewhere between these extremes, and the distribution approximated a normal curve. The resistant populations were very diverse genetically. The varieties ‘Ramapo’ and ‘Rutgers’ (Liberty strain) were highly resistant, but the inbred parents of ‘Ramapo’ were not present in this nursery.

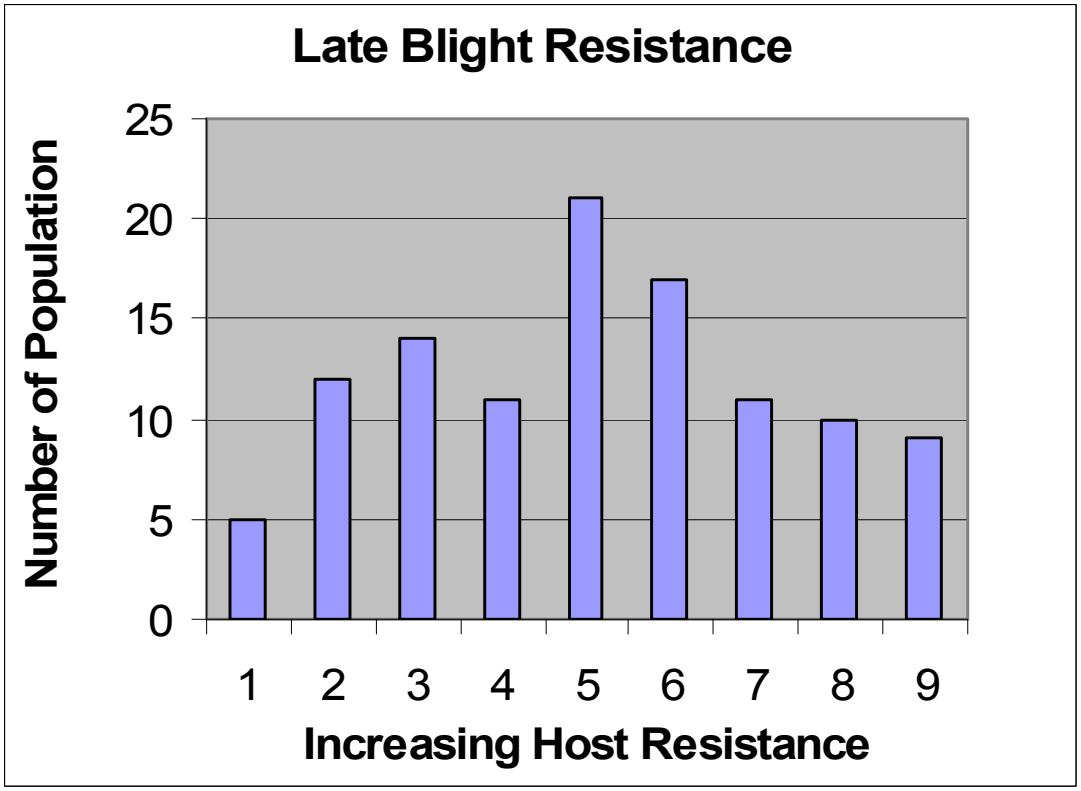

Figure 1. Distribution (number of populations) of disease severity (resistance rating = 9 and susceptibility rating = 1) among 115 tomato populations in the 2009 RAREC breeding nursery

Other resistant populations tended to include a parent derived from the cross of 'BHN684' x 'Early Goliath' (see Table 1). The most susceptible populations had a high representation of parentage derived from 'Applause', but 'Scarlet Red' x 'BHN589' was also highly infected (Table 1).

Table 1. Representative populations that exhibited the range in disease severity observed among 115 tomato populations in the 2009 RAREC breeding nursery

Disease Severity 1 = susceptible = high disease 9 = resistant = low disease	Population
1	[(Applause x 99-19-1-2) x Applause]S3 (Scarlet Red S2 x BHN589 S1)S1
2	'Applause'

4	‘Mountain Spring’
7	‘Celebrity’
9	(BHN684S5 x Early GoliathS1)S2 ‘Rutgers’ (Liberty strain) ‘Ramapo’

Future breeding efforts will focus on the genetic determinants for resistance found in the populations with low disease incidence, and particularly the transfer of resistance genes into commercially viable varieties for the eastern U.S.

The quest for better flavor is continuing. Over the past two years, research has been conducted on the role of fruit acidity and sugars in flavor determination. Data from the 2009 season have not yet been compiled and analyzed, but all observations to date support the conclusion that high acidity is associated with high flavor profile. Results from 2009 are also consistent with the conclusion that the inbred ‘KCA’ has a dominant gene that conditions high acidity. These results will be used in efforts to obtain populations that impart better flavor.

Advanced OP selections were also moved forward in the program towards release to commercial growers. Many populations were comparable to or better than popular commercial check varieties, but these observations were made in a somewhat unrepresentative season with regard to climate. Ultimately, successful releases must perform well consistently, and in many growing contexts in New Jersey. Consequently, two populations will be released to growers on a limited basis during early 2010. These populations are described in Table 2. Information pertaining to access to seeds will be disseminated at the VGANJ meeting.

Table 2. Advanced tomato breeding lines for limited release to growers for evaluation during summer 2010

Population	Description
TFS9014	Intermediate-late maturity (75-100 days); large, firm, globe Fruit; attractive exterior color; crimson interior fruit color; high yielding; Semi-determinate; VFNT background; moderately resistant to LB
TFS8023	Early (60-80 days); large, firm, globe fruit; attractive uniform exterior fruit color; crimson interior fruit color; high yielding; determinate; Not tested for disease resistance but with VFNT background; susceptible to LB

SEED HEAT-TREATMENT AS PART OF AN INTEGRATED MANAGEMENT PLAN FOR CONTROL OF BACTERIAL DISEASES

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Bacterial canker, caused by *Clavibacter michiganensis* subsp. *michiganensis* (canker), bacterial speck (*Pseudomonas syringae* pv. *tomato*), and bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*) are serious pathogens of tomatoes wherever they are grown. These diseases have been increasing in occurrence and severity in the northeastern United States. For many New Jersey tomato growers, bacterial canker is presently the most serious disease in the production system. A severe canker infection can result in complete loss of production, although losses when speck or spot are present in a tomato planting generally vary from none (minimal foliar injury) to significant yield loss, and are dependent on the source of the infection, weather conditions and cultural practices. To be effective, a management plan for bacterial diseases must integrate cultural and sanitary practices with chemical use. Seed heat-treatment is one cultural practice that prevents infected seed from resulting in losses to bacterial disease in the field.

Pathogen Survival and Spread

Infected seed is commonly identified as the source of bacterial infections, and while the speck and spot pathogens can be present on the seed coat, plants that are infected with bacterial canker will produce seed that may contain the bacteria both on and within the seed coat. Bacterial pathogens have been detected on living and dead plant material in infected fields, and canker cells are reported to survive on tomato debris (including seed) for up to 5 years if the debris is undecomposed. Survival is influenced by the depth to which the inoculum is buried, and the degree to which infested debris breaks down. Cells of all three pathogens will survive for relatively short periods of time in soil without solid debris.

Bacterial pathogens can survive for up to a year on infested tomato stakes, and presumably on greenhouse benches and plant debris within the greenhouse. Perennial solanaceous weeds like horsenettle may serve as overwintering hosts, and canker has been isolated from roots of this weed growing in fields without tomatoes for up to 2 years. Debris from annual solanaceous weeds like our nightshades may harbor canker through the winter as well. Additionally, solanaceous weeds serve as asymptomatic hosts on which the pathogen can multiply during the course of a growing season.

A common and serious means of dissemination is through transplant production. In this case, even low numbers of infected seed can result in widespread infections, as seedlings are in close proximity to one another and are handled frequently. Seedlings are also at risk for infection if tools, benches, etc. have not been cleaned properly, or there are potentially infected weed hosts or debris present in the greenhouse. Infected seedlings then are put into the field, where the infection becomes severe. In-field infections can originate from infected tomato plants, infected weeds, or infested debris and stakes. Once individual or groups of plants are infected, dissemination through the field is aided by cultural practices that injure the plants including tying, pruning, and harvesting as well as wind driven rain. Even injury as slight as breaking of the hairs (trichomes) on leaves and stems has been implicated disease spread. Infections are difficult to contain once they appear in a planting. The extent of the damage is largely related to the timing and method of initial of infection.

Management Strategies

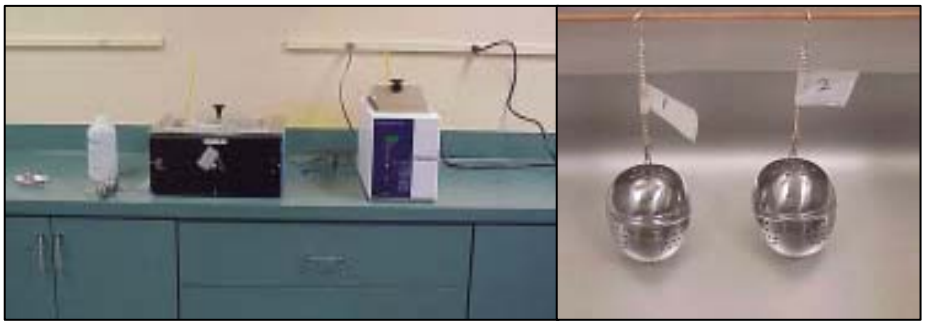
Start with pathogen free seed

Heat treatment of seeds is a non-chemical alternative to conventional chlorine treatments for the elimination of seed-borne pathogens. Heat treatment has the additional benefit of killing pathogens such as the bacterial canker organism of tomatoes that may be found within the seed coat. Heat treatment is particularly useful for tomatoes and other crops that are prone to seed-borne bacterial infections, including peppers and cole crops. Seed heat-treatment follows a strict time and temperature protocol, and is best done with thermostatically controlled water baths. Two baths are required; one for pre-heating, and a second for the effective (pathogen killing) temperature. Seeds are placed in porous containers (tea infusers, sections of window screen fastened at the edges with staples, etc.) and labeled by variety. It is important that the containers not be overfilled. Seeds must move freely so that hot water is in good contact throughout. The initial pre-heat cycle is for 10 minutes at 100ºF (37ºC) followed by the effective temperature cycle. The following, from Dr. Sally Miller of Ohio St. Univ. are effective temperature protocols for several important crop groups:

Seed	Water temperature		Minutes
	°F	**°C**	
Brussels sprouts, eggplant, spinach, cabbage, **tomato**	122	50	25
Broccoli, cauliflower, carrot, collard, kale, kohlrabi, rutabaga, turnip	122	50	20
Mustard, cress, radish	122	50	15
Pepper	125	51	30
Lettuce, celery, celeriac	118	47	30

Immediately after removal from the second bath, seeds should be rinsed with cool water to stop the heating process. Afterward, seeds should be dried on screen or paper, and

may be re-dusted with fungicide if desired. Pelleted seed is not recommended for heat treatment. Heat treat only seed that will be used during the current season.



Water baths (*left*), and tea infusers (*right*)

Transplant greenhouse preparation.

Use new flats, trays and pots. If re-using these containers, treat them in a chlorine bleach soak consisting of 5 gallons of 5.25% sodium hypochlorite (household bleach) per 100 gallons of solution. **Treat all benches and greenhouse surfaces with a commercial sanitizer** such as Greenshield, Physan, Prevent or Zerotol. Eliminate all weeds from the greenhouse, as they may serve as hosts for some pathogens.

Pathogen management during transplant production.

Try to maintain enough separation among flats that splashing between varieties is minimized when watering. This will help prevent spread among varieties should bacterial pathogens be present. **Apply streptomycin** at a rate of 1.25 tsp. per gallon beginning at the first true leaf stage, and again at 4-5 day intervals until transplanting. If transplants are purchased, ask the producer about their disease management practices.

Field rotation and management.

Maintain a 3-year minimum rotation on tomato fields. After a tomato crop is finished, remove plastic mulch and stakes (if used) and **incorporate all plant material into the soil** as completely as possible during the current season. This may entail mold-board plowing. This practice will help insure complete decomposition of debris, making it more difficult for the pathogen to survive long periods.

Eliminate all solanaceous weeds like nightshades and horsenettle from the field, as they are alternate hosts for canker. If they appear during the season, consider hand applications of glyphosate or paraquat to prevent prolonged survival.

Use new stakes, or if re-using old ones, wash them to completely remove soil and sterilize them. This is done by submerging the stakes for at least one hour in a solution consisting of 5 gallons of 5.25% household bleach per 100 gallons of solution, plus a surfactant to help gain penetration into the wood surface. If heat treatment of stakes is feasible, make sure the internal temperature of bundled stakes rises above 122° F for over one hour.

In-field pathogen management.

After transplanting, **treat tomatoes with Actigard at a rate of 0.33 oz . 50WG/A or 1 lb. ai of fixed copper per acre plus mancozeb at 1.5 lb 75 WP/A.** Either treatment should be repeated at 7 day intervals throughout the season. If applying fungicides based on a forecasting system such as TomCast, be sure to maintain the regular copper or Actigard treatments.

Sterilize tying and pruning implements. When plants are to be tied, place buckets of 5% bleach solution at the ends of the field, and have extra wands so that they may be rotated and sterilized at the end of each row. If plants are pruned, soak pruning implements frequently in a similar bleach solution to prevent spread of canker over greater distances in the field.

Avoid working in fields when foliage is wet. When it is necessary to work in more than one planting the same day, always work in the youngest planting first, even if no symptoms are present. This will prevent spread from older plants to younger ones, resulting in greater potential damage.

Seed heat treatment equipment and supplies:

Water baths

Many types of water baths are sold by laboratory supply houses, and depending on the size of seed lots you will treat, you may need larger units than those used by the RCE Vegetable IPM Program. We recommend a less expensive, analog unit for the pre-heat cycle, where temperature control is not as important, and digitally controlled unit for the effective temperature. The units are :

Carolina Water Bath, 110 V- analog unit from Carolina Biological Supply
http://www.carolina.com/

Precision Water Bath 2.5L; Digital Control; 115V 50/60Hz, 2.5A from Fisher Scientific
http://www.fishersci.com/wps/portal/CMSTATIC?href=index.jsp&store=Scientific&segment=scientificStandard

Teflon-Coated Mercury Partial Immersion Thermometers (2) (-20 to 110 C) from Carolina Biological Supply to monitor temperature in both baths.

Misc. supplies:

- Distilled water is recommended to prevent mineral deposits on the baths.
- Fiberglass window screen from which to make pouches for seed, or tea infusers.
- Twine or wire to suspend the pouches or infusers in the baths.
- Stiff wire or similar thin, rigid rod from which to hang the pouches/infusers.
- Labels for each seed lot.
- New envelopes for storing treated seed.

BLUEBERRIES

SESSION

NURSERY STOCK IS A POTENTIAL SOURCE OF *BLUEBERRY SCORCH VIRUS* IN NEW PLANTINGS

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Introduction. *Blueberry scorch virus* (BlScV) is one of the most pervasive pathogens of highbush blueberry. The disease was first described as Sheep Pen Hill disease occurring in New Jersey since the early 1970s and in the 1980s was described as blueberry scorch disease in Washington, with the causal agent identified as being a virus in the *Carlavirus* (Carnation Latent Virus) group. The period between infection and symptom expression, known as the latent period, may extend to years. The virus is vectored by aphids and typically spreads in clustered patterns in the field. Incidence of BlScV in New Jersey was mapped in several fields, based on symptom expression, using hand held global positioning system (GPS) units. It was observed that although older fields typically exhibited the expected radial pattern of symptom development, random distribution was often seen in young fields. Random distribution is inconsistent with aphid-vectored infection, suggesting another source of BlScV introduction.

It was believed that the virus might be introduced on infected nursery stock. Since highbush blueberry plants are asexually propagated through cuttings or tissue culture and the plant materials are usually collected from mature 'mother' plants, BlScV may be spread through symptomless rooted cuttings. To examine this possibility, cuttings of the cultivar Duke were collected from asymptomatic potentially infected and non-infected mother plants and rooted in propagation beds. The objectives of this study were 1) to determine if BlScV was present in any of the mother plants, 2) to determine if cuttings from BlScV infected mother plants would root under typical propagation conditions and 3) to determine, if the cuttings from infected plants did root, the extent to which the cuttings were virus infected.

Incidence in asymptomatic mother plants. The mother plants, from which the materials for this project were collected in March 2002, remained symptomless

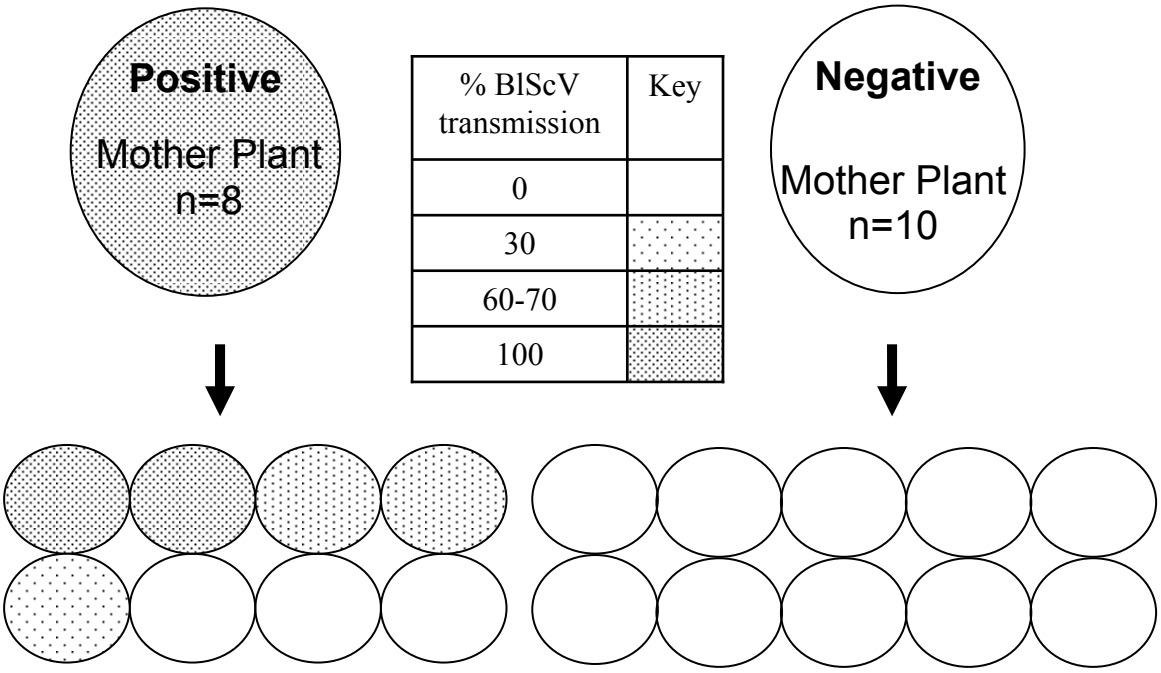
throughout the 2002 growing season. Although symptoms can vary among cultivars, symptoms typically include necrosis of flower buds and a twig dieback giving affected bushes a 'scorched' appearance. Leaf symptoms can appear later in the season and range from a red 'line pattern' to complete necrosis. ELISA testing of leaf samples collected from the original 18 mother plants showed 8 were infected with BlScV. Cuttings from both positive and negative mother plants established in the propagation beds and did not show obvious symptomatic differences.

Survivability and rooting of cuttings. Some cuttings from both infected and uninfected mother plants survived and rooted. However, the percent survival was significantly ($p<.0001$) lower in those from infected plants. After one year, only 47% of the cuttings from infected plants survived versus 71% for cuttings from uninfected plants.

Transmission of BlScV into cuttings. All of the surviving cuttings were tested for BlScV by ELISA. None of the negative mother plants yielded cuttings that tested positive. The percent transmission of BlScV from infected mother plants varied from 0 (three mother plants) to 100% (2 mother plants), while 3 plants showed transmission from 30-70% (Fig. 1). It is interesting that all infected mother plants (3 of 8) did not yield infected cuttings. This may not only be because virus titer variation within and between infected mother plants, but also because of the increased mortality in the cuttings from infected mother plants.

Conclusions. The findings that some mother plants were infected, that cuttings from these plants can survive and that some surviving cuttings were BLScV infected, suggest that nursery stock can be an important source of virus introduction in new fields. With this in mind, we recommend that; 1) Mother blocks be tested each year for potential BLScV infection, 2) that cuttings for propagation never be taken from mature plants in the field as these may also harbor infections, 3) maintain an aphid control program even in cutting beds to help prevent post-cutting infection and 4) purchase rooted cuttings only from certified nurseries.

Fig 1. Transmission (percent) of *Blueberry Scorch Virus* from mother plants to rooted hardwood cuttings.



TREE FRUIT

SESSION

ROOTSTOCKS FOR PEDESTRIAN AND HIGH DENSITY PEACH ORCHARDS

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Peach seedling rootstocks including brachtytic dwarfs rarely reduce scion growth more than 10-15%. Until recently, size control in peaches through the use of rootstocks of other *Prunus* species and hybrids has not been achieved satisfactorily due to incompatibility or poor tree vigor. Without graft compatible, size-controlling rootstocks such as in apple, the use of intensive training systems for pedestrian U-pick orchards for retail growers were not practical or efficient due to shading of the lower fruiting zones and excess pruning costs. Fortunately, new dwarfing rootstocks for peaches are being developed that have reduced vigor and good graft compatibility with little or no reduction in fruit size and quality.

Current available rootstocks in the U.S. that adequately dwarf peach varieties without significant incompatibility problems include the European rootstocks Pumiselect®, a *Prunus pumila* selection developed in Germany, and Krymsk®1 (formerly VVA-1), a *P. tomentosa x P. cerasifera* hybrid from Russia. Pumiselect® and Krymsk®1 produce trees that are 60-70% and 50-60%, respectively, the size of trees grown on peach seedling rootstocks such as Lovell. In addition a new release from California, Controller 5, which is a *P. salicina* x *P. persica* hybrid, has shown good compatibility with peach varieties and produces trees ~50-60% of normal size.

Pumiselect® (Tree Connection, Dundee, Oregon) is resistant to root-knot nematodes (*M. javanica*) and tolerant of sandy soils and drought, but is susceptible to waterlogging, oak root rot (*Armillaria tabescens*), and sometimes exhibits uneven anchorage leading to leaning. Peach fruit size on Pumiselect® rootstocks has been smaller than on Lovell in the NC-140 national rootstock trials. Other selections of *P. pumila* such as Mando have been poor hosts for ring nematodes (*Mesocriconema xenoplax*), but in California Pumiselect® was no better than Lovell seedlings in resistance.

Krymsk®1 (Tree Connection, Dundee, Oregon) is a very dwarfing rootstock for peach but unlike Pumiselect® maintains good fruit size. It has not performed as well in hot (i.e., >90^{o}F) summer climates like South Carolina, but would be a good candidate for very high density plantings. The main problem or concern with it is some delayed incompatibility with some peach cultivars, and it has been incompatible with some

nectarines tested on it. However, if the proper scion varieties are selected, it could make a pedestrian type orchard.

Controller 5 (UC Davis, USDA, California) has potential in high density orchard systems, but still is in the testing stage of development. This rootstock does not runt the tree and is very productive. However, it may have some fruit size and bacterial canker issues, so more testing is needed. It also is a good host for root-knot (*M. incognita*) and lesion (*P. vulnus*) nematodes. When used as an interstock, it is semi-dwarfing (70% normal size) but fruit size has been normal, so though interstems are more expensive, it may be an option if fruit size needs to be maximized or maintained.

Several cold hardy plum rootstocks that are used for peach in marginal northern climates appear to dwarf peach varieties under these cold conditions by 20-30% (i.e., 70-80% of standard peach size). These rootstocks include a *Prunus americana* selection from Bailey Nursery (St. Paul, Minnesota) and St. Julien A, a selection from a plum population derived from the European plum species *P. insititia* and *P. domestica*. This *P. americana* selection is still being evaluated by researchers but it appears to reduce growth at least 20-30% though root collar suckering and some early symptoms of off-green leaves have been observed. St. Julien A is compatible with many peach cultivars; however, it is not used much because of its sensitivity to pathogens such as bacterial canker (*Pseudomonas syringae*) in warmer climates.

An older St. Julien rootstock that was extensively tested but ultimately abandoned is GF 655/2. GF 655/2 has a rather shallow root system that does not adapt well to droughty soils, but it is fairly tolerant of heavy, waterlogged soils, crown gall and replant conditions. It also produces low vigor trees with satisfactory fruit yields. Therefore, this rootstock is suitable for high density planting systems in pedestrian orchards. However, GF 655/2 suckers profusely and can “runt” a peach tree, which is why it probably is not used much.

Future U.S. dwarfing rootstocks for peach include a release of an old (i.e., 1957) USDA plum variety, Hiawatha (*P. besseyi x P. salicina*), which has been a semi-dwarfing (80% normal size) rootstock in tests. Trees on Hiawatha are very productive but there is some off color in the leaves on older trees so delayed incompatibility could be a problem if viruses or other factors affect the tree. This rootstock also is sensitive to root-knot and lesion nematodes and may be too large for a pedestrian orchard.

Soon to be released rootstocks from the U.C. Davis breeding program are selections in the HBOK series, which was developed from a cross between Harrow Blood and Okinawa peach rootstocks. HBOK 10 and 32 are semi-dwarfing producing trees of about 80% of normal tree size. HBOK 28 is slightly more dwarfing (70% of normal) and may have better fruit size than Controller 5. It also may have better bacterial canker resistance, and it appears to be overall better than HBOK 10 and 32.

The availability of dwarfing and semi-dwarfing rootstocks for peach has been long awaited by peach growers. Though some of these rootstocks show promise, growers need to be aware that the degree of dwarfing of these rootstocks will vary with the climate, soil type, endemic diseases and site history. Therefore, until there is geographic testing and scion screening for compatibility, it is difficult to predict how these rootstocks will perform as size controlling rootstocks on your farm. However, there now appears to be some rootstock options for peach growers who want smaller trees for their commercial operations.

INTEGRATING ORCHARD SYSTEM AND MECHANIZATION FOR LABOR EFFICIENCY

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Peach growers in the United States have used the open center or vase-shaped pruning technique to train trees for more than 100 years. Due to increased production costs and market competition, growers are now looking to increase orchard efficiency through new management techniques including new cultivars and tree training methods. Since size-controlling peach rootstocks are relatively new and untested, growers have been adopting training systems such as the perpendicular V (Kearney V or KAC-V), the quad-V, and now more recently the hex-V, which all increase tree numbers per acre. As these systems are being integrated into peach production culture, they are also requiring more hand labor. Therefore, modifying peach tree form so that it can facilitate mechanization of thinning and harvesting would decrease the need for labor and thus ultimately reduce production costs. To reach this idealized orchard system, new peach varieties with unique architectural branching and high density training systems need to be adapted or tweaked to be used effectively with recent and still developing mechanization technology.

The diversity of tree forms (e.g., columnar, upright, weeping, compact) in peach make it possible to “design” a tree that is easy to mechanically manage. Breeders are trying to combine quality fruit characters with machine friendly architectural forms to aid in mechanization of tree fruit production. Two columnar type peach releases, Crimson Rocket and Sweet-N-Up, from the USDA Appalachian Fruit Research Station in Kearneysville, West Virginia exhibit a phenotype with either a pillar (columnar) or an upright growth habit, respectively. These varieties have compact, genetically determined canopies with vigorous vegetative growth, thus requiring management and training techniques different than standard type peach trees. These genetically controlled branching habits are conducive to producing geometrically aligned canopies that can be more efficiently mechanically flower or fruitlet thinned and harvested with self-propelled platforms. Moreover, a series of these novel peach varieties are being developed at Kearneysville to cover the entire harvest season.

Though commercial peach rootstocks are not amenable to some training systems due to either poor or excessive growth, most trees on peach seedling rootstocks such as Lovell can be managed with careful nitrogen management and summer pruning. In addition, new semi-dwarfing peach rootstocks are becoming available to use in higher

density plantings to control tree vigor. Selecting the right vigor rootstock for the desired training system can facilitate orchard management and production efficiency.

In order to ease the adoption of machine-aided production of tree fruit, training systems such as the perpendicular-V, the quad-V, and the hex-V, which maximize light interception and simplify many labor tasks, help the transition of replacing hand labor with increased mechanization. These training systems can be effectively used for peach in the Mid-Atlantic Region.

The desired effect of new varieties, rootstocks, and technology would be to have uniform geometric orchard systems (e.g., V-systems) that are conducive to pruning, thinning, and harvesting with mechanical aids such as the topper hedgers (not necessarily recommended as better machines are in development), the Darwin or similar mechanical thinners, and picking platforms. Furthermore, current research in robotics will allow precise branch or flower removal and even pick fruit at a specific color, firmness or sugar content. Moreover, geometric orchard systems allow uniform, tight spacing and provide the grower another tool to increase yields in the early years of the orchard to pay back establishment costs more quickly. In contrast, the common open center or vase system traditionally employed by peach growers would be difficult to mechanize since each tree, though similar, is still unique in its form and may not be uniform enough to permit the use of some types of mechanization (and/or labor efficiency).

Mechanization technology is rapidly advancing for tree fruit culture in the U.S. after being practiced in Europe for much of the past 10+ years. Machinery developed in Europe such as the Darwin string thinner and numerous self-controlled picking ladders and platforms are both reducing the number of hours and increasing the efficiency of labor in the orchards. As an example, tree fruit can be thinned mechanically at the blossom or early fruit development stages to ensure larger, higher quality product. This management practice, typically performed by hand, is a labor-intensive and expensive activity. Development of methods to mechanize thinning is a top priority for the tree fruit industry. The Darwin string thinner (Fruit Tec, Germany) has the capability to operate in both vertical and horizontal orientation for high density training systems. In addition, a drum shaker prototype (USDA, Kearneysville, WV) for green fruit thinning with design features based on previous testing of mechanical harvester prototypes is nearing its final stages of development.

Now that mechanization is likely to become more prevalent in the orchard, robotics will be the next technological advancement in tree fruit production. Robotics will permit specific targeting of individual flowers, fruit, and shoots and will facilitate “machine vision” for selective fruit thinning and shoot removal. Sensors will be used to detect the trees and control the position of the thinner/pruner relative to the canopy for maximum efficacy and tree safety. Lasers will do the job of hands or pruners in this proposed scenario. “Machine vision” combined with novel precision technology such as lasers should lead to dramatic increases in orchard management efficiency. The future is now closer than ever for robotics to meet the need of an uncertain and increasingly costly agriculture workforce.

APPLIED EFFORTS IN RENEWABLE ENERGY

SESSION

IS WIND ELECTRIC SUITABLE FOR YOU?

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Part 1 of my presentation will address wind site assessment and wind turbine placement, along with a few potential zoning issues and NJ BPU REIP (Renewable Energy Incentive Program) rebate calculations. Topics to be covered include:

- A brief history of wind electric
- Wind site assessment
  - Wind maps
  - Site assessment priorities
  - Turbulence
  - Wind Direction
  - Interpreting a wind rose
  - Site specific example – Princeton, NJ
- Wind turbine sizes
- Types of towers
- Wind speed and tower height
- Tower sizing considerations
- Airport and FAA considerations
- Sound (not noise)
- Wind turbine bird fatalities
- Annual electrical use, wind turbine production and NJ BPU (Board of Public Utilities) REIP (Renewable Energy Incentive Program) calculations
- Historical JCP&L rates
- Wind siting summary

Part 2 is a picture slide show of an installation of a 20 kW wind turbine on a 120' free standing lattice tower, which will familiarize the participants with the construction aspects of a wind turbine installation.

Part 3 will address some of the current drivers for wind power and include brief financial modeling that notes available NJ State rebates, USDA renewable energy grants, and current Federal tax credits, as well as a slide comparing solar and wind electric installations.

- Current drivers for wind power
- Financial Modeling
    - 15 kW wind turbine
    - 20 kW wind turbine
    - 50 kW wind turbine
    - 100 kW wind turbine
    - Solar vs. Wind

This is a Power Point presentation and includes a total of 66 slides. It is available on the NJ Farm Bureau website home page, http://www.njfb.org/, on the left side toward the bottom under, Click here for the Roger Dixon presentation on wind power.

SOLAR ENERGY ON THE HLUBIK FARM

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Most everyone here has probably heard all the numbers concerning solar energy production. So instead of just repeating all that information, I would like to tell of my experience with the system I have installed.

Sun Farms network installed two sets of solar panels at our farm. Both are ground mounted systems, one is a 24kW system which powers my farm market and greenhouses, the other is a 12kW system for my house and farm shop. The 24 kW system has been in operation for two years and the 12kW system has been in operation for seven months. Both systems have performed without any problems to date. Output has been at or above the predicted generation, despite the many cloudy days. The abundance of rainfall meant less electrical use for the farm market as the irrigation well also is connected to this system. My electric bill for the farm market this year consisted of a monthly service charge of $2.50.

On writing this I do not have enough data for the house system as to my total savings, but my last bill was $ 20 instead of $ 240. The solar RECS generated have been very helpful in paying for the system. I currently have a contract for $650 each for this years credits and I have heard numbers above $700 each. The market for credits seems to be strong even though prices are predicted to fall.

USING LANDFILL GAS TO GENERATE ELECTRICITY AND HEAT

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Introduction

The recent installation of a 250 kW landfill-gas fired microturbine system at the New Jersey EcoComplex Research and Demonstration Greenhouse provides a unique opportunity to further study the economic impact of such installations on greenhouse production. Of the 250 kW electricity output, a significant portion will be returned to the utility grid, generating a secondary income stream for the greenhouse operation. The combustion heat (contained in the stack gasses) is diverted through an air-to-water heat exchanger and the captured heat (hot water) is used to help heat the 1-acre greenhouse facility. By generating electricity and capturing 'waste' heat, overall system efficiency is very high compared to conventional heating systems.

The main challenge for an operator of such a microturbine will be how best to determine what the most economical methods are for using the generated electricity. This decision will be influenced by the desired greenhouse environment (particularly whether there is a need for supplemental lighting), desired greenhouse crop growth and development, crop disease and pest pressures, crop schedules, crop prices, weather conditions, as well as the (constantly fluctuating) electricity prices. Managing such a complex system on a day-to-day or perhaps hour-to-hour basis would require a significant effort as well as detailed knowledge of the various parameters (both internal and external to the greenhouse production system) impacting the ultimate economic outcome.

Rationale

The greenhouse industry, like many other industries, is faced with significantly increased energy prices compared to just a few years ago. Compared to industrial and residential buildings, greenhouse facilities are less well insulated since their main purpose is to let as much sunlight in as possible. As a result, the energy use on a square foot basis is high (as high as 80-120 Btu/hr per square foot of floor area), resulting in a significant economic

impact. The greenhouse facility selected for this project is located adjacent to a working landfill and had been heated with captured landfill gas (i.e., a gas pipeline was already installed). The microturbine provides both electricity and heat to the greenhouse facility, thus boosting the conversion efficiency from landfill gas to energy and using a resource that is currently underutilized (i.e., it is flared off, contributing to the 'greenhouse' gasses released into the atmosphere). What we lack is a careful evaluation of all internal (greenhouse) and external (weather, electricity prices) parameters impacting the economic outcome of the decision how best to use the generated electricity. Such an evaluation will result in operational guidelines that will be tested and made available to the greenhouse industry. The monitoring and control equipment associated with the microturbine will provide detailed information about system performance. While this project uses landfill gas as a fuel source, the decision support system we hope to develop can also be used for microturbine systems operated on natural gas.

Project description

The research project aims to develop a decision support system that provides recommendations for the most economical use of the generated electricity. First, operational data will be collected both from the microturbine system, the greenhouse environmental control system, as well as local (dynamic) electricity prices to investigate whether particular trends can be found and whether general system operation guidelines can be established. The developed general system operation guidelines will then be tested and refined. The expected project outcomes include: 1) Operational guidelines for the most economical use of landfill-gas fired microturbines installed at commercial greenhouse facilities, 2) Better understanding of the potential impacts of fluctuating electricity prices on the economics of operating landfill-gas fired microturbines installed at commercial greenhouse operations.

Acknowledgements

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SOLAR ENERGY FOR NJ FARMERS

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New Jersey leads the nation in the growth of the solar (photovoltaics) energy industry. As of October of 2009, 4,522 solar projects have been established to date in NJ with $292 million dollars in rebates to owners generating108,088 kW. As of this same date, 46 solar projects have been completed on farms generating 839 kW with the help of 3.2 million dollars in rebates to offset construction costs. The use of solar by New Jersey farmers has been on the rise since the advent of the states solar financing model. An important component of that model is the Solar Renewable Energy Certificate (SREC) Program and the corresponding Solar Registration Program (SRP). Registration for owners of new solar installations must take place before construction begins in order to be eligible for SREC credits. Once registration and construction is complete, solar-project owners are issued a New Jersey Certification Number. Certification numbers allow solar project owners to create SREC credits.

One SREC is earned once a registered solar installation generates 1,000 kWh of electricity. Each SREC is recorded in the project owners electronic account. The SREC credits are then sold on the Generation Attributes Tracking System (GATS) to generate revenue to the owner of the solar installation. SREC credit prices can vary throughout the year, depending on the market value.

The current finance model to encourage solar energy production sites in NJ is a model that has encouraged the most progressive growth of this industry in the nation. If businesses had to pay total out of pocket costs for solar, it would be difficult to justify the expense. SREC credits at current prices allow investors the ability to pay off their investment in 8 to 12 years in many cases.

Most companies will provide a site analysis to determine if solar power is right for your farm. Established structures can often be used to support solar panels if the orientation of the building is satisfactory and the roof can support the additional weight. In many cases, growers have installed ground mount systems which can range considerably in price depending on the installer.

In this lecture, I will review basic points to consider when installing solar energy on your farm and provide information on how to determine the best system for your farm.

AG MEDIATION & LEADERSHIP

SESSION

AG MEDIATION AND LEADERSHIP:
THE NEW JERSEY AGRICULTURAL MEDIATION PROGRAM

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Sometimes, despite even your best efforts to prevent or resolve a conflict, the dispute doesn't go away.

A neighbor may continue to complain about something you feel is a common farm practice. A local official may interpret an ordinance in a way you feel does not offer enough flexibility. The person you rent some land from may be interfering with your ability to farm. A workplace issue between a few employees, or between a manager and a subordinate, keeps coming up. A farmer and his lender cannot get on the same page. Or the co-owners (perhaps family members) of a farm keep disagreeing about management and other issues.

In these types of cases – when the leadership strategies for addressing conflicts (i.e., the strategies shared by the other speakers) are not enough to resolve the matter on their own – the New Jersey Agricultural Mediation Program may be able to help.

Program Overview

The Agricultural Mediation Program is coordinated by the State Agriculture Development Committee (SADC) to help farmers and others resolve agriculture related disputes quickly, amicably, and in a cost-effective manner.

Mediation is a voluntary process in which a trained, impartial, and certified mediator helps the parties in a dispute examine their mutual problems, identify and consider options, and determine if they can agree on a solution. The job of the mediator is not to impose a solution, but to rather facilitate the discussion. In fact, the mediator has no decision-making authority – he or she is not an arbitrator – so successful mediation is based on the voluntary participation and cooperation of all the parties.

The mediation program is a free service, as the SADC pays the cost of the independent mediator. Mediation is also confidential and generally takes only a meeting or two to complete. Additionally, each mediation session is scheduled at a mutually convenient time and place (a meeting room at the local Rutgers Cooperative Extension county office is typically reserved) and typically last only a few hours.

There are currently 12 individuals on the program's roster of trained mediators. Their backgrounds include agriculture, law, social work, management, sales, and more.

Types of Disputes the Program Mediates

The Agricultural Mediation Program can be used to help resolve any type of agriculture-related dispute. This includes Right to Farm disputes, i.e., disputes between farmers and neighbors or between farmers and towns, as well as USDA program disputes, e.g., agricultural credit disputes between farmers and the Farm Service Agency. Mediation can also be requested to help with other general farm issues or conflicts, e.g., intra-farm family or intra-farm business disputes. Whenever a dispute involves a farmer and agriculture, the program is available to help.

The following is a sample of some of the specific issues for which mediation has been used over time:

- USDA agency related
    - Loan denials
    - Agricultural credit issues
    - Conservation program disputes

- Right to Farm (RTF) related
    - Water runoff
    - Manure management/odor, flies
    - Equipment storage
    - Food processing by-product land application
    - Farm market plant display
    - Nursery and greenhouse activities
    - Horse events
    - Crop gun/cannon
    - Deer fence installation

- Miscellaneous (non-RTF) issues
    - Neighbor's ATV use disturbing farm animals
    - Ditch maintenance of municipal road
    - Use of a town road for accessing the farm
    - Electric company's vegetation management practices
    - Co-owner dispute about having events on the farm/liability

The above list notwithstanding, sometimes the issues in a dispute extend beyond just a specific farm practice or whatever other issues the parties have cited. There may be personal relationship issues, or the parties simply may not have all the information yet, with the result being that the parties form inaccurate ideas about the other's actions and motives (to fill in the information gaps).

Program Benefits

One of the benefits of mediation is that it provides a forum in which the parties can express their points of view and overcome any miscommunication or misunderstandings. The mediator serves as a skilled facilitator in this process, helping the parties to narrow their issues and look for solutions.

Another important benefit of mediation is that it can save farmers and others time and costly legal fees. With regard to Right to Farm disputes, the mediation program exists as an alternative to the lengthy public hearing process. Mediation also allows disputing parties to retain control over shaping a matter's outcome, rather than letting a third-party (e.g., the County Agriculture Development Board (CADB) or the SADC in Right to Farm cases) decide the issue.

Overall program scope and additional program activities

Overall, the program's scope is to help farmers to be more productive and viable through the prevention and resolution of agriculture related disputes.

As described above, the program accomplishes this on a basic level by being a mediation service provider. When farmers and others have disputes, they can contact the program to request mediation, and the program will set up a mediation session for them.

On a more general level, the program also periodically sponsors conflict management and conflict resolution projects and workshops. In 2006, the program coordinated three regional (north, central, south) skills-building workshops on general communication and conflict resolution. The target audience for these workshops was agricultural professionals who dealt regularly with Farmland Preservation, Right to Farm, and agricultural credit issues, e.g., CADB, Rutgers Cooperative Extension, and Farm Service Agency staff. In 2008, the program supported a project designed to help farmers minimize Right to Farm disputes. This project was developed through a Northeast Center for Risk Management Education grant and involved soliciting, compiling, and presenting farmers' own advice for maintaining good relationships with neighbors and towns.

In the future, the Agricultural Mediation Program plans to sponsor additional workshops for farmers on conflict management leadership skills and strategies. If you have ideas for additional activities that the program could undertake within its general scope, feel free to contact the program to share and discuss your ideas.

For more information

For more information on the Agricultural Mediation Program, visit the website at http://nj.gov/agriculture/sadc/, or contact the SADC at (609) 984-2504 or your local CADB.

EXAMPLES/IDEAS FROM ACTUAL FARM DISPUTES

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This presentation is to give growers an insight into real life mediation events. The mediator's job is to have the parties sit down at the same table and talk about the dispute they are having.

There is a Pre-mediation Agreement that all people at the table must sign. That is available to all parties before the meeting.

Items in the agreement generally state the following:

- All agree to the appointed mediator
- No written or tape record of the meeting will be kept
- All parties will keep all discussions confidential
- Parties may bring additional people such as: a family member, attorney, advisor, and other people that are involved
- Any party may terminate the process any time
- All parties are at the table voluntarily
- No legal action can be brought by any party based on information shared at the mediation session
- All parties agree to abide by any signed agreement reached.

The mediator initiates discussion by asking questions about the dispute to all parties, trying to get the parties to express their side of the dispute, and what they would like to see changed. When the parties honestly express exactly what they need, to resolve the dispute, and separate out the items that they would just like to resolve the dispute. The mediator has a list of "deal breakers", "would-like items", and "don't need items". Sometimes there are items that can be agreed upon quickly. Matching the lists and talking about each item has bought some of the disputes to a successful conclusion.

If there is a "deal breaker" that cannot be resolved, all parties can agree to disagree. Most case sessions have provided useful discussions and a better understanding by all parties involved.

NEW FARMER TRAINING I

SESSION

RESOURCES FOR BEGINNING FARMERS: THE STATE AGRICULTURE DEVELOPMENT COMMITTEE (SADC) AND NEW JERSEY DEPARTMENT OF AGRICULTURE (NJDA)

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One part of the puzzle, when starting a new farm business, is becoming aware of and understanding the resources out there that can help.

What agricultural organizations and agencies, for instance, can assist beginning farmers as they are getting started?

In New Jersey, some of these organizations include the State Agriculture Development Committee (SADC), New Jersey Department of Agriculture (NJDA), Rutgers Cooperative Extension, New Jersey Farm Bureau, Northeast-Organic Farming Association of New Jersey (NOFA-NJ), First Pioneer Farm Credit, and the USDA Farm Service Agency. In this article, we will focus on the first two – the SADC and NJDA.

The State Agriculture Development Committee (SADC)

The SADC is the state agency that coordinates the state's Farmland Preservation, Right to Farm, and Agricultural Mediation Programs. Partnering with the SADC on these programs, at the local county level, are eighteen County Agriculture Development Boards (CADBs).

The purpose of the Farmland Preservation Program is to permanently protect an agricultural land base that can support a viable agricultural industry. Landowners voluntarily apply to the program to sell their land's development rights. In exchange for selling these rights, a restriction is put on the property's deed that says the land may not be developed for anything but agriculture. The land is still privately owned, has taxes paid on it, and can be sold to anybody. The new deed restrictions run with the land, however, and apply to all future owners of the land.

According to the 2007 Agricultural Census, New Jersey's land in farms totals 733,450 acres. As of November 2009, almost 25% of that land, or 181,963 acres, had been permanently preserved for agriculture.

Through the Right to Farm Program, the SADC works with and helps educate farmers, residents, and municipalities about the Right to Farm Act, the Act's formal

conflict resolution process, and additional strategies for resolving agricultural disputes (such as using the SADC's free Agricultural Mediation Program) and for supporting a positive agricultural business environment. If a farm meets the eligibility criteria of the Right to Farm Act, it could receive protection from private nuisance complaints (from neighbors) and from unduly restrictive local regulations (from municipalities).

The state's Right to Farm Act is one of the strongest in the nation. At the same time, in terms of conflict management strategies, many farmers acknowledge that the best right to farm protection is often being a good neighbor and not having a conflict in the first place. We recently interviewed more than 50 farmers from around the state and asked them to share what they do on their farms to prevent and manage conflicts. The SADC compiled this feedback into a new publication, "Farmer to Farmer Advice for Avoiding Conflicts With Neighbors and Towns." To see the booklet's common sense advice, visit http://nj.gov/agriculture/sadc/publications/farmeradvicebrochure.html, or contact the SADC to request a printed copy. In their evaluations of the booklet, several farmers said the booklet's ideas and strategies would be good for beginning farmers.

The Farm Link Program

The SADC coordinates the state's Farm Link Program. The Farm Link Program serves as a resource and referral center for beginning farmers, farmers seeking access to land and farming opportunities, landowners seeking farmers, and farmers working on estate and farm transfer plans.

One of the program's functions is to help farm owners (who have farming opportunities available) connect with farm seekers (who are searching for access to land and other farming opportunities). To facilitate these connections, "farm owners" and "farm seekers" can complete short questionnaire forms and have their "farming opportunities available" and "farming opportunities sought" added to the Farm Link website. Once these listings are added, participants are responsible for contacting anyone whose listings interest them. (Most participants elect to include contact information with their listings.) The listings are provided as a free service. On the website, the opportunities available are broken down into the following categories:

- Farmland for lease, and partnership and farm manager opportunities
- Preserved farms for sale, include auctions of preserved farms
- Apprenticeship and internship opportunities

The Farm Link Program's online listings are not exhaustive, of course, of every farming opportunity that is currently available or sought in New Jersey. Some farmers may not be familiar with the program and not use it. And there are others who periodically look at the listings yet decide not create listings for themselves.

With this in mind, using the program's listings is a good way for beginning farmers to advertise for the farming opportunities they are seeking and to connect with farm owners, but it is not the only way. Also talking with farmers and landowners in one's geographical areas of interest, and in general using local word of mouth, can be very effective. One way to reach out to and talk with local farmers is by attending a monthly meeting of a County Board of Agriculture. Additionally, other organizations like Rutgers Cooperative Extension or NOFA-NJ may be familiar with available opportunities. Ads can also be placed with other agriculture sites and publications.

Resources for beginning farmers

Another service the Farm Link Program provides is responding to beginning farmer inquiries and making referrals to appropriate resources. The program's website has a specific page of "Resources for New and Aspiring Farmers," the content of which is based in part on the resources most frequently suggested during referrals. New farmers can contact David Kimmel at Farm Link at (609) 984-2504 or david.kimmel@ag.state.nj.us.

One resource often mentioned during referrals is the Exploring the Small Farm Dream course. Many people who are in the beginning stages of thinking about starting a new farm operation have found this course very helpful. NOFA-NJ and Penn State are two local providers of the course, and it can also be completed as a self-study workbook. Also very helpful for explorers are some of the new farmer resource guides that other states and organizations have created. These comprehensive guides (from New York, Vermont, New England, etc.) may have been produced elsewhere but are adaptable to New Jersey. Their content includes such useful elements as new farmer FAQs, online learning units, resources by topic, discussion about addressing the most common barriers to entry (e.g., access to land, capital, education/experience, and markets), and current news.

Farming opportunities available and access to land

The spectrum of farming opportunities available ranges from 1) working on a farm for someone else (as an employee, intern, apprentice, or farm manager), to 2) collaborating with someone else on a farm operation (as a partner, investor, part of a working transfer agreement, or with some other arrangement), to 3) operating your own farm business and working for yourself (on land you lease or purchase).

For beginning farmers in this last category, i.e., those ready to start new farm businesses on their own, finding access to affordable or tenure-secure land is the key. Farmland preservation helps make land more affordable by removing the development value from the land, however even preserved farmland may be expensive as farmers may find themselves in competition with non-farmers for the land. In place of

purchasing land, many new farmers turn to leasing as a cost-effective way to get started. The 2007 Ag Census reported that 38.8% of the land farmed in New Jersey is leased. The Farm Link Program's website includes links to several regional leasing resources, such as "A Lease Agreement Guide for Landowners and Farmers," "Holding Ground: A Guide to Northeast Farmland Tenure and Stewardship," and sample leases and online tutorials. Farmers typically lease land from private landowners (farmers and non-farmers), municipalities, non-profits, and sometimes state agencies (e.g., the Department of Environmental Protection leases its Wildlife Management Area land).

The New Jersey Department of Agriculture (NJDA)

The NJDA is the state agency responsible for overseeing and promoting New Jersey's agricultural industry as a whole. The Department coordinates many programs and is made up of the following Divisions: Animal Health, Food and Nutrition, Plant Industry, Marketing and Development, and Agricultural and Natural Resources. While the SADC is its own state agency, in some ways the SADC also functions like a division of the NJDA. An eight-member State Board of Agriculture serves in a policy-making role to help direct work of the Secretary of Agriculture and the NJDA.

Agricultural business support and financing resources

The NJDA's Division of Marketing and Development provides agricultural economic development services, including assistance with business development, agricultural credit and finances, risk management, and farm building construction concerns. This assistance is available for all farmers, new and established.

While the NJDA does not have a loan program for purchasing farms or providing farm-operating capital, the Department disseminates information and responds to questions on the availability of agricultural financing and loans from federal, state, and commercial lending institutions. People making inquiries are advised on the importance of developing a business plan, financial records, and asset requirements in obtaining financing. Beginning farmers who have questions about agricultural credit and finance can contact Karen Kritz at the NJDA at (609) 984-2506 or Karen.Kritz@ag.state.nj.us.

Additional NJDA resources

A sample of some of the additional topics that NJDA works on – and that beginning farmers may contact the NJDA for more information on – includes the following: organic certification, farmers' markets, Farmland Assessment, Jersey Fresh quality grading program, animal waste management, soil and water conservation projects, agricultural recycling, nursery inspection and certification, sales and use taxes on farmers' purchases, farm liability, motor vehicle regulations, fish and seafood development, and aquaculture. The website also has a "Topics A to Z" index page.

Websites

- SADC - http://nj.gov/agriculture/sadc/
- Farm Link - http://nj.gov/agriculture/sadc/farmlink/
- NJDA – Topics A to Z– http://www.state.nj.us/agriculture/topics/
- NJDA – Agricultural Economic Development services – http://www.state.nj.us/agriculture/divisions/md/prog/agriculturaleconomic.html

USDA FSA OFFERS SPECIAL LOANS AND WAIVERS FOR BEGINNING FARMERS

Paul Hlubik
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The U.S. Department of Agriculture's (USDA) Farm Service Agency (FSA) makes and guarantees loans to beginning farmers who are unable to obtain financing from commercial lenders. Each fiscal year, the Agency targets a portion of its direct and guaranteed farm ownership (FO) and operating loan (OL) funds to beginning farmers.

A beginning farmer is an individual or entity who (1) has not operated a farm for more than 10 years; (2) meets the loan eligibility requirements of the program to which he/she is applying; (3) substantially participates in the operation; and, (4) for FO purposes, does not own a farm greater than 30 percent of the median size farm in the county. (Note: all applicants for direct FO loans must have participated in the business operation of a farm for at least 3 years.) If the applicant is an entity, all members must be related by blood or marriage, and all members in a corporation must be eligible beginning farmers. Maximum loan amounts are:

- Direct FO or OL: $300,000; and
- Guaranteed FO or OL: $1,112,000 (Amount varies annually based on inflation).

Beginning Farmers and Ranchers may also have purchase requirements waived for participation in the following programs:

- Supplemental Revenue Payment Program (SURE)
- Emergency Livestock Assistance Program (ELAP)
- Tree Assistance Program (TAP)
- Biomass Crop Assistance Program (BCAP)
- Conservation Reserve Program (CRP)

RUTGERS NEW JERSEY AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION

Daniel Kluchinski
Chair
Department of Agricultural and Resource Management Agents
88 Lipman Drive
New Brunswick, NJ 08901-8525

The **New Jersey Agricultural Experiment Station** (NJAES) is an integral component of Rutgers, The State University of New Jersey. The experiment station provides a diverse range of research, extension, and education programs that serve the people of New Jersey and the urban, suburban, and rural communities in which they live. Through its Cooperative Extension offices in all 21 New Jersey counties, 4-H agents, Extension specialists, Family and Community Health Sciences educators, and Agricultural and Resource Management agents work to serve New Jersey residents in every area of the state. In addition, nine off-campus centers focus on research that supports local agriculture and food-related businesses, and 10 centers and institutes on the George H. Cook Campus engage in world-class research that provides solutions for the problems facing New Jersey residents.

Rutgers Cooperative Extension, a program of NJAES, helps the diverse population of New Jersey adapt to a rapidly changing society and improve their lives and communities through an educational process that uses science-based knowledge. Through educational programs, Rutgers Cooperative Extension truly enhances the quality of life for residents of New Jersey and brings the wealth of knowledge of the state university to local communities. Our goals are to ensure healthy lifestyles; provide productive futures for youth, adults, and communities; enhance and protect environmental resources; ensure economic growth and agricultural sustainability; and improve food safety and nutrition.

The **Department of Agricultural and Resource Management Agents** serves the residents of New Jersey through the development and dissemination of research-based information. Our goal is to teach people new skills and information so they can make better informed decisions and changes in themselves, their businesses, and personal lives. Broadly defined, our programs assist commercial businesses, governmental agencies, and residents through personal or group requests for assistance, information and consultation on issues related to agriculture, the environment, and natural resources management.

Our work with **commercial clientele and governmental agencies** is intended to improve public understanding of the relationship between agriculture and open space and the general economic and environmental vitality of the state. Our programs focus on commercial agriculture and horticulture, fisheries and aquaculture, environmental and resource management issues, farm business development and marketing, pesticide safety and training, integrated pest management (IPM), and other related subjects. For

commercial clientele, in-the-field or on-site consultations may be provided. Contact your county Cooperative Extension office for information and initial phone consultation, or face-to-face in-office consultations.

Our work with **residential clientele** includes individuals and organizations. We provide information and educational resources on a diverse range of topics, including gardening, household and structural pest identification and control, tick identification and Lyme disease, composting, and environmentally-sound gardening practices. Residential clientele are offered over-the-phone or face-to-face in-office consultations. Our agents, staff and trained volunteers can offer advice, information and diagnostic services. In most of our county offices, trained volunteers known as Master Gardeners can assist you; all our Master Gardener Helplines for assistance.

Local county offices provide a range of in-office diagnostics services, such as weed and pest identification, tick identification, pH (soil acidity) testing, horticultural advice, etc. The **Plant Diagnostic Laboratory and Nematode Detection Service** and **Soil Testing Laboratory** can conduct analyses for a fee. Contact our local county office for information on free and for-fee services, and sample submission procedures.

Rutgers NJAES Cooperative Extension offers numerous **educational sessions and workshops** throughout the year. Check our Calendar of Events for upcoming educational workshops and seminars being offered locally, regionally or statewide. These programs include in-field educational meetings, conferences and seminars.

Print and web-based information is also available through our **Fact Sheets and Bulletins**. Use our searchable database to find information on thousands of topics, from animal agriculture, to natural resources and the environment, to home gardening and landscaping. Our statewide **newsletters** provide information for commercial agricultural and horticultural businesses, but may also be of general interest to non-commercial clientele. These include subscription and non-subscription newsletters and bulletins, including our various *Plant and Pest Advisory* newsletters. In addition, your local Cooperative Extension county office may offer monthly newsletters or other mailings that include program events or meeting announcements.

Web sites	
New Jersey Agricultural Experiment Station	njaes.rutgers.edu/
Cooperative Extension	njaes.rutgers.edu/extension/
Department of Agricultural & Resource Management Agents	njaes.rutgers.edu/arma/
County Cooperative Extension offices	njaes.rutgers.edu/county/
County Master Gardener Helplines	njaes.rutgers.edu/mastergardeners/helplines.asp
Plant Diagnostic Laboratory and Nematode Detection Service	njaes.rutgers.edu/plantdiagnosticlab/default.asp
Soil Testing Laboratory	njaes.rutgers.edu/soiltestinglab/default.asp
NJAES Calendar of Events	events.rutgers.edu/njaes/
Fact Sheets and Bulletins	njaes.rutgers.edu/pubs/
Newsletters	njaes.rutgers.edu/pubs/newsletters.asp
County office personnel	njaes.rutgers.edu/personnel/unit.asp?id=arma&s=d

ONLINE LEARNING FOR BEGINNING FARMERS

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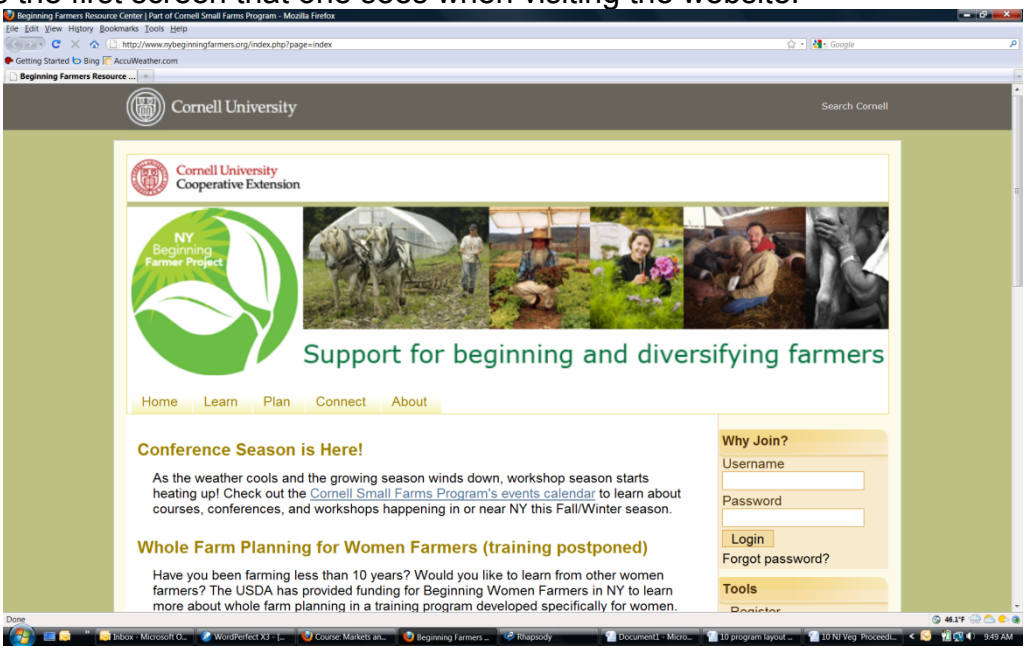
Over the past three years, online learning opportunities have developed and matured under the guidance of the Cornell Small Farms Program. The program received a New York Farm Viability Institute grant to develop online materials for beginning farmers. The first step was to conceptually develop a website that could act as a portal for individual learning.

From this development, Cornell University and Cornell Cooperative Extenion offers those interested in learning about farming a wide variety of online tools. One way for one to learn about farming is to visit the beginning farmers website. The URL for the website is: http://www.nybeginningfarmers.org.

Here is the first screen that one sees when visiting the website:



The website contains a rich assortment of content for an individual interested in learning about farming. When one probes deeper, they will discover seven learning modules to choose from. The modules are designed in such a way that one will be well on their

way to developing a business plan. Tools are available at the website to help the learner track their progress and develop key parts of their business plan as well.

In second phase of the website development was the addition of video. The short video clips that were added were entitled “Voices of Experience” and provide learners the opportunity to see and hear first hand from people who began their own farm businesses. Twelve farmers share their experience in starting farming and briefly share what they have learned. The videos cover a variety of commodities and various stages of development of the farm business. A compilation of beginning farmer videos can also be found on YouTube. The URL for finding these videos is: http://www.youtube.com/user/cornellsmallfarms.

For those wanting more structure and interactive online learning experience, a variety of online courses are available. The development of the online courses started back in the fall of 2007, when the first online learning course was launched as a pilot. A nine week course was developed with the learning objective of having participants well on their way to developing a business plan. What we learned from teaching this course was that it was too long for many adult online learners.

A new strategy was put in place for developing online courses. Courses were designed to cover one to two topics only, instead of six or seven. To date, two shorter courses have been developed and offered. The first redeveloped course to be offered is called “Taking Stock: Evaluating Your Land and Resources and Choosing an Enterprise.” As the name implies, this course is designed to help learners who are looking to start a farm to choose the best possible soil resources possible. This course will steers participants through:

- Farm goal-setting
- Evaluating physical resources of your farm
- Choosing an enterprise
- Starting the development of a farm plan

The second course that was offered was entitled “Markets and Profits: Making Money Selling What You Grow.” This course is designed to help learners start the process to develop a marketing plan and to learn if what they are considering growing can be done so profitably.

As much as possible, the courses are not specific to New York State. Participants from all across the country have been in the courses that have been offered to date.

More courses are being developed and two more will be offered in March of 2010. One course will help learners further develop a marketing plan for their business. The second course is designed to help learners organize their business from the beginning. For example, should I incorporate or operate the business as a sole proprietor? This course does cover material that is specific to New York state, such as agricultural value assessment, sales tax, etc.

It is the plan of the Beginning Farmer Program to offer a wide variety of online courses each year. While there is demand for them, courses already developed will be offered at least once each year while new courses will be developed and offered as well. To learn what courses are available and when they will be offered, visit the NY Beginning Farmers website.

NEW FARMER TRAINING II

SESSION

EVALUATING YOUR LAND AND INFRASTRUCTURE

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One of the first things that my soils science professor told the class was that there are many things that you change on a farm to improve productivity. However, the soil is not one of them. Therefore, it is very important for those looking for farmland to choose the best soil resource they can afford. Other resources are important, but can be modified to meet the needs of the product being produced. Some of the resources that can be modified are: buildings, water sources and machinery.

Where to start in figuring out what to grow? One place to start is to take stock of where you are now and define what goals you have for the farm business. Defining what your goals are for the farm business is important and helps direct what you might be interested in producing and what resources are needed. Some questions that need to be answered are:

- How much time am I willing to devote to the farm business?
- How much of my family living income do I need to generate from the farm business?
- Why does farming appeal to you?

These questions should be answered by each person who may be involved partly or wholly in the farm business. This means that family members, friends and others that might help you develop the farm need be asked these questions and have a dialogue so that a collective vision of the farm can be developed.

An inventory of current resources is good to do as well. These resources are more personal and need to carefully evaluate what strengths you have that lend themselves to farming. For example, do you have some carpentry skills or developed budgets for a business or an organization you belong to? Some ideas on how to collect information about your resources can be found at the NY beginning farmers website. The website address is: http://www.nybeginningfarmers.org.

Having this information in hand will help you start to narrow the list of what you might like to grow as a farmer. Ok I got a list, where can I learn what kind soil and other resources might be good for growing this crop? To help you figure out the soil resources, the National Resource Conservation Service Web Soil Survey (WSS) is a good place to go to learn what kind of soil is an area that you are interested in. Already have some land? The WSS is a valuable tool to help you learn what the potential of the land you own is. The website address for WSS is: http://websoilsurvey.nrcs.usda.gov/app/.

To use the survey tool, just enter an address near the land you are interested in and a map will appear identifying the entered address. The next step is to identify the "Area of Interest" (AOI). The map as displayed is of land over a larger geographic area. By selecting AOI, you are only getting information on particular fields and land you are interested in.

Once the AOI is identified, a soils map is generated that explains what soil types are contained in that particular area. What do these symbols mean? The symbols on the map explain what the soil type is. A key is generated with the soils map to explain what soil types are in the AOI and what percent of the area is composed of that particular soil type. Here is an example of the soil type description.

BucB—Bucks silt loam, 2 to 6 percent slopes

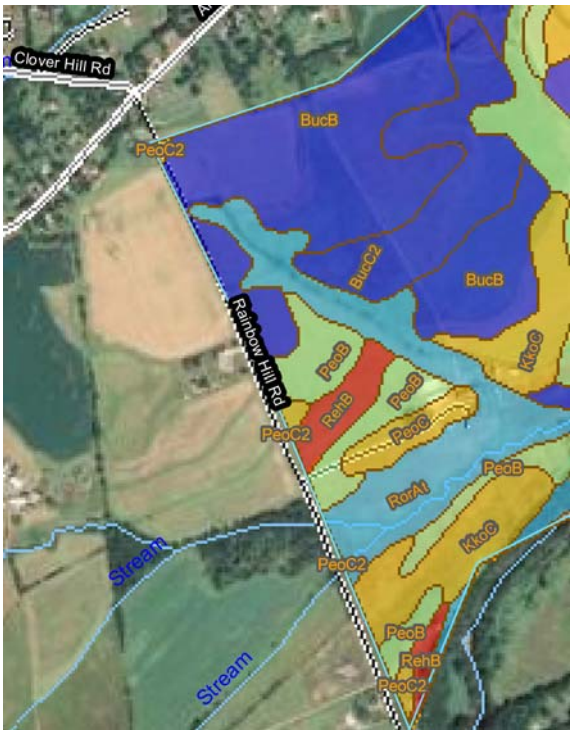
Map Unit Setting

Elevation: 250 to 1,000 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 200 days

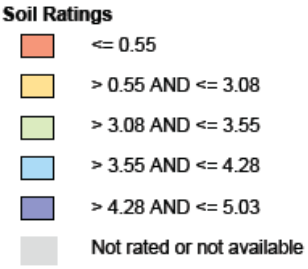
Map Unit Composition

Bucks and similar soils: 85 percent
Minor components: 15 percent

Not only does the soil type key describe the soil, but it also provides other important information for deciding what crops might be grown on this land. Climate is a key factor in figuring out what crops to grow. The key provides mean temperature and rainfall and frost free period information as well.



Ok, I now know the soil types for the area that I am interested in and some climate data. How productive are these soils? Another feature of WSS is to provide you with a way to compare the productivity of the soils in an Area of Interest. Here is an example of the productivity map that is generated.



The example is estimating how many tons of alfalfa hay would be produced on various fields in the Area of Interest. The map can be generated using a variety of different crops. The number of different crops that can

be selected is somewhat limited, but a crop can be used as an index of the relative productivity of the fields that you are interested in.

In determining what crops might be grown in a particular field, knowing the soil type is important. However, infrastructure considerations need to be addressed as well. Many crops will require irrigation at key times during the growing season. Is there an adequate source of water for irrigation near the fields? Are any buildings needed for harvesting or processing the crop? If so, are any of the current buildings suitable for use?

In summary, determining soil and infrastructure needs is just one step in figuring out what crop (or crops) to grow on your farm. Figuring out the soil and infrastructure needs is somewhat complex and takes into account a variety of factors. An important place to start is figuring out your goals for the farm business.

ASSESSING YOUR POTENTIAL MARKETS

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Setting realistic goals and developing a sound marketing and business plan are important components of any successful business. Unfortunately these important considerations are often overlooked as new farmers begin their farming operation. A successful farm business plan should not only determine what commodity is produced it should also develop a plan for who is going to purchase the product, at what price and how often. New farmers can dramatically reduce the potential for failure by evaluating their target market and develop a plan to promote their products to this specific audience.

One of the first questions a new farmer should ask is who wants/needs my product? This question is the foundation of a sound marketing plan. A new farmer may be very interested in growing a certain variety of peppers, but if there are no customers all of the effort will have been in vain.

It is also important to gain an understanding of what motivates the consumer to purchase your product. Factors such as supporting local farms or specific products grown or raised for certain holidays or religious observances can play an important role in motivating potential customers to purchase your product. Gaining an understanding of what factors motivate your potential customers to purchase certain products will allow you to develop a marketing strategy to meet their specific needs.

Price is another important consideration when developing a marketing plan. If several farmers are producing the same crop or commodity then the supply may be impact price. For example, if several farmers are producing a similar crop and growing conditions are favorable for high yields then the supply will be high and prices may be lower than if weather conditions did not favor high yields. In an ideal situation, your product will fit your operations limitations while meeting a specific need of your clientele.

It is also important to assess your resources when developing a marketing plan. Some specific considerations should include assessing your land resources, understanding how your location impacts your customer, infrastructure and amenities and your labor and time requirements. Answering these questions will help you determine not only what marketing opportunities exist, but which ones match your goals for your farm.

Developing a marketing plan is an essential first step for anyone whether you are interested in starting a farming enterprise or expanding an existing operation.

EVALUATING WATER RESOURCES FOR FARMING

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Water resources

Rainfall is plentiful in New Jersey, with annual rainfall ranging from 45 to 50 inches in most places. However, temporal variation in rainfall, along with occasional short-term droughts, necessitates irrigating most vegetable and horticultural crops. Increasing demands have strained water supplies in some areas. Proper water management is critical for high crop yields and crop quality. Providing insufficient water to crops during critical periods, which could be early or late in the life cycle of the crop, can reduce crop yields. But excessive irrigation can reduce crop quality or post harvest life. Additionally, excessive irrigation can cause excessive leaching or runoff, which remove nutrients from the soil. Applied irrigation, particularly through drip irrigation, can be used to deliver fertilizer and pesticides directly to crops.

Crops can be irrigated with well water or water from surface ponds or streams. However, it is important to understand that having a well or pond on your property does not give you the right to use that water for irrigation. The New Jersey Department of Environmental Protection (NJDEP) must approve diverting more than 100,000 gallons of water per day or the capacity to pump 70 gallons per minute or more. In addition, all withdrawals from surface water bodies require NJDEP approval no matter the amount. Water users are required to keep a log of their monthly water use for each water source. If a water source is not metered, hours of pump operation will need to be recorded to calculate water use. Crops and acreages will also need to be recorded.

Water amount and scheduling

Because irrigation is so critical to producing high quality crops, it is important both to apply the correct amount of water and to apply it at the correct time. There are several principals that need to be considered:

- The amount of water a plant and its surroundings use (*evapotranspiration*) varies by environmental conditions like humidity, incident sunlight, wind, temperature, as well as different amounts for different crops and different ages of crops.
- The soil can hold water, but only a limited amount, called the soil *water holding capacity*. The water holding capacity varies by soil *texture*, with sands holding less, loams holding more, and organic matter increasing the holding capacity.

- Crops can suffer yield losses if they are grown in soils which are allowed to become too dry. While this varies by crop, it is generally desirable to keep vegetable crops at 75% to 90% of the *field capacity* of the soil.
- Irrigation water should not be applied more quickly than the *infiltration rate* of the soil, in order to prevent surface runoff.
- Irrigation amounts and timing can be determined with devices that measure the amount of soil water, such as tensiometers and electronic soil moisture sensors.

These principles are further explained in Section C of Orton and Garrison (2009).

Water quality

The term *water quality* is used ambiguously in agricultural production. It can refer to *source water quality*: that is, how well suited a water source is for use as irrigation water. It can also refer to *environmental water quality*: that is, the potential for agricultural production to adversely affect lakes, streams, and groundwater. This paper is concerned with *source water quality*.

There are a variety of minerals and organisms that may affect the suitability of a water source for use as irrigation water. An excess of minerals like salts or pathogenic organisms like *Phytophthora* can impede crop growth or affect crop quality. An excess of minerals like iron could clog drip emitters. An excess of human pathogens, like *E. coli* bacteria, can make crops unsaleable because they would dangerous for human consumption.

If the well is properly sealed from surface contamination, well water is typically clean of human and plant pathogens. However it may be high in salts if there is the possibility of salt water intrusion from nearby oceans. High amounts of iron occur in aquifers in some areas of New Jersey, and can be a concern in irrigation water from wells. Surface water, including natural streams and farm ponds are more likely to contain human or plant pathogens. pH, electrical conductivity (abbreviated *EC*, a measure of the amount of salts in water), and hardness can affect the appropriateness of using injected or tank-mixed pesticides with that water. Excess amounts of dissolved solids or alkalinity in irrigation water can cause clogging of emitters.

Water testing and treatment

Because of these concerns, new sources of irrigation water should be tested for certain chemical parameters by sending a sample to a qualified laboratory. Basic chemical parameters tested should include pH, EC, hardness, iron, and manganese. Be sure to get a sample which will be representative of your irrigation water and to following sampling directions of the laboratory. Chemical parameters in irrigation water may vary over time, and regular testing of water may be helpful. Some parameters can be tested onsite with relatively inexpensive meters, including pH, EC, and iron. When irrigating

from ponds or streams, testing for plant or human pathogens by university, public, or private laboratories may be appropriate. Human pathogens are particularly a concern when irrigating food crops with overhead irrigation.

Salinity

The salinity of irrigation water can be a problem when streams used for irrigation are affected by saline waters or there is salt water intrusion into well water sources. Salinity may be measured as electrical conductivity (EC) or total dissolved solids (TDS). Plants vary in their sensitivity to being irrigated with saline water, and recommendations specific to your crops should be followed if salinity may be a problem. In general, declines in yields for most vegetable crops begin to occur when the salinity of the water (EC_w) is between 1 and 2 millimhos per cm (mmho/cm) (1–2 dS/cm). However caution should be used in interpreting guidelines: some recommendations are given for the EC of the soil (EC_e) while others are given for the EC of the water (EC_w). Furthermore, most guidelines were developed in hot dry climates; crops in humid climates may be more tolerant than guidelines suggest, especially where rains occasionally flush excess salts from the soil. When using water with a relatively high salinity, be sure to follow leaching guidelines to prevent salt buildup in the root zone, and be aware young crops may be more sensitive. The most effective treatment for saline water is switching to a water source with a lower salt concentration, such as well water. For very high-value crops, salt can be removed from water with equipment through the process of *reverse* osmosis.

Iron

Excess iron can be a problem in water from surface water sources or wells. High concentrations of iron can cause clogging of sprinklers and irrigation emitters, and its management is essential when using drip irrigation systems with high-iron waters. Iron can also cause discoloration of leaf surfaces or fruits if applied overhead to plants. Dissolved iron in irrigation water may be unnoticeable; however, when it is oxidized it has the tendency to precipitate as solid minerals, which have the potential to clog emitters or discolor plants. Additionally, certain bacteria that feed on iron in water form a slimy biofilm that can clog emitters. Iron concentrations of 0.1 ppm (0.1 mg/L) can cause clogging problems in drip irrigation systems, and concentrations above 1.0 ppm will probably require treatment for use with drip irrigation. One treatment method is to pump the water into a reservoir or tank, aerate the water to cause the iron to oxidize and precipitate, and then filter the iron precipitate out of the water. A second method is to treat the water with chorine to destroy organic matter and oxidize the iron, causing it to form a precipitate, which is then filtered out. This method may be particularly desirable when the iron is associated with organic molecules, which may be the case when using surface water sources. There are a variety of sources of chlorine, with chlorine tablets perhaps being the simplest. Chlorine gas should be used with caution since it represents an environmental and worker safety risk.

Plant pathogens

Certain plant pathogens, including *Phytophthora* and *Pythium*, can survive in farm ponds and other surface water. If irrigation water is applied to susceptible crops without killing viable pathogen organisms, reductions in crop yield or quality, or the complete loss of a crop, can result. Pathogens may be a particular concern where runoff water is collected from production areas and recycled to be used again as irrigation water. In some cases, drawing water from the center of the water column of a pond may reduce the incidence of viable pathogenic organisms, as the pathogens may settle to the bottom or float on the surface. However, it should be noted that these organisms have motile zoospores: a life stage capable of swimming freely in water. Treatment methods include chlorine, ozone, and ultraviolet light (UV) treatment. UV treatment requires fairly clear water for the UV light to penetrate the water stream and kill the pathogens. Both chlorine and ozone treatment will be made less effective when there is a high amount of organic matter in the water. Because of these considerations, these methods may require pre-treatment with a settling basin or filtration to remove sediment or organic matter. All these treatment methods require a certain concentration and contact time to obtain effective elimination of the pathogens. There are worker safety issues with handling chlorine or ozone, and both may cause damage to plants if the residual in the irrigation water is too great and water is applied overhead to plants.

E. coli

E. coli, along with other potential human pathogens, is commonly found in farm ponds and natural streams. Additionally, there may be bacterial contamination in wells from surface surfaces, but this is usually only the case if wells are not kept sealed from surface contamination. Because bacteria and other organisms can enter surface water from a variety of sources, including excrement from visiting wildlife, it is difficult to keep ponds free of all bacterial contamination. However, using a vegetated buffer area to treat incoming runoff may reduce the bacterial load in a pond. Treatment options for reducing bacteria in irrigation water are similar to those listed above for plant pathogen control, and the same pre-treatments and worker-safety and environmental precautions should be considered. Applying water directly to the soil instead of to the edible portion of the crop reduces the chance of crop contamination. Once a crop is contaminated with *E. coli*, it is difficult to remove the bacteria with washes or other methods. In all cases, additional food safety practices, including harvest and post-harvest procedures, appropriate to your crop type and third-party audit or buyer requirements, should be followed.

References:

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PRODUCING ENERGY CROPS

SESSION

AG RESIDUES AND BIOWASTE FEEDSTOCKS

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In the United States, current strategies to reduce dependency on imported energy and non-renewable energy include using biomass (generally plant derived material) as an energy source. One of the largest sources of non-food/feed biomass available are crop residues. These result from the harvest and/or processing of field grown crops such as corn, wheat, soybeans, cotton, grain sorghum and other grain crops. Other sources include fruit and vegetable residues left in the field at harvest, handling and processing wastes, and damaged crops such as moldy hay or fruit and vegetable culls. Currently, these crop residues remain in the field or are returned to the land to provide nutrients and organic matter for soil health and conservation. In some cases, residues are also used as livestock feed.

Many of these residues have been considered for conversion to energy by direct combustion (burning) for heat and for electricity, thermochemical conversion (pyrolysis, gasification, etc.) to various fuels, anaerobic digestion to biogas (methane, etc.) and more recently new technology referred to as “cellulosic” conversion to ethanol.

Crop Residues

A survey of biomass residues and other potential bioenergy feedstocks in New Jersey was conducted in 2007 by the New Jersey Agricultural Experiment Station with support from the New Jersey Board of Public Utilities. The following table provides an estimate of various net harvestable crop residues produced in New Jersey in recent years and their total potential energy value statewide.

Table 1. Estimated Harvestable Residue Production and Energy Potential from New Jersey Crops

Crop/Residue	Tons (dry)	Total Energy (Million BTU)
Sweet Corn Residue	7,765	122,143

Rye Straw	38,087	594,157
Field Corn Residue	135,728	2,135,001
Wheat Straw	42,752	639,570
Non-Alfalfa Hay	129,549	2,020,964
Processing Residues	97,193	1,588,134

Source (1)

It is important to note that these are total estimated harvestable biomass, but some percentage, minimally 30%, should remain on the soil for conservation purposes. It is also important to understand that these are potential energy values on a dry basis. Wet or field dry residues will have less net energy because water does not burn and when burned for heat, some energy will be lost through the stack and otherwise.

To evaluate the potential of crop residues for conversion to energy, it is important to consider the gross energy content. Table 2 contains BTU's per pound of material for various residues.

Table 2. Gross Energy Content (BTU's/lb. - dry basis) of Various Crop Residues at Harvest

Crop Residue	BTU's/lb.
Rye*	7,655
Oats*	7,544
Corn Stover**	7,245
Corn Cobs	7,524
Grain Sorghum Stover	7,242
Soybean Stover	7,466
Sorghum & Sudangrass Hybrid***	7,230

* "Long straw" i.e. early heading stage
** Stover refers to stems, leaves and other harvestable material (except cobs) left behind after grain harvest
*** Hard dough stage, heads on

Source (2)

As apparent from these data, crop residues have a low energy density compared to traditional fossil fuels, i.e. about ½ to 2/3's the energy value (BTU/lb) and 1/3 the energy density (BTU/cubic foot) of coal. Because crop residues are often in a form which may contain 15-70% or more moisture, this further lowers the "as-is" energy value (water doesn't burn!). This overall low energy density makes it uneconomical to transport crop

residue very far (most economic analyses say less than 30 miles) because of high trucking/fuel costs. This suggests that conversion to energy will occur on or near the farm, otherwise, residues would need to be processed (densified) to allow for more distant transportation. It's of interest to note that corn (grain) has similar gross energy values as woody residues. Stoves and furnaces have been available for many years to burn corn grain when it's cheap. Although not a field residue, spent cooking oil (typically soybean and other plant oils used for deep fat frying) has a very high energy value being similar to the restaurant grease.

From a conservation and energy efficiency standpoint, direct combustion for heat generation is the most efficient way to convert plant biomass, like crop residues, into energy. Various cultures have, and still do, use wood and herbaceous plants and residues for heating and cooking. While dry plant material can be burnt directly in a wood/coal stove or furnace, a current trend is to make pellets, briquettes, or other densified forms so that plant biomass can be transported farther and stoking can be mechanized. Such densification, however, reduces the positive energy balance of residues and increases the cost of using residues for energy. Growers and users of biomass can make some simple calculations to determine if using crop residues might be economical. A farmer should first estimate the amount of residue available per acre. A 100 bu/A corn grain crop will generally leave about 2T of residue for harvest after leaving sufficient amounts in the field for a 30% cover for soil conservation purposes which the NRCS deems a minimum amount for conservation tillage/cover. Soybeans at 30 bu/A grain yields will leave less than a ton and thus are not recommended for harvest. Wheat at 75 bu/A grain will leave about 2T of straw for harvest after accounting for 30% residue cover for soil conservation. Using a ton of field dry corn stalks, for example, would contain almost the same amount of useable heat energy as 80-90 gallons of fuel oil. If growers have or can obtain appropriate equipment for harvesting, processing and burning the biomass and determine their costs for such equipment life, they can determine if it is economical to collect and utilize biomass for energy. The value of crop residue as a nutrient and organic matter source along with the soil conservation value should also be considered in the calculations. A ton of corn grain stalk residue can contain more than $30 of nutrients at today's prices (Table 3). Finally as a note of caution on the use of residues for direct combustion, although problem gases (CO; NO_x) are generally low compared to coal, particulate matter and ash are often higher. The ash that is removed from the combustion equipment can be reapplied to the field thereby recycling some of the plant nutrients.

Several relatively new methods of energy conversion include thermochemical conversion (pyrolysis, gasification, etc.) and fermentation processes like cellulosic conversion to ethanol. Only a few processing facilities have been built to date, but most energy experts suggest, as the technology progresses, they will be utilized commercially on a large scale like oil refineries. These facilities will require more than 10,000 contiguous acres of biomass supply within 30 miles of the facility, a situation

which no longer exists in a densely populated state like New Jersey, unless the facility can also utilize waste biomass from trash.

When considering the use of crop residues for biomass energy, it is not only important to consider economics and ultimate conversion processes, but also how the residue will be harvested and how much will be left behind for conservation and nutrient purposes.

Two important considerations for harvesting are 1) keeping the crop materials from further having soil collect on it (this increases ash) and 2) field drying to harvest (bale) the material at a low moisture content (gives higher heating value and gives more tons per package/bale). Unlike hay for feed, it does not matter as much if the residue gets rained on or is exposed to heavy dew (assuming minimal soil splash) as long as it is dry at harvest. In fact, while total yield of residue may decrease after weathering, the remaining residue is often higher in energy value and lower in ash because K and other nutrients leach out into the soil. Storage of the baled crop residue must also be taken into consideration. While most farms will have enough land to accommodate the bales, they must be kept dry and away from any flammable materials. Stacking and tarping the bales at the edge of the field until they are needed will work in most cases.

From a nutrient and conservation standpoint, the more residue left on the field the better for reducing soil and water erosion, returning nutrients (see Table 3), and increasing soil organic matter (carbon sequestration). A farmer's conservation plan and the Natural Resources Conservation Service of USDA can provide recommendations for proper amounts of crop residue that need to remain to protect the soil from erosion and nutrient replacement strategies. Normally, leaving a good stubble height (6-8") and the smaller residues that fall to the soil surface will be adequate for conservation purposes unless the field is considered highly erodible land and or is on a steep slope. Cover crops and no-till crop production practices may also be needed where residues are removed.

Table 3. Nutrient Content of Crop Residues and Hay (lbs/T).

Residue	N	P	K
Corn Stover	17	2	26
Soybean Stover	14	1	10
Sorghum Stover	14	2	19
Rye Straw	9	2	18
Wheat Straw	11	1	21
Alfalfa-Timothy Hay	39	11	39

Source (3)

Livestock manure

Animal manure from cows, swine, horses and poultry can also be used to produce bioenergy. Anaerobic digestion is the bioenergy technology mainly used for animal manure because these materials are high in moisture. Unfortunately, the capital and operating cost of an anaerobic digestion system are not economically viable unless it is done at a large scale. As a general rule of thumb, a dairy would need about 500 cows for an anaerobic digestion system to be a viable option. Most NJ animal farms fall under this threshold. However, cooperation with other farms at a local level may provide enough feedstock to make anaerobic digestion an economical alternative. Another option would be to combine animal manure with food processing or similar wastes. Together, these materials make more biomethane than either feedstock by itself. The additional income generated by processing the food waste may also make anaerobic digestion on a smaller livestock farm a viable option. This model has been done successfully in Europe and at dairy farms in New York State.

In addition to the biogas produced from an anaerobic digester, these systems also produce liquid fertilizer and compost. The liquid fertilizer should be land applied and can serve as a major source of nutrients for many field crops. The compost will need to be processed further in order to dry it down and reduce odors.

High moisture vegetative waste

Many fruit, vegetable, and ornamental growers have plant residues, culls, and/or processing wastes in their operations. These materials tend to have very high moisture content (>70%), making it uneconomical to consider drying them for eventual combustion to heat. Anaerobic digestion would be the bioenergy technology of choice for converting this material. A steady supply of vegetative waste is needed to make this a viable option for a farm. Therefore, cooperation with a nearby livestock farm or food processing facility should be considered. The biomethane can be used for combustion heat or partially cleaned and used in low tech LP gas-type engines. Anaerobic digestion efficiency is dependent upon the actual crop material, carbon–to-nitrogen ratio, moisture, temperature, and other factors that control digestion/fermentation. Current NJAES research is exploring anaerobic digestion processes, but no specific recommendations are yet available for the various crop materials.

Woody biomass crops and residues

Fast growing woody crops can also be grown for bioenergy production on New Jersey farms. Marginal soils could become more productive by growing a bioenergy crop that is adapted to the soil conditions and improves the quality of those soils by increasing the organic carbon level. Woody bioenergy crops may be able to compete economically with conventional crops on marginal soils while protecting the soil better than an annual crop would. The woody biomass crops for New Jersey are short-

rotation tree crops such as hybrid poplar or hybrid willow. An important element of the rationale for growing woody biomass crops is that they can be grown using less intensive production techniques on marginal farmland, thereby avoiding competition with food production on better quality land.

While the production of any crop will require an adequate supply of water, the annual fall of deciduous leaves will contribute to a layer of organic material on top of the soil as well as an increase in organic matter in the soil's upper levels that together will act to hold water and slow its percolation through the soil, thereby making water consumption over time more efficient. Short-rotation tree crops are grown on multiyear (15-20 year) rotations. In addition, certain willows and poplars will sprout vigorously from the stump when cut down (a practice known as coppicing). Once planted, such woody biomass crops would not require cultivation thereby reducing soil erosion by wind or water. Willow and poplars are typical of trees that colonize bare ground. Hence, they grow on poorer soils and they will respond to applications of conventional fertilizers. Nutrients, however, will be recycled back to the soil in the annual fall of deciduous leaves, thereby diminishing the longer-term need for additional fertilizer.

There is a significant amount of marginal farmland in NJ. In total, there are approximately 178,000 acres, or approximately 1/3, of the total prime and marginal farmland combined. Assuming a long-term sustainable yield of 5 tons (green-weight basis) per acre per year, (4) woody biomass crops grown on marginal farmland in New Jersey could supply as much as 890,000 tons per year of biomass.

There are also many forest and wood processing residues that can be utilized for direct combustion or converted otherwise to energy. The energy content of woody material usually averages about 10% higher (7800-8800 BTUs/lb on a dry basis)than that of herbaceous crops and has lower ash values. In recent years some of these residues, ie sawdust and wood chips have been densified into pellets for the residential and commercial direct combustion markets(stoves, furnaces, boilers,etc). Further processed wood sources(chemically treated, etc) should be specifically evaluated before considering their use as an energy source .

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ALTERNATIVE ENERGY IN AGRICULTURE

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Agriculture not only produces food, feed and fiber for society, but is quickly becoming a sustainable energy producer. In doing all this, U.S. agriculture uses only a little over 1% of total U.S. energy consumption. The use of fertilizers represents nearly half of that use with Nitrogen being produced from natural gas representing more than 80% of the fertilizer energy. Liquid fossil fuels consumed in tractors and other power equipment also represent a large amount of energy consumed on the farm. Energy consumption also varies by commodity. Fruits and vegetables and other intensively managed crops, particularly those requiring large amounts of nitrogen, use larger amounts of energy than crops like soybeans which fix their own N and the small grains that use less pesticides and fertilizers. Reducing tillage operations and other trips across the field while using fertilizers and pesticides judiciously can result in agriculture doing their part in energy conservation.

Because plants capture solar energy from the sun and fix carbon compounds, agriculture and forestry are the only two major industries that can “create” new energy and sequester carbon at the same time. Termed “biomass energy”, growing whole crops or parts of crops for energy is a recognized priority of the USDA and the U.S. Department of Energy. The use of biomass for energy is not new. Forest industry residues, corn cobs and stalks and various other plant and even animal residues have been burnt to generate heat and in some locations co-fired with coal to generate electricity. For nearly a decade now ethanol from corn and biodiesel from soybean and other oil crops have supplemented the fuel needs of Americans and the world as a whole.

Beyond the advantage of being renewable, energy positive and having the ability to sequester carbon from the atmosphere, biomass energy crops, particularly perennial grasses, have the opportunity to provide ecosystem services like soil and water conservation and wildlife habitat. The U.S. Department of Energy has proposed that biomass could replace up to ⅓ of the U. S. transportation fuel needs by increasing the yields of current crops used directly for fuel and/or their residues and by growing millions of acres of perennial grasses and fast growing trees on lands not currently producing foods crops.

Biomass, however, has some major challenges. First it is not grown in a form directly useable as a replacement for fossil fuels. It also has an energy content of only ⅓ to ½ that of our traditional fossil fuels making it less energy dense. Coupled with this fact is that it may be initially harvested in a high moisture state thus requiring energy to be expended in drying and possible densification for any significant transportation. Regardless, biomass is a renewable, clean energy source that can be converted through a variety of processes to forms of energy commonly used in today's society. Direct combustion, particularly of dried residue materials, can and do supplement fossil fuels for power generation and provide heat on small and large scales. A relatively new process of pelletizing biomass provides for convenient handling and transportation, although requiring energy, can enhance the usability of biomass. Various thermochemical conversion processes like gasification and pyrolysis can convert biomass to syngas or further be converted to liquid fuel. Fermentation of sugar and starch crops to ethanol has been around for centuries (wine making) but most recently been applied to corn grain ethanol. The new process of cellulosic conversion to ethanol holds much promise because of its ability to use almost any grass, wood or other fiber crop as feedstock. The physiochemical conversion process for plant oils such as soybeans and canola to biodiesel has been perfected but current competition with food and industrial uses may limit these crops as energy feedstocks. Tropical oil crops, however, such as palm and algae hold promise. Finally for wet wastes, animal manures and food wastes, anaerobic digestion to produce methane provides an opportunity for waste recycling to energy.

USDA FSA BIOMASS CROP ASSISTANCE PROGRAM (BCAP)

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The USDA Farm Service Agency (FSA) Biomass Crop Assistance Program (BCAP):

- assists agricultural and forest land owners and operators with matching payments for the amount paid for the collection, harvest, storage and transportation (CHST) of eligible material by a qualified Biomass Conversion Facility (BCF).

- supports establishing and producing eligible crops for the conversion to bioenergy through project areas and on contract acreage up to 5 years for annual and non-woody perennial crops or up to 15 years for woody perennial crops. This provision will be implemented in the future.

The CHST Matching Payment Program will provide eligible material owners matching payments for the sale and delivery of eligible material to a CHST-qualified BCF. These payments will be available to eligible material owners at the rate of $1 for each $1 per dry ton paid by the CHST-qualified BCF to the eligible material owners, limited to a maximum of $45 per dry ton and limited to a 2-year payment duration.

The New Jersey FSA recently announced that Plainview Growers, Inc. is now qualified under BCAP as the first BCF. Their Allamuchy facility in Warren County has six plus acres of glass greenhouse space now heated by biomass pellets. With energy independence a top priority for Plainview Growers, President Arie Van Vugt invested in two biomass pellet storage silos and a pellet furnace now fueled by wood pellets and soon to be fueled by grass grown locally and pelletized on site

Farmers from Sussex, Warren, Somerset, Morris, and Hunterdon Counties as well as Monroe, Pike, and Northampton Counties across the river may be eligible for matching payments for delivery of eligible material to Plainview Growers. The contact information for this facility is listed on FSA's BCAP webpage located at http://www.fsa.usda.gov/energy. Producers of eligible material in both states may contact the Hackettstown FSA Service Center at 908-852-2576 to begin applying for CHST matching payments.

NJ AGRIBUSINESS TOPICS

SESSION

WATER ISSUES: WATER QUALITY CONCERNS FOR AGRIBUSINESS

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Agriculture and water pollution

Agricultural production has the potential to negatively impact surface waters and groundwater. Potential pollutants of concern from agricultural production include sediment, nutrients (fertilizers), pesticides, pathogens, salts, and trash. Each of these can make its way through surface runoff or leaching and contaminate waterbodies, though each will also have its own unique transport and fate properties. For example, some chemicals, including salts, can dissolve in water and move readily with that water. Others, including certain pesticides, will tend to adhere to sediments, and, therefore, their movement can be controlled by controlling sediment movement. Some pesticides will degrade relatively rapidly in the environment, while plastic trash will not. Pollutants can make their way to waterbodies with leaching or runoff generated by irrigation or precipitation, or by wind. Onsite, the impacts to water resources of agricultural production can be minimized through *source control*—that is, the proper and judicious application of water, fertilizers, and pesticides, as well as preventing soil erosion—and through *runoff treatment*—that is, using measures like vegetated buffers or impoundment basins to reduce pollutant loads in water leaving the property. Collectively, recommended measures to prevent a site's contribution to pollution can be called *best management practices* (BMPs).

Because the potential for agricultural sites to contribute to water pollution varies greatly by production practices, site characteristics, and the use of BMPs, it difficult to generalize the impacts of agriculture relative to other land uses. Even when the impacts of agriculture are similar on a per-acre basis to other uses such as suburban development, a large percentage of land devoted to agriculture in a watershed may make agriculture the largest contributor to water quality impairments in that watershed. On a national scale, the U.S. Environmental Protection Agency (EPA) estimates that agriculture is the leading source of pollution for 48% of river miles, 41% of lake acres, and 18% of estuary miles of impaired waterbodies (Ribaudo and Johansson, 2006). Vegetable and horticultural crops may have a relatively high potential for water quality pollution because producing these crops uses relatively high amounts of water, fertilizers, and pesticides; these crops may have relatively shallow root systems; and production may involve leaving some soil bare for extended periods.

Regulatory environment
Agriculture is considered a *non-point source* of pollution, in that pollutants tend to be

found diffusely across an area and make their way to waterbodies through diffuse pathways. This is in contrast to *point sources* of pollution, such as a discharge pipe from a factory or wastewater treatment plant, where the pollutants are discharged from a single identifiable source. Certain agricultural discharges can be considered point sources, including discharges from concentrated animal feeding operations (CAFOs) and return flows from irrigation. In general, non-point sources of pollution are difficult to regulate since it is difficult to quantify contributions, there may be many operations contributing, and each operation may be contributing only a small portion of the total pollutant load.

The Clean Water Act (CWA) is the principal federal law regulating water pollution. Under this law, while CAFOs are required to comply the with discharge permit rules that pertain to other point sources, return flows and stormwater runoff from agriculture were specifically exempted. Similarly, "regular farming activities" including the construction and maintenance of farm roads, ponds, and ditches were specifically exempted in 1977, though with some conditions. The CWA addresses non-point source pollution in its section 303, which mandates states determine which waterbodies do not meet water quality standards and then determine the sources of pollutants and required reductions by source, a process called *total maximum daily load*, or TMDL. Initially, section 303 was largely ignored by states, but since the 1980s and 1990s, in response to lawsuits and renewed efforts by the federal EPA, many states have undertaken these responsibilities more seriously. In most cases watershed plans in response to TMDLs emphasize voluntary pollution reduction measures: education and incentive programs. However, states have the option of imposing regulatory requirements. It is estimated that 33 states have laws with regulatory provisions for agriculture (Ribaudo and Johansson, 2006). Farmers may be required to develop conservation plans or implement certain BMPs, though these provisions might be triggered only in certain circumstances. New Jersey has developed several TMDLs which include agriculture as a source of pollutants, primarily for phosphorus and bacteria. In addition, in 2009, New Jersey adopted a new rule, written by the state Department of Agriculture, requiring certain management practices to reduce the impact of livestock manure on waterbodies.

Media and society influences
There has been increased public interest in the ecological role played by agricultural production. Some of this interest has been positive, with more people in American society taking a greater interest in where and how their food is produced. Examples of this increased interest include the growth of the "slow food" movement, interest in local food and community supported agriculture, and interest in organic and other ecologically-minded food production. This interest has been manifested through the popularity of certain media phenomena, such as the books of Michael Pollan and the

recent movie *Food, Inc.* (2008). The positive side to this interest is that people will be more motivated to support domestic, local, and sustainable produce and goods. The negative side is that these movements and media pieces may lead some to the conclusion that agriculture typically causes pollution through excessive use of fertilizers and pesticides, or give a generally negative perception of agriculture.

Discussions of environmental issues may unfairly isolate agriculture as a source of pollutants. For example, some coverage of the announcement of President Obama's executive order to restore Chesapeake Bay (2009) summarized it as a plan to limit the impacts of agriculture to Chesapeake Bay, even though official descriptions of the order more fairly described the sources of pollution to the bay. Likewise, controversy surrounding actions in California to protect the delta smelt and related ecosystem (2009) have sometimes been portrayed as Central Valley farmers against environmentalists. Discussions of the Clean Water Restoration Act of 2009 may similarly pit concerned farmers against environmentalists when it moves to floor debate. While these discussions have the positive effect of getting the public to think more about the role agriculture plays in the ecology of the landscape, they also potentially have the negative effect of portraying agriculture as being a source of pollution and negative ecological consequences.

The California example

Because regulation of agriculture in regards to the potential for water pollution rests largely in the hands of state and local governments, there is considerable variety in the degree and methods with which agricultural production is regulated. As an example, in recent years, California has increased regulatory requirements for agricultural producers. While the state water pollution law, the Porter–Cologne Act, had authority for preventing pollution from a wide range of sources, agriculture, dairy, and silviculture operations were given blanket "waivers" from complying with any specific regulations. Mostly in response to lawsuits and pressure from the state legislature, the state water regulators began to impose requirements on agriculture in the early 2000s. Different regional water quality control boards have different regulations, with one regulatory model, the "conditional agricultural waiver," adopted in a few regions. This model technically treats agricultural producers as dischargers, but allows producers to join together as group to share monitoring and reporting costs, and uses required education programs in lieu of the normal discharge permit. The actual costs to growers of this regulation vary by region as well as producer size and type. Since this process is based on state law, it is conceptually distinct from the federally-mandated TMDL process, though there may be some overlap in practice. Additional regulatory and permit requirements can come from other state, federal, or local agencies. In San Diego county, the County Department of Agriculture, Weights and Measures regulates agricultural facilities that it considers high priority, including nurseries, greenhouses, golf courses, and horse facilities. This regulation mandates specific practices and authorizes application fees and onsite inspections. While current water quality

regulations in California are not particularly onerous, they do represent additional costs and bureaucratic procedures that growers must bear, and sometimes there are multiple agencies farmers must deal with. If the "conditional agriculture waiver" model is found to be successful in reducing agriculture's contribution to water impairments, other states may take interest in adopting similar programs.

Maintaining a positive image for agriculture

As the above discussion points out, agriculture is sometimes portrayed, both fairly and unfairly, as a potential source of water pollution. Agricultural producers should consider taking proactive steps to encourage the public's maintaining a positive image for agriculture as well as reducing the real contribution of agricultural operations to water pollution:

- Maintain coherence in industry groups and lobbying groups. Having industry solidarity facilitates communication within and without the industry and aids in finding solutions with regulatory agencies or local environmental groups. When potential regulations are considered, having agriculture's concerns represented is important.
- Assess operations and fix potential water pollution problems. Follow the most recent crop-specific recommendations for irrigation, fertilizer, and pest management. Prevent soil erosion and consider BMPs. Expand conservation practices, employing vegetated buffers, runoff impoundments, and cover crops. Take advantage of funding sources for conservation practices, such as those from the USDA–NRCS.
- Document and keep records for implemented BMPs; irrigation, fertilizer, and pesticide applications; and soil or plant tissue test results. Develop and implement conservation plans, nutrient management plans, integrated pest management plans, and manure management plans, as appropriate.
- Support positive campaigns which emphasize positive associations between local agriculture and health and environmental quality, such as the Jersey Fresh program. Consider taking advantage of people's interest in where and how their food is produced, by, for example, participating in a community supported agriculture program or devoting some of the operation to organic production.

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NATIVE POLLINATORS ON AGRICULTURAL LANDS

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Insect pollination services are a highly important agricultural input. Three-quarters of the world's leading crop plants either require animal pollination, or show increased fruit set with animal pollination, and many crops have higher quality after animal pollination (Free 1993; Klein et al. 2007). Bees are the most important animal pollinators in most ecosystems (Neff and Simpson 1993). The estimated value of bee pollination services to crops in New Jersey and Pennsylvania ranges from $6 - 263 million annually, depending on the valuation method used (Winfree and Gross In revision).

Honeybee numbers in Pennsylvania and New Jersey have been declining over the past several years. Beekeepers recorded overwinter losses of 26- 48% and 17-40% respectively in Pennsylvania and New Jersey between 2006 and 2009 (vanEngelsdorp et al. 2008; Gill 2008). These losses are higher than the typical 15% losses seen in previous years (Tim Schuler, State Apiarist, personal communication). Although many growers rent managed honeybees to increase crop yield and quality, surveys of small to medium size farms in New Jersey and Pennsylvania have shown that native bees provide a substantial portion of pollination services, and in some cases fully pollinate the crop (Winfree et al. 2007; Winfree et al. 2008). By increasing the number and diversity of native bees, growers in our region may be able to counter rising costs of rented bee colonies, while gaining sustainable pollination on their farms.

This talk will present the results of research on native bees in New Jersey and Pennsylvania agriculture, including recommendations for how to increase native bee populations on farms. Based on our own research and the published literature, we identify the native bee species that are most likely to pollinate 10 important crops in our region (Table 1). An illustrated guide to identifying these types of bees will be handed out at the talk. We have identified native plant species that are attractive to these bees (Table 2). In collaboration with the Natural Resource Conservation Service (NRCS), I am currently testing these species for suitability in restoration plantings in a large-scale experiment in New Jersey. A printed brochure containing complete information on native bees and agriculture in our region, including the information presented here, will be distributed at the talk. The brochure ("Native Bee Benefits") is also downloadable in pdf format from my faculty web site in the Department of Entomology, Rutgers University.

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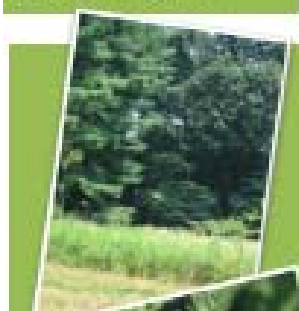
Table 1

The most efficient native bees for top regional fruits and vegetables.[11,12]

All these bees are good pollinators, but three stars (***) indicates a key pollinator for that crop. Supporting a variety of bee species will help maintain reliable pollination of crops season after season. A good goal would be to attract as diverse a collection of bees as possible.

Bee Species	Crops	Apple	Blueberry	Cranberry	Cucumber	Muskmelon	Pepper	Squash	Strawberry	Tomato	Watermelon
Andrena (multiple species)		*	**						*		
Augochlora pura						***	**			**	**
Augochlorella striata						***	**		*	**	**
Bombus (multiple species)			*	*		***	*	**		**	***
Bombus impatiens			*	**	**	***	*	**		**	***
Ceratina (multiple species)						*					
Colletes inaequalis		*	**								
Habropoda laboriosa			***								
Halictus confusus							***		*	**	**
Lasioglossum (Dialictus)			*			**	***		**	***	***
Peponapis pruinosa						*		***			*
Xylocopa virginica			**								

Bee importance for crop pollination	
*	Good
**	Better
***	Best



How do I attract these bees to my farm?

There are two key things that would likely increase support for native bees on PA and NJ farmland:

- Grow recommended native plants that studies have shown are preferred by bees in order to attract more pollinators to your property (see page 6).
- Establish areas of suitable pollinator habitat around the farm. This will allow more bees to nest on your property and encourage their return year after year (see page 7).

The rest of this pamphlet provides guidelines for what you can do to make your farm a bee haven.

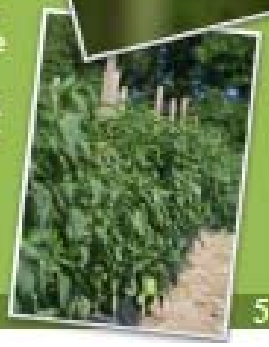


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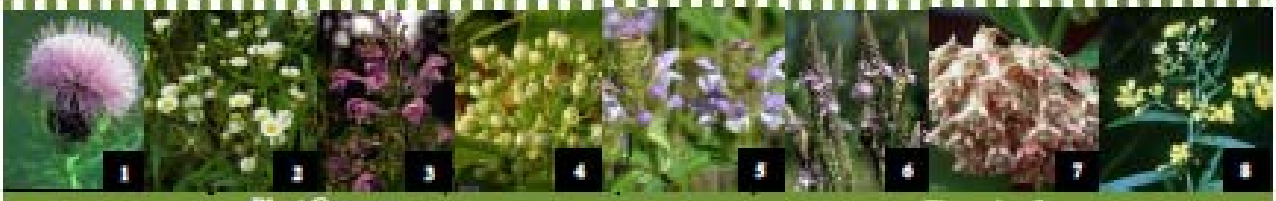
Table 2

Foraging Needs

Bees feed on nectar and pollen, which come exclusively from flowers. Plant a variety of flowers that will provide bee foraging resources throughout the growing season. This will ensure that at any given time at least some flowers are in bloom and that you will attract a diversity of pollinators. These plants must be close to bee nesting sites (within a bee's flight range, shown on pages 2-4) and sufficiently abundant to support both large and small bees. Larger bees have longer flight distances and so can fly further to reach food. They also require greater amounts of food (more flowers). Cultivating large clumps of recommended native flowers (shown below) in various areas around your farm will be more effective for attracting bees than growing them all in one spot. Plants with more stars (***) are more preferred by the indicated visiting bees.[4]

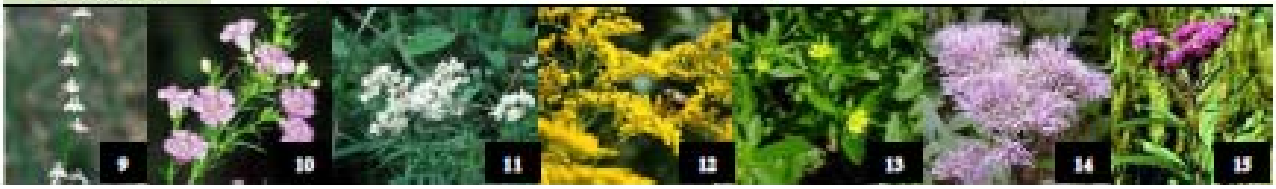
[†] The USDA-NRCS PLANTS database lists *Cirsium discolor*, a native field thistle, as potentially weedy or invasive. Though you should not encourage large populations, it is a valuable pollinator foraging resource and can be managed as such. Its seeds are not commercially available.



Plant Scientific Name	Plant Common Name (Perennial, Annual)	Visiting Bees	Bee Preference	Flowering Season (April – May – June – July – Aug – Sept)
1. *Cirsium discolor*[†]	Field thistle (P)	Ap, B, X	**	
2. *Erigeron strigosus*	Daisy fleabane (A)	Ap, Au, C, H, L	*	
3. *Scutellaria integrifolia*	Helmet flower (P)	B	***	
4. *Apocynum cannabinum*	Indianhemp (P)	Au, Ap, Au, B, L	**	
5. *Prunella vulgaris*	Common selfheal (P)	Ap, Au, B, L	**	
6. *Verbena hastata*	Swamp verbena (P)	C	***	
7. *Asclepias syriaca*	Common milkweed (P)	Ap, B, X	***	
8. *Euthamia graminifolia*	Flat-top goldentop (P)	Ag, Au, C, H, L, X	**	
9. *Lobelia spicata*	Palespike lobelia (P)	B, C	***	
10. *Agalinis purpurea*	False foxglove (A)	Au	***	
11. *Pycnanthemum tenuifolium*	Narrowleaf mountainmint (P)	Ap, Au, B, C, H, L	**	
12. *Solidago odora*	Anisescented goldenrod (P)	Ag, Au, C, H, L, X	**	
13. *Potentilla norvegica*	Norwegian cinquefoil (A/P)	Au, H, L	***	
14. *Eupatorium maculatum*	Spotted joe pye weed (P)	B, C, H	***	
15. *Vernonia noveboracensis*	Broadleaf ironweed (P)	Au, C, H, L	***	

Visiting Bees Key:

Am= Andrena
Ap= Apis
Au= Augochlorella/Augochloropsis
B= Bombus
C= Ceratina
H= Halictus
L= Lasioglossum
X= Xylocopa



PREPARING FOR A USDA THIRD PARTY AUDIT

SESSION

Changes to the USDA Audit Verification Checklist for 2010

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Introduction

USDA had not updated their audit verification checklist (third party audit) since May 2007. With all the new knowledge in food safety and how third party audits should be conducted they released the new version in November 2009. This audit will go into effect immediately.

Growers should download the new version at http://www.ams.usda.gov/gapghp. This will allow the grower the opportunity to review the changes and see if any changes are needed for their food safety plan prior to the next third party audit. Since a new audit is required each year, this revised audit is required for 2010. We will review the major changes in the new version and discuss in detail during the workshop.

Audit Scope

The audit scope has changed for growers from five parts to four. The reduction in audit areas results from traceback being incorporated into the other sections. Growers in most cases will now need to have some type of traceback program in place to pass the audit.

For wholesale buyers and handlers, the parts have been reduced from two (part 6 and 6A) to part 6 by incorporating the traceback into part 6. There have been some questions reworded and a few added. See part 6 below for more details.

USDA has clarified what type of documentation will be required to individual questions. Instead just requiring a type of documentation when a question is marked with a “D”

they now spell out the type of documentation. A “D” may combine a standard operating procedure outlining the company policy along with records indicating the required action; an “R” requires that records be kept; and a “P” indicates that a policy/standard operating procedures must be documented in the food safety plan.

General Questions

This section must be passed before proceeding on to any of the other parts (1-4). The grower must now have a written food safety program (plan) in place and someone designated in charge of the program. Without these two items the audit cannot commence. Two questions have been added on traceability where a grower must show that a traceability program has been put in place and that a successful “mock recall” was performed in the last year. The two questions are 14% of the total points. Other questions have been moved around, but are the same as the past version.

Part 1 – Farm Review

Points have been increased for water quality to emphasize the importance of water testing to confirm good water quality for crop production. A traceability question was added related to being able to identify each production area. This can be done by having a map of all production areas and code them for easy tracing. These three questions are 21% of all points. All the other questions are the same with slight rewording.

Part 2 – Field Harvest and Field Packing Activities

Four new questions have been added to this section. A documented pre-harvest assessment of the production areas for potential risks and sources of contamination is required. Two questions were added concerning field packing and the use and storage of new or sanitized containers.

Product moving out of the field will now need to be uniquely identified for traceability. This can be done in a number of ways, but probably the easiest is to attach a label to each container right in the field. If the container is the final shipping box then the label could have all the information for traceability e.g. harvest date, field, picking crew. Other questions were slightly reworded or moved, but are essentially the same.

Part 3 – House Packing Facility

Four additional questions were added to this part. A question on the use of new or sanitized packing containers and two on observing whether pallets and containers are clean, in good condition and stored properly were added. Traceability was added to this part indicating records must be kept on the incoming product and the destination of the outgoing product so it can be uniquely indentified. Additions to one question now require documented cleaning logs for all food contact surfaces prior to use.

Part 4 – Storage and Transportation

This is the section that has the most changes. Most of the new questions were repeated from the 'House Packing Facility' part since someone may not be packing produce just storing and shipping it. Anyone being audited under this part should review each question carefully to insure they comply.

A new traceability question was added to require record keeping of incoming and outgoing products so each container can be uniquely identified.

Part 5 – Note: This is not being used

Part 6 – Wholesale Distribution Center/Terminal Warehouse

A written policy is now required on the disposition of product that is not within the temperature guidelines for the company when product is received. Temperature monitoring for processing water has been added if water is used in repacking. A traceback question was added to be able to trace incoming and destination of outgoing product.

Conclusion

Now is the time to start thinking about and acting on the food safety plan for the coming year. As the product season approaches it becomes more and more difficult to develop the plan. There are always more pressing needs to get a crop planted, to manage the crop and harvest. No one wants to be rushed into doing a food safety plan at the last minute. It takes time! So start now!